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Herbicide Tolerance/Resistance in Plants
April 1991 - March 1994

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Article title.
Author. Place of publication: Publisher. Journal Title.
Date. Volume (Issue). Pages. (NAL Call Number).

Example:
1 NAL Call No.: DNAL 389.8.SCH6
Morrison, S.B. Denver, Colo.: American School Food Service Association. School foodservice journal. Sept 1987. v. 41 (8). p.48-50. ill.

BOOK:

Citation # NAL Call Number
Title.
Author. Place of publication: Publisher, date. Information on pagination, indices, or bibliographies.

Example:
1 NAL Call No.: DNAL RM218.K36 1987
Exploring careers in dietetics and nutrition.
Kane, June Kozak. New York: Rosen Pub. Group, 1987.
Includes index. xii, 133 p.: ill.; 22 cm. Bibliography: p. 126.

AUDIOVISUAL:

Citation # NAL Call Number
Title.
Author. Place of publication: Publisher, date.
Supplemental information such as funding. Media format (i.e., videocassette): Description (sound, color, size).

Example:
1 NAL Call No.: DNAL FNCTX364.A425 F&N AV
All aboard the nutri-train.
Mayo, Cynthia. Richmond, Va.: Richmond Public Schools, 1981. NET funded. Activity packet prepared by Cynthia Mayo. 1 videocassette (30 min.): sd., col.; 3/4 in. + activity packet.

Herbicide Tolerance/Resistance in Plants

SEARCH STRATEGY

SET	ITEMS	DESCRIPTION
S1	823	HERBICID? (W) (TOLERAN? OR RESISTAN?)
S2	396	S1 AND PY=1991:1999
S3	395	S2/ENG

Herbicide Tolerance/Resistance in Plants

1 NAL Call. No.: 275.29 N272EX
A 1992 guide for--herbicide use in Nebraska.
Lincoln, Neb. : The Service; 1992.
EC - Cooperative Extension Service, University of Nebraska (92-130): 51 p.; 1992. Includes references.

Language: English

Descriptors: Nebraska; Weed control; Herbicides; Weeds; Herbicide resistance; Conservation tillage

2 NAL Call. No.: 79.8 W41
Absence of a role for absorption, translocation, and metabolism in differential sensitivity of hemp dogbane (Apocynum cannabinum) to two pyridine herbicides.
Orfanedes, M.S.; Wax, L.M.; Liebel, R.A.
Champaign, Ill. : Weed Science Society of America; 1993 Jan.
Weed science v. 41 (1): p. 1-6; 1993 Jan. Includes references.

Language: English

Descriptors: Apocynum cannabinum; Clopyralid; Fluroxypyr; Herbicide resistance; Susceptibility; Absorption; Metabolism; Translocation; Weeds; Weed control

Abstract: Hemp dogbane is sensitive to fluroxypyr and tolerant to clopyralid. Absorption, translocation, and metabolism of clopyralid and fluroxypyr were studied in hemp dogbane to determine if differences in these processes could be responsible for differential sensitivity. In addition, the effect of growth stage on herbicide absorption and translocation was evaluated. The 14C-herbicides were applied to the adaxial side of a single leaf located near the midpoint of hydroponically cultured plants. Uptake of fluroxypyr was more rapid than clopyralid. At 72 h after treatment (HAT), fluroxypyr and clopyralid absorption was 62 and 38%, respectively. Clopyralid was much more mobile than fluroxypyr, with 75% of the absorbed 14C from 14C-clopyralid recovered outside the treated leaf compared to only 45% for fluroxypyr 72 HAT. Relative to fluroxypyr, a higher percentage of 14C-clopyralid recovered outside the treated leaf translocated acropetally, especially when plants were treated during the vegetative stage. Treatment during the early reproductive stage increased basipetal and reduced acropetal translocation relative to the vegetative stage. Neither herbicide was metabolized rapidly. Approximately 60 and 90% of the recovered 14C was attributable to unaltered fluroxypyr and clopyralid, respectively, 72 HAT. Some differences in absorption, translocation, and metabolism between clopyralid and fluroxypyr exist, but they cannot fully account for differential sensitivity of hemp dogbane to these two herbicides. Differences in activity at the target site may be responsible for differential activity of these herbicides on hemp dogbane.

3 NAL Call. No.: SB951.P49

Absorption and metabolism of clomazone by suspension-cultured cells of soybean and velvetleaf.
Weimer, M.R.; Balke, N.E.; Buhler, D.D.
Orlando, Fla. : Academic Press; 1992 Jan.
Pesticide biochemistry and physiology v. 42 (1): p. 43-53; 1992 Jan. Includes references.

Language: English

Descriptors: Glycine max; Abutilon theophrasti; Cell suspensions; Cell cultures; Metabolic detoxification; Clomazone; Absorption; Metabolism; Oxidation; Metabolites; Characterization; Herbicide resistance; Species differences; Phytotoxicity; Selectivity; Pharmacokinetics

Abstract: Clomazone uptake and metabolism were compared in soybean and velvetleaf suspension cultured cells utilizing either [14C]methylene-clomazone or [14C]carbonyl-clomazone. Velvetleaf cells absorbed more clomazone than soybean did. Cells of both species accumulated more metabolites when treated with [14C]methylene-clomazone than when treated with [14C]carbonyl-clomazone. Higher amounts of [14C]metabolites were present in the media of cells treated with [14C]carbonyl-clomazone than [14C]methylene-clomazone. Differences in uptake were due to cellular retention of the benzyl moiety and efflux of the heterocyclic moiety after cleavage of clomazone. All metabolites produced in soybean and velvetleaf cells were more polar than clomazone. No qualitative differences in the metabolites produced by soybean and velvetleaf were identified. Both soybean and velvetleaf oxidatively cleaved the clomazone molecule and subsequently conjugated the benzyl moiety with glucose. One of the aglycones was identified as 2-chlorobenzylalcohol. Oxidative cleavage of clomazone was a major metabolic reaction occurring in both the tolerant (soybean) and susceptible (velvetleaf) species.

4 NAL Call. No.: SD13.C35
Absorption and translocation of [14C]glyphosate in four woody plant species. Green, T.H.; Minogue, P.J.; Brewer, C.H.; Glover, G.R.; Gjerstad, D.H. Ottawa, Ont. : National Research Council of Canada; 1992 Jun. Canadian journal of forest research; Revue canadienne de recherche forestiere v. 22 (6): p. 785-789; 1992 Jun. Includes references.

Language: English

Descriptors: Southeastern states of U.S.A.; Pinus taeda; Ilex vomitoria; Acer rubrum; Quercus rubra; Glyphosate; Tolerance; Translocation; Absorption; Leaves; Roots; Stems

Abstract: Absorption and translocation patterns of radio-labelled glyphosate (N-(phosphonomethyl)glycine) were examined in four species of woody plants to determine mechanisms of herbicide tolerance in species common to the southeastern United States. Loblolly pine (Pinus taeda L.) and yaupon (Ilex vomitoria (L.) Ait.), both tolerant to the herbicide, absorbed significantly less glyphosate than did red maple (Acer rubrum L.) or white oak (Quercus alba L.), indicating the importance of foliar absorption as a barrier to glyphosate entry. Although herbicide absorption was similar between the sensitive white oak and the tolerant red maple, white oak accumulated more glyphosate in the roots than did red maple, indicating that translocation patterns also contribute significantly to glyphosate tolerance in some woody species.

5 NAL Call. No.: 450 P692
Acetolactate synthase inhibiting herbicides bind to the regulatory site. Subramanian, M.V.; Loney-Gallant, V.; Dias, J.M.; Mireles, L.C. Rockville, Md. : American Society of Plant Physiologists; 1991 May. Plant physiology v. 96 (1): p. 310-313; 1991 May. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Gossypium hirsutum; Mutants; Herbicide resistance; Phytotoxicity; Triazole herbicides; Sulfonylurea herbicides; Chlorsulfuron; Imazethapyr; Imidazolinone herbicides; Ligases; Enzyme inhibitors; Binding site; Leucine

Abstract: Acetolactate synthase from spontaneous mutants of tobacco (Nicotiana tabacum; KS-43 and SK-53) and cotton (Gossypium hirsutum; PS-3, PSH-91, and DO-2) selected in tissue culture for resistance to a triazolopyrimidine sulfonanilide showed varying degrees of insensitivity to feedback inhibitor(s) valine and/or leucine. A similar feature was evident in the enzyme isolated from chlorsulfuron-resistant weed biotypes, Kochia scoparia and Stellaria media. Dual inhibition analyses of triazolopyrimidine sulfonanilide, thifensulfuron, and imazethapyr versus feedback inhibitor leucine revealed that the three herbicides were competitive with the amino acid for binding to acetolactate synthase from wild-type cotton cultures. Acetolactate synthase inhibiting herbicides may bind to the regulatory site on the enzyme.

6 NAL Call. No.: 79.8 W41
Acifluorfen tolerance in Lycopersicon.
Ricotta, J.A.; Masiunas, J.B.
Champaign, Ill. : Weed Science Society of America; 1992 Jul. Weed science v. 40 (3): p. 413-417; 1992 Jul. Includes references.

Language: English

Descriptors: Lycopersicon esculentum; Genotypes; Herbicide resistance; Acifluorfen; Absorption; Foliar uptake; Leaves; Cuticle; Waxes; Translocation; Metabolism; Ascorbic acid; Varietal susceptibility; Chlorophyll

Abstract: Studies were conducted to determine the mechanism of acifluorfen tolerance within the Lycopersicon genus. Absorption of 14C-acifluorfen was not correlated with tolerance. There was a negative correlation (r = -0.57) between absorption 24 h after treatment and wax density. No other surface characteristic correlated with absorption. Less than 3% of absorbed 14C was translocated and there was no metabolism of acifluorfen. All genotypes were susceptible to paraquat, and acifluorfen-tolerant genotypes had lower levels of ascorbate than susceptible genotypes, implying that free radical protectant systems were not involved in tolerance. Genotypes varied in amounts of chlorophyll a, chlorophyll b, and total chlorophyll but the differences did not correlate to acifluorfen tolerance.

7 NAL Call. No.: SB610.W39
Addressing real weed science needs with innovations.

Gressel, J.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 509-525; 1992 Jul. Literature review. Includes references.

Language: English

Descriptors: Weeds; Weed control; Agricultural research; Herbicides; Herbicide resistance; Pest management; Biological control; Biotechnology; Parasitic weeds; Agriculture; Literature reviews

8 NAL Call. No.: SB123.P55
Advances in achieving the needs for biotechnologically-derived herbicide resistant crops.
Gressel, J.
New York, N.Y. : John Wiley & Sons, Inc; 1993.
Plant breeding reviews v. 11: p. 155-198; 1993. Includes references.

Language: English

Descriptors: Crops; Plant breeding; Herbicide resistance; Genes; Genetic engineering; Biotechnology; Cultivars; Weed control; Genetic resistance; Literature reviews

9 NAL Call. No.: QK725.P54
Agrobacterium mediated transfer of a mutant Arabidopsis acetolactate synthase gene confers resistance to chlorsulfuron in chicory (Chichorium intybus L.). Vermeulen, A.; Vaucheret, H.; Pautot, V.; Chupeau, Y.
Berlin, W. Ger. : Springer International; 1992.
Plant cell reports v. 11 (5/6): p. 243-247; 1992. Includes references.

Language: English

Descriptors: Cichorium intybus; Genetic transformation; Herbicide resistance; Chlorsulfuron; Kanamycin; Transgenics; Agrobacterium tumefaciens; Arabidopsis thaliana; Gene transfer

Abstract: Leaf discs of C. intybus were inoculated with an Agrobacterium tumefaciens strain harboring a neomycin phosphotransferase (neo) gene for kanamycin resistance and a mutant acetolactate synthase gene (csr1-1) from Arabidopsis thaliana conferring resistance to sulfonylurea herbicides. A regeneration medium was optimized which permitted an efficient shoot regeneration from leaf discs. Transgenic shoots were selected on rooting medium containing 100 mg/l kanamycin sulfate. Integration of the csr1-1 gene into genomic DNA of kanamycin resistant chicory plants was confirmed by Southern blot hybridizations. Analysis of the selfed progenies (S1 and S2) of two independent transformed clones showed that kanamycin and chlorsulfuron resistances were inherited as dominant Mendelian trails. The method described here for producing transformed plants will allow new opportunities for chicory breeding.

10 NAL Call. No.: 30 Ad9
Agronomic improvement in oilseed brassicas.
Downey, R.K.; Rimmer, S.R.

San Diego, Calif. : Academic Press; 1993.
Advances in agronomy v. 50: p. 1-66; 1993. Includes references.

Language: English

Descriptors: Brassica campestris; Brassica carinata; Brassica juncea; Brassica napus; Oilseed plants; Macroeconomics; Biotechnology; Crop yield; Cultivars; Genetic improvement; Genome analysis; Hybridization; Disease resistance; Herbicide resistance; Pest resistance; Yield components; Plant oils; Protein content; Seeds; Literature reviews

11 NAL Call. No.: 64.8 C883
Agronomic performance of sulfonylurea-resistant transgenic flue-cured tobacco grown under field conditions.
Brandle, J.E.; Miki, B.L.
Madison, Wis. : Crop Science Society of America, 1961-; 1993 Jul. Crop science v. 33 (4): p. 847-852; 1993 Jul. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Transgenic plants; Lines; Herbicide resistance; Sulfonylurea herbicides; Agronomic characteristics; Genetic resistance; Chlorsulfuron; Tribenuron; Phytotoxicity; Crop yield; Crop damage; Gene expression; Genetic variation

Abstract: Field testing of transgenic crops is an essential step towards commercialization. This study was conducted to assess the agronomic performance of herbicide-resistant transgenic tobacco (Nicotiana tabacum L.) lines relative to untransformed controls and to evaluate their sensitivity to sulfonylurea herbicides in a field situation. Two transgenic flue-cured tobacco lines harboring the csr1-1 gene for sulfonylurea resistance were evaluated after application of three rates of two sulfonylurea herbicides [chlorsulfuron (2-chloro-N[(4-methoxy-6-methyl- 1,3,5 triazin-2-yl) aminocarbonyl]-aminosulfonyl]-2-thiophenecarboxylate) R9674, a 2:1 mixture of thifensulfuron (methyl-3-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl aminocarbonyl]aminosulfonyl]-2-thiophenecarboxy- late) and tribenuron (methyl-2[[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl]carbonyl]amino]sulfonyl]benzoate)]. We show that one of the lines was resistant to 10 g a.i. ha-1 of chlorsulfuron but not to 20 g a.i. ha-1 and that both lines were susceptible to DPX-R9674. Comparison of transgenics to an untransformed control in the absence of herbicide treatment showed that both transgenics were lower yielding than tbe controls. This impairment of agronomic performance could be attributed to any of a number of factors. Resistance to chlorsulfuron was adequate, but margins of safety need to be increased before any farm level use of these transgenic lines can be considered. Selection among lines for maximum expression of the transgene and selection or backcrossing to recover the parental phenotype may further improve agronomic performance.

12 NAL Call. No.: SB193.F59
Alfalfa germplasm with resistance to terbacil.
Caddel, J.L.; Stritzke, J.F.; Anderson, M.P.; Bensch, C.
Georgetown, Tx. : American Forage and Grassland Council; 1992.
Proceedings of the Forage and Grassland Conference v. 1: p.

162-165; 1992.

Language: English

Descriptors: Oklahoma; Medicago sativa; Terbacil; Herbicide resistance; Germplasm; Selection

13 NAL Call. No.: 442.8 Z8
Allelic mutations in acetyl-coenzyme A carboxylase confer herbicide tolerance in maize.
Marshall, L.C.; Somers, D.A.; Dotray, P.D.; Gengenbach, B.G.; Wyse, D.L.; Gronwald, J.W.
Berlin, W. Ger. : Springer International; 1992.
Theoretical and applied genetics v. 83 (4): p. 435-442; 1992.
Includes references.

Language: English

Descriptors: Zea mays; Structural genes; Alleles; Acetyl-coa carboxylase; Mutants; Mutations; Herbicide resistance; Haloxyfop; Sethoxydim; Allelism; In vitro selection; Inheritance; Semidominance; Enzyme activity

Abstract: The genetic relationship between acetyl-coenzyme A carboxylase (ACCase; EC 6.4.1.2.) activity and herbicide tolerance was determined for five maize (Zea mays L.) mutants regenerated from tissue cultures selected for tolerance to the ACCase-inhibiting herbicides, sethoxydim and haloxyfop. Herbicide tolerance in each mutant was inherited as a partially dominant, nuclear mutation. Allelism tests indicated that the five mutations were allelic. Three distinguishable herbicide tolerance phenotypes were differentiated among the five mutants. Seedling tolerance to herbicide treatments cosegregated with reduced inhibition of seedling leaf ACCase activity by sethoxydim and haloxyfop demonstrating that alterations of ACCase conferred herbicide tolerance. Therefore, we propose that at least three, and possible five, new alleles of the maize ACCase structural gene (Acc1) were identified based on their differential response to sethoxydim and haloxyfop. The group represented by Acc1-S1, Acc1-S2 and Acc1-S3 alleles, which had similar phenotypes, exhibited tolerance to high rates of sethoxydim and haloxyfop. The Acc1-H1 allele lacked sethoxydim tolerance but was tolerant to haloxyfop, whereas the Acc1-H2 allele had intermediate tolerance to sethoxydim but was tolerant to haloxyfop. Differences in tolerance to the two herbicides among mutants homozygous for different Acc1 alleles suggested that sites on ACCase that interact with the different herbicides do not completely overlap. These mutations in maize ACCase should prove useful in characterization of the regulatory role of ACCase in fatty acid biosynthesis and in development of herbicide-tolerant maize germplasm.

14 NAL Call. No.: SB610.W39
Alternatives for control of paraquat tolerant American black nightshade (Solanum americana).
Bewick, T.A.; Stall, W.M.; Kostewicz, S.R.; Smith, K.
Champaign, Ill. : The Society; 1991 Jan.
Weed technology : a journal of the Weed Science Society of America v. 5 (1): p. 61-65; 1991 Jan. Includes references.

Language: English

Descriptors: Lycopersicon esculentum; Weed control; Solanum Americanum; Herbicide resistant weeds; Paraquat; Herbicide resistance; Biotypes; Chemical control; Diquat; Oxyfluorfen; Acifluorfen; Tridiphane; Pyridate; Chelates; Herbicide mixtures; Application rates

15 NAL Call. No.: QH301.A76
Alternatives to triazines for weed control in forest nurseries. Mason, W.L.
Wellesbourne, Warwick : The Association of Applied Biologists; 1992. Aspects of applied biology (29): p. 149-155; 1992. In the series analytic: Vegetation management in forestry, amenity and conservation areas. Paper presented at the conference of the Association, April 7-9, 1992, University of York, England. Includes references.

Language: English

Descriptors: Great Britain; Forest nurseries; Herbicide resistance; Herbicides; Metazachlor; Site factors; Triazines; Weed control

16 NAL Call. No.: 79.8 W41
Amitrole, triazine, substituted urea, and metribuzin resistance in a biotype of rigid ryegras (Lolium rigidum). Burnet, M.W.M.; Hildebrand, O.B.; Holtum, J.A.M.; Powles, S.B.
Champaign, Ill. : Weed Science Society of America; 1991 Jul. Weed science v. 39 (3): p. 317-323; 1991 Jul. Includes references.

Language: English

Descriptors: Lolium rigidum; Biotypes; Herbicide resistance; Herbicide resistant weeds; Amitrole; Atrazine; Cross resistance; Simazine; Cyanazine; Propazine; Ametryn; Prometryn; Chlorotoluron; Isoproturon; Metoxuron; Diuron; Fluometuron; Metribuzin; Methazole; Resistance mechanisms; Photosynthesis

Abstract: A biotype of rigid ryegrass (Lolium rigidum G. LOLRI) has become resistant to amitrole and atrazine after 10 yr of exposure to a mixture of these herbicides. Resistance has also been demonstrated to the chloro-s-triazines: simazine, cyanazine, propazine; the methylthio-s-triazines: ametryn, prometryn; the substituted ureas: chlortoluron, isoproturon, metoxuron, diuron, fluometuron, methazole; and the triazinone herbicide metribuzin. The biotype remains susceptible to chlorsulfuron, metsulfuron, sulfometuron, sethoxydim, diclofop, fluazifop, glyphosate, carbetamide, and oxyfluorfen. Inhibition of oxygen evolution by atrazine, diuron, and metribuzin was similar in thylakoids isolated from both resistant and susceptible biotypes. Therefore, resistance to the photosystem II inhibitors is not caused by an alteration of the target site of these herbicides. Resistant plants treated with a 3-h pulse of 0.12 millimoles chlortoluron recover photosynthetic activity more rapidly than susceptible plants. This suggests that the basis for resistance is enhanced metabolism or sequestration of the herbicide within the leaf.

17 NAL Call. No.: QH431.A1G43
Analysis of the effects of herbicides on pea seedlings and

calluses, and the isolation of herbicide-resistant callus lines and regenerant plants. Ezhova, T.A.; Tikhvinskaya, N.S.; Petrova, T.V.; Bagrova, A.M.; Vasil'ev, I.R.; Matorin, D.N.; Gostimskii, S.A.
New York, N.Y. : Consultants Bureau; 1991 May.
Soviet genetics v. 26 (11): p. 1317-1322; 1991 May.
Translated from: Genetika, v. 26 (11), 1990, p. 2012-2019.
(QH431.A1G4). Includes references.

Language: English; Russian

Descriptors: Pisum sativum; Mutants; Induced mutations; In vitro selection; Artificial selection; Seedlings; Callus; Tissue culture; Herbicide resistance; Atrazine; Dinoseb; Glyphosate; Diuron; Inheritance; Heritability

Abstract: The effects of atrazine, dinoseb, diuron, and glyphosate on pea seedlings and prolonged cultures of photoheterotrophic calluses were compared. Herbicides were found to have similar effects on the growth of seedlings and the survival of calluses. Cultivation of calluses on selective media containing threshold concentrations of herbicide resulted in the isolation of callus lines resistant to the herbicide used (42, 13, 10, and 8 lines resistant to atrazine, dinoseb, diuron, and glyphosate respectively were obtained). Regenerant plants of the R0 and R1 generations were obtained from photosynthesis-blocking herbicide-resistant calluses. Delayed fluorescence analysis showed that resistance to photosynthesis-blocking herbicide in the callus lines selected was not only retained when plants were regenerated, but was also passed on to the subsequent seed generation (R1), demonstrating its genetic nature. Resistance to atrazine in two R1 regenerant lines was shown to result from reductions in the sensitivity of electron transfer to the acceptor component of photosystem II, which is presumably due to alterations in the herbicide binding protein D-1.

18 NAL Call. No.: SB610.2.B74
Annual ryegrass: an abundance of resistance, a plethora of mechanisms. Holtum, J.A.M.; Powles, S.B.
Surrey : BCPC Registered Office; 1991.
Brighton Crop Protection Conference-Weeds v. 3: p. 1071-1078; 1991. Meeting held November 18-21, 1991, Brighton, England.
Includes references.

Language: English

Descriptors: Australia; Lolium rigidum; Biotypes; Herbicide resistance; Inheritance; Phenoxypropionic herbicides; Chlorsulfuron

19 NAL Call. No.: 381 B522
Apparent destabilization of the S1 state related to herbicide resistance in a cyanobacterium mutant.
Kirilovsky, D.; Ducruet, J.M.; Etienne, A.L.
Amsterdam : Elsevier Science Publishers; 1991 Sep27.
Biochimica et biophysica acta : International journal of biochemistry and biophysics v. 1060 (1): p. 37-44; 1991 Sep27.
Includes references.

Language: English

Descriptors: Metribuzin; Cyanobacteria; Mutants; Photosystem

ii; Herbicide resistance

Abstract: In this work we describe a new phenotype of herbicide-resistant mutants. We have selected and characterized several metribuzin resistant mutants from Synechocystis 6714. We found that an increase in metribuzin resistance involved a cross-resistance with other herbicides. Therefore, the mutants could be classified in three groups: (1) metribuzin resistant; (2) atrazine and metribuzin resistant; (3) DCMU, atrazine and metribuzin resistant. Mutants which did not present cross-resistance were up to 25-fold more resistant to metribuzin than the wild type. We have studied the electron transfer properties of Photosystem II in these mutants using several techniques (oxygen emission, fluorescence, and thermoluminescence measurements). They presented modifications in the electron transfer between QA and QB, as was generally observed in most herbicide-resistant mutants previously studied. However, unexpectedly, one of these mutants, M30, presented a modified oscillatory pattern of oxygen emission. After dark adaptation the maximum of the oscillation was shifted by one flash. The matrix analysis indicated that the shifted maximum of the oxygen sequence corresponded to an increased S0 concentration in the dark-adapted state. In whole cells S0 and S1 are in equilibrium. This equilibrium is shifted in favor of S0 in the M30 mutant. The mutation renders the S-states more accessible to cell reductants.

20 NAL Call. No.: S77.I56
Applications of biotechnology to crop improvement.
Warnes, D.D.; Somers, D.A.
Morris, Minn. : The Station; 1992.
Innovations - University of Minnesota, West Central Experiment Station v. 2 (1): p. 5; 1992.

Language: English

Descriptors: Plant breeding; Genetic engineering; Genetic resistance; Herbicide resistance; Pest resistance

21 NAL Call. No.: 79.8 W41
Applications of molecular biology in weed science.
Dyer, W.E.
Champaign, Ill. : Weed Science Society of America; 1991 Jul.
Weed science v. 39 (3): p. 482-488; 1991 Jul. Paper presented at the "Symposium on New Techniques adn Advances in Weed Physiology and Molecular Biology," February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Weeds; Weed biology; Molecular biology; Transgenics; Laboratory methods; Restriction mapping; Restriction fragment length polymorphism; Cloning; Dna hybridization; Gene transfer; Electrophoresis; Gene expression; Genome analysis; Genetic analysis

Abstract: Rapid strides are being made in understanding the fundamental regulation of plant growth, development, and responses to the environment due to recent advances in molecular biology. Current questions in weed science such as herbicide mechanisms of action, biodegradation, and mechanisms of weed resistance are equally approachable using such

methodology. Efforts to introduce herbicide resistance into agronomically important crops are possible because of successful isolation and transfer of genes. Investigations of weed survival and competitive strategies based on developmental processes, such as seed dormancy, are currently underway using techniques designed to monitor and characterize differential gene expression. Molecular methodology also plays a key role in taxonomic studies of weed populations using restriction fragment length polymorphism (RFLP) mapping. The future potential for these and other techniques such as nucleic acid hybridization, polymerase chain reaction (PCR), gene transfer, and the use of transgenic plants is described.

22 NAL Call. No.: SB951.P47
An association between triazine resistance and powdery mildew resistance in Epilobium ciliatum and Senecio vulgaris.
Clay, D.V.; Nash, C.; Bailey, J.A.
Essex : Elsevier Applied Science Publishers; 1991.
Pesticide science v. 33 (2): p. 189-196; 1991. Includes references.

Language: English

Descriptors: Uk; Epilobium; Senecio vulgaris; Atrazine; Herbicide resistance; Disease resistance; Mildews; Erysiphe cichoracearum; Sphaerotheca; Susceptibility; Relationships; Types

Abstract: The response of four naturally, occurring biotypes of Epilobium ciliatum and four sources of Senecio vulgaris to the herbicide atrazine were compared with their susceptibility to the powdery mildews Sphaerotheca epilobii and Erysiphe cichoracearum. Biotypes that were resistant to atrazine were also resistant to mildew. Mechanisms that night explain the association between atrazine resistance and mildews resistance are discussed, along with possible implications of these findings for farmland ecology, an for the production of herbicide- and mildew-resistant crop plants.

23 NAL Call. No.: 450 P692
Atrazine resistance in a velvetleaf (Abutilon theophrasti) biotype due to enhanced glutathione S-transferase activity.
Anderson, M.P.; Gronwald, J.W.
Rockville, Md. : American Society of Plant Physiologists; 1991 May.
Plant physiology v. 96 (1): p. 104-109; 1991 May. Includes references.

Language: English

Descriptors: Maryland; Minnesota; Abutilon theophrasti; Biotypes; Atrazine; Herbicide resistance; Glutathione transferase; Enzyme activity; Genetic resistance

Abstract: We previously reported that a velvetleaf (Abutilon theophrasti Medic) biotype found in Maryland was resistant to atrazine because of an enhanced capacity to detoxify the herbicide via glutathione conjugation (JW Gronwald, Andersen RN, Yee C [1989] Pestic Biochem Physiol 34: 149-163). The biochemical basis for the enhanced atrazine conjugation capacity in this biotype was examined. Glutathione levels and glutathione S-transferase activity were determined in extracts from the atrazine-resistant biotype and an atrazine-susceptible or "wild-type" velvetleaf biotype. In both

biotypes, the highest concentration of glutathione (approximately 600 nanomoles per gram fresh weight) was found in leaf tissue. However, no significant differences were found in glutathione levels in roots, stems, or leaves of either biotype. In both biotypes, the highest concentration of glutathione S-transferase activity measured with 1-chloro-2,4-dinitrobenzene or atrazine as substrate was in leaf tissue. Glutathione S-transferase measured with 1-chloro-2,4-dinitrobenzene as substrate was 40 and 25% greater in leaf and stem tissue, respectively, of the susceptible biotype compared to the resistant biotype. In contrast, glutathione S-transferase activity measured with atrazine as substrate was 4.4- and 3.6-fold greater in leaf and stem tissue, respectively, of the resistant biotype. Kinetic analyses of glutathione S-transferase activity in leaf extracts from the resistant and susceptible biotypes were performed with the substrates glutathione, 1-chloro-2,4-dinitrobenzene, and atrazine. There was little or no change in apparent Km values for glutathione, atrazine, or 1-chloro-2,4-dinitrobenzene. However, the Vmax for glutathione and atrazine were approximately 3-fold higher in the resistant biotype than in the susceptible biotype. In contrast, the Vmax for 1-chloro-2,4-dinitrobenzene was 30% lower in the resistant biotype. Leaf glutathione S-transferase isozymes that exhibit activity with atrazine and 1-chloro-2,4-dinitrobenzene were separated by fast protein liquid (anion-exchange) chromatography. The susceptible biotype, had three peaks exhibiting activity with atrazine and the resistant biotype had two. The two peaks of glutathione S-transferase activity with atrazine from the resistant biotype coeluted with two of the peaks from the susceptible biotype, but peak height was three- to fourfold greater in the resistant biotype, in both biotypes, two of the peaks that exhibit glutathione S-transferase activity with atrazine also exhibited activity with 1-chloro-2,4-dinitrobenzene, with the peak height being greater in the susceptibele biotype. The resulsts indicated that atraine glutathionse S-trasferase activity for atrazine resistant in the velvetleaf biotype from Maryland is due to enhanced glutathione S-transferase activity foratrazine in leaf and stem tissue which results in an enhanced capacity to detoxify the herbicide via glutathione conjugation.

24 NAL Call. No.: 79.8 W412
Attempts to transfer paraquat resistance from barley grass (Hordeum glaucum Steud.) to barley and wheat.
Islam, A.K.M.R.; Australia; Powles, S.B.
Oxford : Blackwell Scientific Publications; 1991 Dec.
Weed research v. 31 (6): p. 395-399; 1991 Dec. Includes references.

Language: English

Descriptors: Hordeum vulgare; Triticum aestivum; Selection criteria; Herbicide resistance; Paraquat; Hybridization; Hordeum glaucum; Transfer

25 NAL Call. No.: QP601.M49
The bar gene as selectable and screenable marker in plant engineering. D'Halluin, K.; Block, M. de; Denecke, J.; Janssens, J.; Leemans, J.; Reynaerts, A.; Botterman, J.
San Diego, Calif. : Academic Press; 1992.
Methods in enzymology (216): p. 397-414; 1992. In the series analytic: Recombinant DNA (part G) / edited by R. Wu.

Includes references.

Language: English

Descriptors: Plants; Bilanafos; Herbicide resistance; Reporter genes; Marker genes; Genetic transformation; Plant breeding; Molecular biology; Tissue cultures

26 NAL Call. No.: 79.8 W41
Basis of differential tolerance of two corn hybrids (Zea mays) to metolachlor. Cottingham, C.K.; Hatzios, K.K.
Champaign, Ill. : Weed Science Society of America; 1992 Jul.
Weed science v. 40 (3): p. 359-363; 1992 Jul. Includes references.

Language: English

Descriptors: Zea mays; Hybrids; Herbicide resistance; Metolachlor; Varietal susceptibility; Enzyme activity; Glutathione transferase; Metabolic detoxification; Absorption; Translocation; Pharmacokinetics; Phytotoxicity; Crop damage

Abstract: Greenhouse and laboratory studies were conducted to determine the basis of differential response of two corn hybrids to the chloroacetanilide herbicide metolachlor. In greenhouse experiments, metolachlor at 6.7 kg ha-1 reduced the height of the susceptible 'Northrup-King 9283' corn by 53% relative to untreated controls and caused extensive visible injury 14 d after treatment. Under the same conditions, the height of metolachlor-treated 'Cargill 7567' corn seedlings was reduced by only 18% without any visible herbicide injury. The 14C-metolachlor was more rapidly absorbed by the emerging shoot of the metolachlor-susceptible hybrid, Northrup-King 9283. Thus, differential metolachlor tolerance may be due in part to processes at the level of herbicide uptake. Metabolism experiments revealed that both hybrids were able to conjugate 14C-metolachlor with glutathione at similar rates. However, glutathione S-transferase activity increased earlier during seedling development and reached higher activities in the metolachlor-tolerant hybrid, Cargill 7567.

27 NAL Call. No.: QH442.B5
Bialaphos treatment of transgenic rice plants expressing a bar gene prevents infection by the sheath blight pathogen (Rhizoctonia solani). Uchimiya, H.; Iwata, M.; Nojirl, C.; Samarajeewa, P.K.; Takamatsu, S.; Ooba, S.; Anzai, H.; Christensen, A.H.; Quail, P.H.; Toki, S.
New York, N.Y. : Nature Publishing,; 1993 Jul.
Bio/technology v. 11 (7): p. 835-836; 1993 Jul. Includes references.

Language: English

Descriptors: Oryza sativa; Rhizoctonia solani; Transgenic plants; Genetic transformation; Disease resistance; Glyphosate; Herbicide resistance; Blight; Structural genes; Acyltransferases

28 NAL Call. No.: QD415.A1B58
Biochemcial characterization of tobacco mutants resistant to azole fungicides and herbicides.
Schaller, H.; Maillot-Vernier, P.; Gondet, L.; Belliard, G.;

Benveniste, P. London : Portland Press; 1993 Nov.
Transactions v. 21 (4): p. 1052-1057; 1993 Nov. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Mutants; Conazole fungicides; Imidazolinone herbicides; Fungicide tolerance; Herbicide resistance

29 NAL Call. No.: SB950.9.C44
Biochemical basis of herbicide resistance.
Vaughn, K.C.; Duke, S.O.
Berlin, W. Ger. : Springer-Verlag; 1991.
Chemistry of plant protection v. 7: p. 141-169; 1991. In the series analytic: Herbicide resistance--brassinosteroids, gibberellins, plant growth regulators / edited by W. Ebing.
Literature review. Includes references.

Language: English

Descriptors: Herbicide resistant weeds; Biotypes; Herbicide resistance; Resistance mechanisms; Glyphosate; Sulfonylurea herbicides; Imidazolinone herbicides; Glufosinate; Triazine herbicides; Paraquat; Dinitroaniline herbicides; Mcpa; 2,4-d; Mode of action; Biochemical pathways; Enzyme inhibitors; Biosynthesis; Amino acids; Photosynthesis; Mitosis; Cell walls; Literature reviews

30 NAL Call. No.: SB957.R474 1991
Biochemical mechanisms of resistance to photosystem II herbicides. Rensen, J.J.S. van; Vos, O.J. de
London : Published for SCI by Elsevier Applied Science; 1991.
Resistance '91, Achievement and Developments in Combating Pesticide Resistance / edited by Ian Denholm, Alan L. Devonshire, and Derek W. Hollomon. p. 251-261; 1991.
Proceedings of the SCI Symposium "Resistance '91: Achievements and Developments in Combating Pesticide Resistance," 15-17 July 1991, Rothamsted Experimental Station, Harpenden, UK.
Includes references.

Language: English

Descriptors: Photosystem ii; Herbicide resistance; Photoinhibition

31 NAL Call. No.: QH442.G4522
Biotech fix for African crops held hostage to profit motive.
Conroy, D.
Washington, D.C. : King Pub. Group; 1993 Feb17.
Biotech daily v. 2 (124): p. 3; 1993 Feb17.

Language: English

Descriptors: Africa; Herbicide resistance; Genetic engineering; Food crops; Food supply

32 NAL Call. No.: QH442.B5
Biotechnology in the food industry.
Beck, C.I.; Ulrich, T.
New York, N.Y. : Nature Publishing Company; 1993 Aug.

Bio/technology v. 11 (8): p. 895-902; 1993 Aug. Includes references.

Language: English

Descriptors: Food crops; Plant breeding; Genetic engineering; Biotechnology; Food quality; Food processing quality; Genetic resistance; Herbicide resistance; Plant development

33 NAL Call. No.: 79.8 W41
A biotype of hare barley (Hordeum leporinum) resistant to paraquat and diquat. Tucker, E.S.; Powles, S.B.
Champaign, Ill. : Weed Science Society of America; 1991 Apr.
Weed science v. 39 (2): p. 159-162; 1991 Apr. Includes references.

Language: English

Descriptors: Victoria; Hordeum murinum subsp. leporinum; Biotypes; Herbicide resistance; Paraquat; Diquat; Sethoxydim; Fluazifop; Glyphosate; Cross resistance; Dry matter accumulation; Growth rate; Survival; Weed biology

Abstract: A biotype of the annual grass weed hare barley infesting an alfalfa field with a 24-yr history of the use of the bipyridylium herbicides paraquat and diquat, was investigated for resistance to these herbicides. Rates of up to 800 g ai ha-1 of each herbicide caused no mortality in the hare barley plants from this field. The same species, collected from an adjacent pasture field with no history of bipyridylium herbicide application, exhibited LD50's of 57 and 160 g ai ha-1 for paraquat and diquat, respectively. Tiller numbers and dry matter production in the biotype from the alfalfa field were not affected by the normal rate recommended for both herbicides. These results clearly show that hare barley from the alfalfa field is resistant to paraquat and diquat. Both biotypes were equally sensitive to fluazifop, glyphosate, and sethoxydim.

34 NAL Call. No.: A00035
Breakthrough should lead to higher wheat yields.
Summit, N.J. : CTB International Pub. Co; 1992 Jun04.
Biotechnology news v. 12 (14): p. 1-2; 1992 Jun04.

Language: English

Descriptors: Triticum aestivum; Genetic engineering; Micromanipulation; Herbicide resistance

35 NAL Call. No.: SB1.H6
Buffalograss tolerance to postemergence herbicides.
McCarty, L.B.; Colvin, D.L.
Alexandria, Va. : American Society for Horticultural Science; 1992 Aug. HortScience v. 27 (8): p. 898-899; 1992 Aug.
Includes references.

Language: English

Descriptors: Buchloe dactyloides; Lawns and turf; Weed control; Chemical control; 2,4-d; Dicamba; Bentazone; Mecoprop; Metsulfuron; Quinclorac; Imazaquin; Diclofop; Triclopyr; Atrazine; Asulam; Sethoxydim; Msma; Sulfometuron;

Herbicide resistance

Abstract: Buffalograss [Buchloe dactyloides (Nutt.) Engelm.] is a turfgrass species traditionally adapted to low-rainfall areas that may incur unacceptable weed encroachment when grown in higher rainfall areas such as Florida. An experiment was performed to evaluate the tolerance of two new buffalograss cultivars, 'Oasis' and 'Prairie', to postemergence herbicides commonly used for grass, broadleaf, and sedge weed control. Twenty to 40 days were required for each cultivar to recover from treatment with asulam, MSMA, and sethoxydim (2.24, 2.24, and 0.56 kg.ha-1, respectively). Other herbicides used for postemergence grass weed control (metsulfuron, quinclorac, and diclofop at 0.017, 0.56, and 1.12 kg.ha-1, respectively) did not cause unacceptable buffalograss injury. Herbicides used for postemergence broadleaf weed control, triclopyr, 2,4-D, sulfometuron, dicamba (0.56, 1.12, 0.017, and 0.56 kg.ha-1, respectively), and a three-way combination of 2,4-D + dicamba + mecoprop (1.2 + 0.54 + 0.13 kg.ha-1), caused 20 to 30 days of unacceptable or marginally acceptable turfgrass quality, while 20 days were required for 'Prairie' buffalograss to recover from atrazine treatments. 'Oasis' buffalograss did not fully recover from 2,4-D or 2,4-D + dicamba + mecoprop through 40 days after treatment. Herbicides used for postemergence sedge control, bentazon and imazaquin, caused slightly reduced, but acceptable, levels of turf quality in both cultivars throughout the experiment.

36 NAL Call. No.: TP248.27.P55P53 1991
Cell selection.
Loh, W.H.T.
Oxford : Pergamon Press; 1992.
Plant biotechnology : comprehensive biotechnology, second supplement / volume editors, Michael W. Fowler & Graham S. Warren; editor-in-chief, Murray Moo-Young. p. 33-44; 1992.
Literature review. Includes references.

Language: English

Descriptors: Plants; Mutants; Induced mutations; In vitro selection; Herbicide resistance; Salt tolerance; Metal tolerance; Heavy metals; Disease resistance; Tissue culture; Cell culture; Literature reviews

37 NAL Call. No.: SB123.P535
Characterization of a spontaneous rapeseed mutant tolerant to sulfonylurea and imidazolinone herbicides.
Magha, M.I.; Guerche, P.; Bregeon, M.; Renard, M.
Berlin : P. Parey, 1986-; 1993 Sep.
Plant breeding; Zeitschrift fur Pflanzenzuchtung v. 111 (2): p. 132-141; 1993 Sep. Includes references.

Language: English

Descriptors: Brassica napus; Mutants; Mutations; Structural genes; Oxo-acid-lyases; Dominance; Herbicide resistance; Chlorsulfuron; Triasulfuron; Metsulfuron; Imazamethabenz

38 NAL Call. No.: 79.8 W41
Characterization of acifluorfen tolerance in selected somaclones of eastern black nightshade (Solanum ptycanthum).
Yu, C.Y.; Masiunas, J.B.

Champaign, Ill. : Weed Science Society of America; 1992 Jul.
Weed science v. 40 (3): p. 408-412; 1992 Jul. Includes references.

Language: English

Descriptors: Solanum; Herbicide resistant weeds; Acifluorfen; Somaclonal variation; Herbicide resistance; Absorption; Translocation; Metabolism; Metabolic detoxification; Cross resistance; Diquat; Oxyfluorfen; Paraquat

Abstract: Acifluorfen tolerance in eastern black nightshade somaclones was characterized in two experiments. One experiment determined the involvement of absorption, translocation, and metabolism in acfiluorfen tolerance. Less than 6% of the applied 14C-acifluorfen was absorbed. There were no differences in acifluorfen absorption between susceptible and tolerant somaclones. More 14C-acifluorfen was translocated in the susceptible than the tolerant somaclones. The susceptible somaclone did not metabolize acifluorfen while some somaclones (i.e., EBN-3A) metabolized 14C-acifluorfen. A second experiment determined the tolerance of the somaclones to oxyfluorfen, diquat, and paraquat. Most acifluorfen-tolerant somaclones were tolerant to oxyfluorfen but were susceptible to diquat and paraquat. One somaclone, EBN-3A, was extremely tolerant to acifluorfen, paraquat, and diquat.

39 NAL Call. No.: SB957.R47
Characterization of resistance to atrazine in a velvetleaf (Abutilon theophrasti Medik.) biotype from Wisconsin.
Gray, J.A.; Stoltenberg, D.E.; Balke, N.E.
East Lansing, Mich. : Pesticide Research Center, Michigan State University,; 1993.
Resistant pest management v. 5 (2): p. 17; 1993.

Language: English

Descriptors: Wisconsin; Cabt; Abutilon theophrasti; Herbicide resistant weeds; Biotypes; Atrazine; Herbicide resistance

40 NAL Call. No.: 442.8 Z8
Characterization of transgenic sulfonylurea-resistant flax (Linum usitatissimum).
McSheffrey, S.A.; McHughen, A.; Devine, M.D.
Berlin, W. Ger. : Springer International; 1992.
Theoretical and applied genetics v. 84 (3/4): p. 480-481; 1992. Includes references.

Language: English

Descriptors: Linum usitatissimum; Arabidopsis thaliana; Agrobacterium tumefaciens; Genetic transformation; Transgenics; Gene transfer; Ligases; Structural genes; Enzyme activity; Herbicide resistance; Chlorsulfuron; Metsulfuron; Segregation; Inheritance; Line differences; Roots; Growth

Abstract: Fourteen transgenic flax (Linum usitatissimum) lines, carrying a mutant Arabidopsis acetolactate synthase (ALS) gene selected for resistance to chlorsulfuron, were characterized for resistance to two sulfonylurea herbicides. Progeny of 10 of the 14 lines segregated in a ratio of 3 resistant to 1 susceptible, indicating a single insertion. Progeny of 1 line segregated in a 15:1 ratio, indicating two

insertions of the ALS gene at independent loci. Progeny from 3 lines did not segregate in a Mendelian fashion and were likely the products of chimeric shoots. Resistance to chlorsulfuron was stably inherited in all lines. At the enzyme level, the transgenic lines were 2.5 to more than 60 times more resistant to chlorsulfuron than the parental lines. The transgenic lines were 25-260 times more resistant to chlorsulfuron than the parental lines in root growth experiments and demonstrated resistance when grown in soil treated with 20 g ha-1 chlorsulfuron. The lines demonstrated less resistance to metsulfuron methyl; in root growth experiments, the transgenic lines were only 1.6-4.8 times more resistant to metsulfuron methyl than the parental lines. Resistance was demonstrated in the field at half (2.25 g ha-1) and full (4.5 g ha-1) rates of metsulfuron methyl.

41 NAL Call. No.: SB951.P49
Chlorsulfuron inhibition of phloem translocation in chlorsulfuron-resistant and -susceptible Arabidopsis thaliana.
Hall, L.M.; Devine, M.D.
Orlando, Fla. : Academic Press; 1993 Feb.
Pesticide biochemistry and physiology v. 45 (2): p. 81-90; 1993 Feb. Includes references.

Language: English

Descriptors: Chlorsulfuron; Phloem loading; Inhibition; Arabidopsis thaliana; Types; Herbicide resistance; Susceptibility; Uptake mechanisms; Sucrose; Plasma membranes; Microsomes; Enzymes; Adenosinetriphosphatase; Enzyme activity; Protein content

Abstract: The herbicide chlorsulfuron is not translocated readily in plants because of an inhibitory effect on phloem translocation. More chlorsulfuron was translocated in a chlorsulfuron-resistant (R) biotype of Arabidopsis thaliana than in a susceptible (S) biotype, indicating that the effect on translocation is secondary to inhibition of ALS, the primary site of action of the herbicide. The R biotype did not different from the S biotype in its ability, to translocate exogenously applied sucrose: however, translocation of exogenously applied sucrose following chlorsulfuron treatment was greater in the R biotype than in the S biotype. Chlorsulfuron pretreatment inhibited rapid sucrose uptake into leaf discs by 41% in the S biotype but by only 17% in the R biotype. This result suggests that chlorsulfuron inhibits phloem transport by restricting sucrose uptake into the phloem. Purified plasma membrane preparations extracted from the two biotypes following chlorsulfuron treatment did not differ in H+ -ATPase activity or total plasmalemma protein content. Possible alternative mechanisms by which chlorsulfuron may inhibit phloem transport are discussed.

42 NAL Call. No.: 79.8 W41
Chlorsulfuron-resistant sugarbeet: cross-resistance and physiological basis of resistance.
Hart, S.E.; Saunders, J.W.; Penner, D.
Champaign, Ill. : Weed Science Society of America; 1992 Jul.
Weed science v. 40 (3): p. 378-383; 1992 Jul. Includes references.

Language: English

Descriptors: Beta vulgaris; Herbicide resistance; Chlorsulfuron; Cross resistance; Chlorimuron; Imidazolinone herbicides; Sulfonylurea herbicides; Enzyme inhibitors; Oxo-acid-lyases; Enzyme activity; Absorption; Metabolism

Abstract: Greenhouse and laboratory studies were conducted to determine the extent of cross-resistance of chlorsulfuron-resistant sugarbeet (CR1-B) to other herbicides that inhibit acetolactate synthase (ALS) and to determine the physiological basis of resistance. Cross-resistance to metsulfuron, imazaquin, and imazethapyr was not evident, while only marginal cross-resistance was observed to triasulfuron, DPX-L5300, and nicosulfuron. CR1-B was moderately resistant to chlorsulfuron and chlorimuron and was highly cross-resistant to thifensulfuron and primisulfuron. Further greenhouse studies demonstrated that CR1-B was not significantly injured by thifensulfuron and primisulfuron applied at or exceeding the field use rate. Studies with 14C-primisulfuron showed that differential absorption or metabolism of primisulfuron could not account for the observed resistance. ALS enzyme assays showed that the CR1-B ALS enzyme activity was 66, 26, and 13 times less sensitive to chlorsulfuron, thifensulfuron, and primisulfuron inhibition, respectively, compared to ALS enzyme extracted from sensitive sugarbeets. An altered ALS enzyme, which is less sensitive to sulfonylurea herbicide inhibition, appears to be the physiological basis of resistance.

43 NAL Call. No.: SD112.F67
Clonal variation in tolerance to hexazinone.
Borough, C.; Jamieson, D.
Rotorua : The Institute; 1991.
FRI bulletin - Forest Research Institute, New Zealand Forest Service (160): p. 139-141; 1991. Paper presented at the "FRI/NZFP Forest Ltd., Clonal Forestry Workshop, May 1-2, 1989, Rotorua, New Zealand.

Language: English

Descriptors: Forest trees; Clones; Hexazinone; Herbicide resistance; Genetic variation

44 NAL Call. No.: TP248.13.S68
Cloning and expression of mutant EPSP-synthetase gene of Escherichia coli in transgenic plants.
Mett, V.L.; Urmeeva, F.I.; Kobets, N.S.; Kolganova, T.V.; Aliev, K.A.; Piruzyan, E.S.
New York, N.Y. : Allerton Press; 1991.
Soviet biotechnology (3): p. 27-33; 1991. Translated from: Biotekhnologiia, (3), 1991, p. 19-22, (TP248.2.B57). Includes references.

Language: English; Russian

Descriptors: Genetic engineering; Escherichia coli; Mutants; Glyphosate; Herbicide resistance; Treatment; Nitroso compounds; Guanidines; Genetic analysis; Phosphates; Ligases; Genetic code; Gene expression; Cloning; Plasmids; Transgenics; Nicotiana tabacum

45 NAL Call. No.: 79.8 W41
Cole crop (Brassica oleracea) tolerance to clomazone.
Scott, J.E.; Weston, L.A.

Champaign, Ill. : Weed Science Society of America; 1992 Jan.
Weed science v. 40 (1): p. 7-11; 1992 Jan. Includes
references.

Language: English

Descriptors: Brassica oleracea; Herbicide resistance;
Clomazone; Bioassays; Chlorophyll; Biosynthesis; Application
rates; Metabolic inhibitors; Mode of action; Metabolic
detoxification; Source sink relations; Metabolites; Roots;
Uptake; Translocation

Abstract: A laboratory bioassay was conducted to determine
the differential tolerance of cole crops to clomazone as
measured by extractable total chlorophyll and carotenoids.
Clomazone concentrations causing 50% inhibition (I50) in the
biosynthesis of total chlorophyll in broccoli, cauliflower,
and green and red cabbage cotyledons were 16, 11, 3, and 11
micromolar respectively, while I50 values for carotenoid
levels were 20, 10, 4, and 8 micromolar clomazone,
respectively. Therefore, broccoli was the most tolerant to
clomazone based upon extractable chlorophyll and carotenoid
concentrations. Further laboratory studies were performed to
investigate the basis for differential clomazone tolerance in
3-wk-old cole crop seedlings. No differences in total root
uptake of 14C-clomazone were observed between these crops
after 24 h. There were no differences in rate of metabolism of
14C-clomazone to methanol-soluble metabolites in roots of
these crops. Percentage of polar metabolites in roots remained
fairly constant over time. There were also no differences
between crops in percentage of methanol-soluble 14C-clomazone
metabolites formed in shoots between 24 and 96 h. In all
crops, levels of 14C-clomazone decreased in a similar manner
over time in methanolic extracts of roots and shoots while
nonextractable 14C levels increased, indicating a conversion
of clomazone to insoluble, nonextractable forms. Differential
uptake, translocation, and metabolism do not appear to account
for clomazone selectivity differences between cole crop
seedlings.

46 NAL Call. No.: SB951.P49
Comparative uptake, translocation, and metabolism of paraquat
in tolerant Kwangkyo and susceptible Hood soybean.
Kim, S.; Hatzios, K.K.
Orlando, Fla. : Academic Press; 1993 Oct.
Pesticide biochemistry and physiology v. 47 (2): p. 149-158;
1993 Oct. Includes references.

Language: English

Descriptors: Glycine max; Cultivars; Susceptibility; Herbicide
resistance; Paraquat; Uptake; Deposition; Leaves; Waxes;
Absorption; Spatial distribution; Plant tissues;
Translocation; Metabolism; Mode of action

Abstract: The "Kwangkyo" and "Hood" cultivars of soybean
[Glycine max (L.) Merr.] are differentially sensitive to the
herbicide paraquat. The margin of this intraspecific
differential herbicide tolerance is narrow and Kwangkyo is
about 10-fold more tolerant to paraquat than Hood soybean. The
deposition of epicuticular wax on the surface of the first
fully expanded trifoliolate was similar in both soybean
cultivars and treatment with 1 millimole paraquat did not
influence the epicuticular wax content in any cultivar.

Seedlings of Kwangkyo and Hood soybean absorbed comparable amounts of radioactivity following exposure to root-applied 14C-labeled paraquat for 24 hr. Most of the absorbed radioactivity remained in the roots of seedlings of both cultivars, but a greater amount of the recovered radioactivity translocated from roots to stems and leaves of the sensitive Hood soybean. Following feeding of the cut ends of their petioles with [14C]paraquat for 12 and 24 hr, excised trifoliolates of Kwangkyo soybean retained a greater portion of absorbed radioactivity in their petioles and translocated a smaller amount of radioactivity into the interveinal regions. By contrast, excised trifoliolates of Hood soybean retained a smaller portion of absorbed radioactivity in their petioles and released a higher amount of absorbed radioactivity into the interveinal regions. Extractable paraquat was not metabolized to any extent by tissues of either of the two cultivars and differential metabolism does not appear to play a role in the observed differential response of Kwangkyo and Hood soybean to paraquat. Overall, the results of the present study suggest that restricted mobility or a delayed release of paraquat into the mesophyll region is a likely basis for the observed tolerance of Kwangkyo soybean to the herbicide paraquat.

47 NAL Call. No.: SB610.W39
Concerns a weed scientist might have about herbicide-tolerant crops. Radosevich, S.R.; Ghersa, C.M.; Comstock, G.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 635-639; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance; Weed control; Biotechnology; Ethics

48 NAL Call. No.: SB610.W39
Concerns of seed company officials with herbicide-tolerant cultivars. Duvick, D.N.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 640-646; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Seed industry; Transgenic plants; Herbicide resistance; Cultivars; Biotechnology; Profitability; Supply balance; Research

49 NAL Call. No.: QR53.B56
Construction of multiple herbicide resistant ammonia excreting strains of cyanobacterium Nostoc muscorum.
Modi, D.R.; Singh, D.R.; Rao, A.K.; Chakravarty, K.S.; Singh, H.N. Middlesex : Science and Technology Letters; 1991 Nov.
Biotechnology letters v. 13 (11): p. 793-798; 1991 Nov.
Includes references.

Language: English

Descriptors: Nostoc muscorum; Strains; Gloeocapsa; Herbicides; Herbicide resistance; Phenotypes; Dna; Genetic transformation; Gene transfer; Mutations; Ammonia; Excretion; Photosystem ii; Nitrogen fixation

Abstract: Machete resistant (Matr), basalin resistant (Basr), 3(3,4 dichlorophenyl)-1,1-dimethyl urea resistant (DCMUr), atrazine resistant (Atr(r)) and propanil resistant (Prpr) phenotypes Gloeocapsa sp. were contransformed to Nostoc muscorum at high frequency. Spontaneously occurring mutants of the multiple herbicide resistant transformant containing L-methionine-DL-sulfoximine resistant (Msxr), ethylene diamine resistant (Edar) of phosphinothricin resistant (Pptr) glutamine synthetase (GS) showed extracellular liberation of ammonia resulting from fixation of N2 under photosynthetic conditions. Results suggest a definite role of GS activity in regulation of extracellular ammonia.

50 NAL Call. No.: SB610.W39
Control of annual bluegrass (Poa annua) in Kentucky bluegrass (Poa pratensis) turf with linuron.
Hall, J.C.; Carey, C.K.
Champaign, Ill. : The Weed Science Society of America; 1992 Oct. Weed technology : a journal of the Weed Science Society of America v. 6 (4): p. 852-857; 1992 Oct. Includes references.

Language: English

Descriptors: Ontario; Cabt; Poa pratensis; Cultivars; Herbicide resistance; Linuron; Application rates; Poa annua; Weed control; Chemical control; Plant density; Quality; Seedling emergence; Injuries; Temperate climate

51 NAL Call. No.: 79.9 W52R
Control of diclofop-resistant Italian ryegrass.
Brewster, B.D.; Donaldson, W.S.; Appleby, A.P.
S.l. : The Society; 1992.
Research progress report - Western Society of Weed Science. p. III/128; 1992. Meeting held on March 9-12, 1992, Salt Lake City, Utah.

Language: English

Descriptors: Oregon; Lolium multiflorum; Diclofop; Herbicide resistance; Weed control

52 NAL Call. No.: SB476.G7
Controlling weeds in ornamental grasses.
Whitwell, T.
Overland Park, Kan. : Intertec Publishing Corporation; 1993 Aug. Grounds maintenance v. 28 (8): p. 26-30; 1993 Aug.

Language: English

Descriptors: Grasses; Ornamental herbaceous plants; Weed control; Herbicides; Herbicide resistance

53 NAL Call. No.: SB951.P49
Correlation of propanil hydrolyzing enzyme activity with leaf morphology in wild rices of genome CCDD.
Jun, C.J.; Matsunaka, S.
Orlando, Fla. : Academic Press; 1991 May.
Pesticide biochemistry and physiology v. 40 (1): p. 80-85; 1991 May. Includes references.

Language: English

Descriptors: Oryza; Wild plants; Hybrids; Leaves; Plant morphology; Amidase; Enzyme activity; Herbicide resistance; Propanil; Phytotoxicity

Abstract: The propanil hydrolyzing enzyme, aryl acylamidase I (AAI) (arylacylamine amidohydrolase, EC 3.5.1.13), was highly correlated (r = -0.83) with leaf width in three species of genus Oryza with genome CCDD. The specific activity of AAI was lower in the leaves of wide-leafed plants and this was well-reflected in propanil phytotoxicity in those plants. There were no significant differences between conjugation of 3,4-dichloroaniline or the presence of AAI inhibitors in the crude enzyme solutions from the narrow-leafed and wide-leafed strains. The same relationship between AAI activity and leaf width was observed in interspecific F, hybrids involving genome CCDD. In those F1 hybrids the wide- and narrow-leafed strains showed comparable AAI activity per leaf of equal length. It was concluded that the concentration of the enzyme in the CCDD plants was diluted by plant bulk in the wide-leafed strains and the correlation appeared to be the indirect effect of genes altering plant morphology, especially leaf area. The significance of the correlations is discussed in relation to propanil resistance and plant phylogenetics.

54 NAL Call. No.: 442.8 Z8
The cost of herbicide resistance measured by a competition experiment. Reboud, X.; Till-Bottraud, I.
Berlin, W. Ger. : Springer International; 1991.
Theoretical and applied genetics v. 82 (6): p. 690-696; 1991. Includes references.

Language: English

Descriptors: Setaria italica; Herbicide resistance; Atrazine; Plant competition; Shoots; Dry matter; Plant height; Seed set; Seeds; Line differences; Plant density

Abstract: The cost of resistance has been measured by a competition experiment over a ranee of densities, in the absence of herbicide treatment, on two nearly isogenic lines of Foxtail millet, differing in a chloroplastic resistance to herbicide. Three characters have been measured: shoot height, shoot weight, and seed production. Sensitive individuals were better competitors despite a larger decrease in production under within-biotype competition. The cost of resistance was density dependent and increased with density. The cost was higher when measured on seed production and reached 65% at the higher density for resistant individuals. This is compatible with the low frequency or the absence of that gene in natural populations. This work illustrates that the cost is easiest to observe when high levels of constraints are used.

55 NAL Call. No.: SB113.2.S45

Cotton meets the biotech challenge: genetic engineering races to the marketplace.
Cutler, K.
Cedar Falls, IA : Freiberg Pub. Co; 1991 Nov.
Seed industry v. 42 (10): p. 4-5, 19; 1991 Nov.

Language: English

Descriptors: Gossypium; Bromoxynil; Herbicide resistance; Genetic engineering; Field tests; Sulfonylurea herbicides; Usda

56 NAL Call. No.: 450 P692
Cross-resistance to herbicides in annual ryegrass (Lolium rigidum). II. Chlorsulfuron resistance involves a wheat-like detoxification system. Christopher, J.T.; Powles, S.B.; Liljegren, D.R.; Holtum, J.A.M. Rockville, Md. : American Society of Plant Physiologists; 1991 Apr. Plant physiology v. 95 (4): p. 1036-1043; 1991 Apr. Includes references.

Language: English

Descriptors: Lolium rigidum; Triticum aestivum; Biotypes; Chlorsulfuron; Herbicide resistance; Cross resistance; Metabolism; Ligases; Translocation; Phytotoxicity; Metabolic detoxification; Biochemical pathways

Abstract: Lolium rigidum Gaud. biotype SLR31 is resistant to the herbicide diclofop-methyl and cross-resistant to several sulfonylurea herbicides. Wheat and the cross-resistant ryegrass exhibit similar patterns of resistance to sulfonylurea herbicides, suggesting that the mechanism of resistance may be similar. Cross-resistant ryegrass is also resistant to the wheat-selective imidazolinone herbicide imazamethabenz. The cross-resistant biotype SLR31 metabolized [phenyl-U-14C]chlorsulfuron at a faster rate than a biotype which is susceptible to both diclolop-methyl and chlorsulfuron. A third biotype which is resistant to diclofop-methyl but not to chlorsulfuron metabolized chlorsulfuron at the same rate as the susceptible biotype. The increased metabolism of chlorsulfuron observed in the cross-resistant biotype is, therefore, correlated with the patterns of resistance observed in these L. rigidum biotypes. During high performance liquid chromatography analysis the major metabolite of chlorsulfuron in both susceptible and cross-resistant ryegrass coeluted with the major metabolite produced in wheat. The major product is clearly different from the major product in the tolerant dicot species, flax (Linium usitatissimum). The elution pattern of metabolites of chlorsulfuron was the same for both the susceptible and cross-resistant ryegrass but the cross-resistant ryegrass metabolized chlorsulfuron more rapidly. The investigation of the dose response to sulfonylurea herbicides at the whole plant level and the study of the metabolism of chlorsulfuron provide two independent sets of data which both suggest that the resistance to chlorsulfuron in cross-resistant ryegrass biotype SLR31 involves a wheat-like detoxification system.

57 NAL Call. No.: 450 P692
Cross-resistance to herbicides in annual ryegrass (Lolium rigidum). III. On the mechanism of resistance to diclofop-methyl.
Holtum, J.A.M.; Matthews, J.M.; Hausler, R.E.; Lijegren, D.R.;

Powles, S.B. Rockville, Md. : American Society of Plant Physiologists; 1991 Nov. Plant physiology v. 97 (3): p. 1026-1034; 1991 Nov. Includes references.

Language: English

Descriptors: Australia; Lolium rigidum; Leaves; Diclofop; Herbicide resistant weeds; Biotypes; Metabolism; Uptake; Translocation; Genetic variation; Weed control; Weed biology

Abstract: Annual ryegrass (Lolium rigidum) biotype SLR 31 is resistant to the postemergent graminicide methyl-2-[4-(2,4-dichlorophenoxy) phenoxy]-propanoate (diclofop-methyl). Uptake of [14C](Uphenyl)diclofop-methyl and root/shoot distribution of radioactivity in susceptible and resistant plants were similar. In both biotypes, diclofop-methyl was rapidly demethylated to the biocidal metabolite diclofop acid which, in turn, was metabolized to ester and aryl-O-sugar conjugates. Susceptible plants accumulated 5 to 15% more radioactivity in diclofop acid than did resistant plants. Resistant plants had a slightly greater capacity to form nonbiocidal sugar conjugates. Despite these differences, resistant plants retained 20% of 14C in the biocidal metabolite diclofop acid 192 hours after treatment, whereas susceptible plants, which were close to death, retained 30% in diclofop acid. The small differences in the pool sizes of the active and inactive metabolites are by themselves unlikely to account for a 30-fold difference in sensitivity to the herbicide at the whole plant level. Similar highpressure liquid chromatography elution patterns of conjugates from both susceptible and resistant biotypes indicated that the mechanisms and the products of catabolism in the biotypes are similar. It is suggested that metabolism of diclofop-methyl by the resistant biotype does not alone explain resistance observed at the whole-plant level. Diclofop acid reduced the electrochemical potential of membranes in etiolated coleoptiles of both biotypes; 50% depolarization required 1 to 4 micromole diclofop acid. After removal of diclofop acid, membranes from the resistant biotype recovered polarity, whereas membranes from the susceptible biotype did not. Internal concentrations of diclofop acid 4 h after exposing plants to herbicide were estimated to be 36 to 39 micromolar in a membrane fraction and 16 to 17 micromolar in a soluble fraction. Such concentrations should be sufficient to fully depolarize membranes. It is postulated that differences in the ability of membranes to recover from depolarization are correlated with the resistance response of biotype SLR 31.

58 NAL Call. No.: 450 P692
Cross-resistance to herbicides in annual ryegrass (Lolium rigidum). IV. Correlation between membrane effects and resistance to graminicides. Hausler, R.E.; Holtum, J.A.M.; Powles, S.B.
Rockville, Md. : American Society of Plant Physiologists; 1991 Nov. Plant physiology v. 97 (3): p. 1035-1043; 1991 Nov. Includes references.

Language: English

Descriptors: Australia; Lolium rigidum; Biotypes; Herbicide resistant weeds; Weed control; Cross resistance; Diclofop; Fluazifop; Herbicides; Weed biology; Cell membranes; Polarity; Membrane potential

Abstract: The herbicidally active aryloxyphenoxypropionates diclofop acid, haloxyfop acid, and fluazifop acid and the cyclohexanedione sethoxydim depolarized membranes in coleoptiles of eight biotypes of herbicide-susceptible and herbicide-resistant annual ryegrass (Lolium rigidum). Membrane polarity was reduced from -100 millivolts to -30 to -50 millivolts. Membranes repolarized after removal of the compounds only in biotypes with resistance to the compound added. Repolarization was not observed in herbicide-susceptible L. rigidum, nor was it observed in biotypes resistant to triazine, triazole, triazinone, phenylurea, or sulfonylurea herbicides but not resistant to aryloxyphenoxypropionates and cyclohexanediones. Chlorsulfuron, a sulfonylurea herbicide, at a saturating concentration of 1 micromolar, reduced membrane polarity in all biotypes studied by only 15 millivolts. The recovery of membrane potential following the removal of chlorsulfuron was restricted to chlorsulfuron-susceptible and -resistant biotypes that did not exhibit diclofop resistance. These differences in membrane responses are correlated with resistance to diclofop rather than with resistance to chlorsulfuron. It is suggested that the differences may reflect altered membrane properties of diclofop-resistant biotypes. Further circumstantial evidence for dissimilarity of properties of membranes from diclofop-resistant and diclofop-susceptible ryegrass is provided by observations that K+/Na+ ratios were significantly higher in coleoptiles from diclofop-resistant biotypes than in coleoptiles from susceptible plants. Intact and excised roots from susceptible biotypes were capable of acidifying the external medium, whereas roots from resistant biotypes were unable to do so. The ineluctable conclusion is that in L. rigidum the phenomena of membrane repolarization and resistance to aryloxyphenoxypropionate and cyclohexanedione herbicides are correlated.

59 NAL Call. No.: 442.8 B5236
Dark adapted leaves of paraquat-resistant tobacco plants emit less ultraweak light than susceptible ones.
Hideg, E.; Inaba, H.
Orlando, Fla. : Academic Press; 1991 Jul31.
Biochemical and biophysical research communications v. 178 (2): p. 438-443; 1991 Jul31. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Leaves; Paraquat; Herbicide resistance; Biotypes; Superoxide dismutase; Dark; Light; Emission; Light intensity

Abstract: Long term light emission was compared from leaves of paraquat-resistant and -susceptible tobacco plants. In the minutes time scale, delayed light emission of the two biotypes was similar both in kinetics and in intensity. However, after several hours in the dark, ultraweak light emission from leaves of resistant plants was about one third of the light emitted by susceptible samples, We suggest, that this difference is due to the higher activity of superoxide dismutase in resistant biotypes, earlier reported by Tanaka et al. (1988) (Plant Cell Physiol. 29, 743-746), and propose a model for the mechanism of ultraweak light emission from these samples.

60 NAL Call. No.: SB951.P47

Deamination of metribuzin in tolerant and susceptible soybean (Glycine max) cultivars.
Fedtke, C.
Essex : Elsevier Applied Science Publishers; 1991.
Pesticide science v. 31 (2): p. 175-183; 1991. Includes references.

Language: English

Descriptors: Glycine max; Cultivars; Herbicide resistance; Susceptibility; Metribuzin; Carbon; Deamination; Isotope labeling; Metabolites; Herbicide residues

Abstract: The deamination of metribuzin was studied in vitro in peroxisomes isolated from the leaves of soybean cultivars which were either metribuzin tolerant, intermediate, or sensitive. The deamination rate observed with peroxisomes from tolerant leaves was about twice the rate observed with peroxisomes from sensitive leaves. The intermediate group was also intermediate with respect to the in-vitro deamination rate. Tolerant and sensitive intact soybean plants were pulse-labeled with [14C]metribuzin via the roots for 5 h. The extractable radioactivity in roots, stems and leaves was measured and separated into metabolites after the 5 h pulse and after an additional 24 h growth in water. The level of DA (deaminated metribuzin) was always significantly higher in the stems and leaves of tolerant soybean plants (4.8-10.0% of the extracted radioactivity) than in sensitive stems and leaves (1.8-2.9%). Conjugates were rapidly formed in tolerant as well as in sensitive soybean tissues. More conjugates were found in the tolerant cultivars, especially after the 5 + 24 h incubation time. Labeled [14C]DA fed to soybean plants via the roots was conjugated two to four times faster than [14C]metribuzin. Tolerant soybean tissue conjugated [14C]DA two to three times faster than sensitive tissue. The results are interpreted as showing that, in tolerant soybean plants, metribuzin is metabolized via deamination and subsequent conjugation, in addition to the well-known direct conjugation of metribuzin parent compound.

61 NAL Call. No.: SB950.2.I3I4
Developing herbicide resistance in corn.
Schoper, J.; Armstrong-Gustafson, P.; McBratney, B.
Urbana, Ill. : Cooperative Extension Service, Univ of Illinois at Urbana-Champaign; 1991.
Illinois Agricultural Pesticides Conference summaries of presentations January 8, 9, 10, 1991, Urbana, Illinois / Univ of Illinois at Urbana-Champaign, Coop Ext Serv, in coop with the Illinois Natural History Survey. p. 59-60; 1991.
"Proceedings of the 1991 Illinois Agricultural Pesticides Conference," January 8-10, 1991, Urbana, Illinois.

Language: English

Descriptors: Zea mays; Herbicide resistance

62 NAL Call. No.: TP248.27.P55P52
Developing herbicide resistance in crops by gene transfer technology. Stalker, D.M.
New York, N.Y. : Chapman and Hall; 1991.
Plant biotechnology v. 1: p. 82-104; 1991. In the series analytic: Plant genetic engineering / edited by D. Grierson.
Literature review. Includes references.

Language: English

Descriptors: Crops; Gene transfer; Herbicide resistance; Genetic transformation; Vectors; Plasmids; Transgenics; Agrobacterium tumefaciens; Agrobacterium rhizogenes; Direct DNAuptake; Literature reviews

63 NAL Call. No.: SB610.W39
Developing herbicide-tolerant crop cultivars: introduction.
Harrison, H.F. Jr
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 613-614; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance; Cultivars; Genotypes; Genetic engineering; Biotechnology

64 NAL Call. No.: QH301.A76
Development of herbicide tolerance in peas. I. Tissue culture and in vitro selection.
Van Roggen, P.M.; Kirkwood, R.C.; Boyd, P.A.
Wellesbourne, Warwick : The Association of Applied Biologists; 1991. Aspects of applied biology (27): p. 267-270; 1991. In the series analytic: Production and protection of legumes / edited by R.J. Froud-Williams, P. Gladders, M.C. Heath, J.F. Jenkyn, C.M. Knott, A. Lane and D. Pink. Includes references.

Language: English

Descriptors: Pisum sativum; Callus; Growth; Growth inhibitors; Herbicides; Resistance; Glyphosate; Metsulfuron; Tissue culture

65 NAL Call. No.: QH301.A76
Development of herbicide tolerance in peas. II. Regeneration via somatic embryogenesis.
Van Doorne, L.E.; Marshall, G.; Kirkwood, R.C.
Wellesbourne, Warwick : The Association of Applied Biologists; 1991. Aspects of applied biology (27): p. 271-274; 1991. In the series analytic: Production and protection of legumes / edited by R.J. Froud-Williams, P. Gladders, M.C. Heath, J.F. Jenkyn, C.M. Knott, A. Lane and D. Pink. Includes references.

Language: English

Descriptors: Pisum sativum; Cultivars; Culture media; Genotypes; Herbicide resistance; Diflufenican; Glyphosate; Metsulfuron; Somatic embryogenesis

66 NAL Call. No.: QK600.M82
Development of resistance in Bipolaris oryzae against edifenphos. Annamalai, P.; Lalithakumari, D.
Cambridge : Cambridge University Press; 1992 Jun.
Mycological research v. 96 (pt.6): p. 454-460; 1992 Jun.
Includes references.

Language: English

Descriptors: Oryza sativa; Bipolaris; Plant pathogenic fungi; Edifenphos; Herbicide resistance; Mutants; Adaptation; Virulence; Pathogenicity; Strain differences

67 NAL Call. No.: QH301.N32
Development of shade-type appearance-light intensity adaptation and regulation of the D1 protein Synechococcus. Koenig, F.
New York, N.Y. : Plenum Press; 1992.
NATO ASI series : Series A : Life sciences v. 226: p. 545-550; 1992. In the series analytic: Regulation of chloroplast biogenesis / edited by J.H. Argyroudi-Akoyunoglou. Proceedings of a NATO Advanced Research Workshop, July 28-August 3, 1991, Crete, Greece. Includes references.

Language: English

Descriptors: Synechococcus; Biological development; Light intensity; Photosynthesis; Plant proteins; Protein synthesis; Shade; Herbicide resistance; Mutants

68 NAL Call. No.: 442.8 Z8
The development of sulfonylurea herbicide-resistant birdsfoot trefoil (Lotus corniculatus) plants from in vitro selection. Pofelis, S.; Le, H.; Grant, W.F.
Berlin, W. Ger. : Springer International; 1992.
Theoretical and applied genetics v. 83 (4): p. 480-488; 1992. Includes references.

Language: English

Descriptors: Lotus corniculatus; In vitro selection; Herbicide resistance; Sulfonylurea herbicides; Callus; Tissue culture; Shoots; Regeneration; Inheritance; Oxo-acid-lyases; Enzyme activity; Phytotoxicity

Abstract: Herbicide-resistant lines of birdsfoot trefoil (Lotus corniculatus L. cv 'Leo') were isolated after sequential selection at the callus, shoot, and whole plant levels to the sulfonylurea (SU) herbicide Harmony [DPX-M6316; 3-[[[(4-methoxy-6methyl-1,3,5, triazine-2-yl) amino] carbonyl] amino] sulfonyl-2-thiophenecarboxylate]. In field and growth chamber tests the Harmony regenerant lines displayed an increased tolerance as compared to control plants from tissue culture and controls grown from seed. Results of evaluation of callus cultures of regenerated mutant lines signify stability of the resistance. Outcrossed seeds collected from field trials, and tested in vitro for herbicide resistance, indicate that the trait is heritable and that resistance may be due to reduced sensitivity of acetolactate synthase to SU inhibition. Genetically stable herbicide-resistant lines of birdsfoot trefoil were successfully isolated using in vitro selection.

69 NAL Call. No.: 64.8 C883
Development of sulfonylurea-resistant rapeseed using chemical mutagenesis. Tonnemaker, K.A.; Auld, D.L.; Thill, D.C.; Mallory-Smith, C.A.; Erickson, D.A. Madison, Wis. : Crop Science Society of America; 1992 Nov. Crop science v. 32 (6): p. 1387-1391; 1992 Nov. Includes references.

Language: English

Descriptors: Brassica napus; Herbicide resistance; Chlorsulfuron; Metsulfuron; Screening; Induced mutations; Sulfonylurea herbicides; Cultivars; Mutants; Varietal susceptibility; Genotypes

Abstract: Residual levels of sulfonylurea (SU) herbicides in the soil have limited rapeseed (Brassica napus L. var. napus) production in the Pacific Northwest. In a greenhouse screening procedure, the test herbicide suppressed the growth of susceptible rapeseed plants but allowed normal growth of resistant plants. Mutant (M2) populations of 'Cascade', 'Bridger', and 'Cathy' winter rapeseed, 'R-500' spring rapeseed (B. rapa L. subsp. rapa), and 'Tilney' spring mustard (Sinapis alba L.; syn F. hirta Moench.) were screened with DPX-G8311, a 5:1 mixture of the SU herbicides chlorsulfuron (2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide) and metsulfuron [(methyl 1-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-amino]carbonyl]amino] sulfonyl)benzoate]], applied preemergence at 7.5 g a.i. ha-1. Approximately 243 000 M2 seedlings were screened and 178 were selected for additional tests. In progeny tests, several M3 and M4 families were identified that survived 6.5 g a.i. ha-1 DPX-G8311 applied preemergence but failed to survive the same rate of DPX-G8311 applied postemergence. DPX-G8311 was applied preemergence at 0 to 64 g a.i. ha-1, to one M3 and six M4 families to determine a dose X family response relationship. Calculated 50% growth reduction (GR(50)) values for both number of nodes produced and dry weight accumulation were up to 25 times greater for the selected M3 and M4 families than for the susceptible cultivar Cascade. Rapeseed lines resistant to soil residual levels of SU herbicides but susceptible to SU herbicide foliar applied would allow rapeseed to be planted after a small-grain cereal to which a SU herbicide had been applied.

70 NAL Call. No.: 450 P692

Developmental variability of photooxidative stress tolerance in paraquat-resistant Conyza.

Amsellem, Z.; Jansen, M.A.K.; Driesenaar, A.R.J.; Gressel, J.

Rockville, MD : American Society of Plant Physiologists, 1926- ; 1993 Dec. Plant physiology v. 103 (4): p. 1097-1106; 1993 Dec. Includes references.

Language: English

Descriptors: Egypt; Cabt; Conyza bonariensis; Oxidants; Detoxification; Stress response; Regulation; Enzyme activity; Light; Temperature; Paraquat; Herbicide resistance; Weed biology; Growth stages; Enzymes; Photoinhibition

Abstract: Paraquat-resistant hairy fleabane (Conyza bonariensis L. Cronq.) has been extensively studied, with some contention. A single, dominant gene pleiotropically controls levels of oxidant-detoxifying enzymes and tolerance to many photooxidants, to photoinhibition, and possibly to other stresses. The weed forms a rosette on humid short days and flowers in dry long days and, thus, needs plasticity to photooxidant stresses. In a series of four experiments over 20 months, the resistant and susceptible biotypes were cultured in constant 10-h low-light short days at 25 degrees C.

Resistance was measured as recovery from paraquat. The concentration required to achieve 50% inhibition of the resistant biotype was about 30 times that of the susceptible one just after germination, increased to > 300 times that of the susceptibles at 10 weeks of growth, and then decreased to 20-fold, remaining constant except for a brief increase while bolting. Resistance increased when plants were induced to flower by long days. The levels of plastid superoxide dismutase and of glutathione reductase were generally highest in resistant plants compared to those of the susceptibles at the times of highest paraquat resistance, but they were imperceptibly different from the susceptible type at the times of lower paraquat resistance. Photoinhibition tolerance measured as quantum yield of oxygen evolution at ambient temperatures was highest when the relative amounts of enzymes were highest in the resistant biotype. Resistance to photoinhibition was not detected by chlorophyll a fluorescence. Enzyme levels, photoinhibition tolerance, and paraquat resistance all increased during flowering in both biotypes. Imperceptibly small increases in enzyme levels would be needed for 20-fold resistance, based on the moderate enzyme increases correlated with 300-fold resistance. Thus, it is feasible that either these enzymes play a role in the first line of defense against photooxidants, or another, yet unknown mechanism(s) facilitate(s) the lower level of resistance, or the enzymes and unknown mechanisms act together.

71 NAL Call. No.: SB951.P49
Diclofop and fenoxaprop resistance in wild oats is associated with an altered effect on the plasma membrane electrogenic potential.
Devine, M.D.; Hall, J.C.; Romano, M.L.; Marles, M.A.S.; Thomson, L.W.; Shimabukuro, R.H.
Orlando, Fla. : Academic Press; 1993 Mar.
Pesticide biochemistry and physiology v. 45 (3): p. 167-177; 1993 Mar. Includes references.

Language: English

Descriptors: Manitoba; Avena fatua; Varietal susceptibility; Diclofop; Fenoxaprop; Insecticide resistance; Resistance mechanisms; Plasma membranes; Acetyl-coa carboxylase; Inhibition; Membrane potential; Electrical activity; Wild plants

Abstract: We have examined the mechanism of herbicide resistance in a biotype of wild oat (Avena fatua L.) that is resistant to diclofop-methyl and many other acetyl-coenzyme A carboxylase (ACCase) inhibitors. Resistance to diclofop-methyl and fenoxaprop-ethyl was not based on reduced uptake nor on enhanced metabolism of the herbicides to inactive products. In in vitro assays of crude or partially purified preparations, ACCase from the resistant (UM-1) and susceptible (UM-5) biotypes was equally sensitive to diclofop, with I50 values of 6.1 and 7.3 micromolar for UM-1 and UM-5, respectively. Corresponding values for fenoxaprop were 2.5 and 1.0 micromolar. These results suggest that the high level of resistance observed toward these herbicides is not based on an altered target enzyme. Root tissue from both UM-1 and UM-5 acidified an unbuffered bathing solution. Addition of 100 KM diclofop or fenoxaprop prevented acidification of the bathing medium by UM-1, but alkalinization occurred rapidly with UM-5. When diclofop was removed from the treatment solution, UM-1 resumed acidification of the solution, whereas the pH of the

UM-5 bathing solution continued to increase. Diclofop (50 micromolar) rapidly depolarized the cell membrane in peeled coleoptile sections, with no difference between UM-1 and UM-5. However, when diclofop was removed from the treatment solution, the electrogenic membrane potential was quickly reestablished in UM-1, but remained collapsed in UM-5. These results provide support for the hypothesis that the effect of diclofop on the plasma membrane potential is an important component of its herbicidal activity. The reversibility of the effect of diclofop and fenoxaprop on transmembrane proton flux in UM-1 appears to be associated with resistance to these herbicides.

72 NAL Call. No.: SB610.W39
Differential bentazon response in cowpea (Vigna unguiculata).
Harrison, H.F. Jr; Fery, R.L.
Champaign, Ill. : The Weed Science Society of America; 1993 Jul.
Weed technology : a journal of the Weed Science Society of America v. 7 (3): p. 756-758; 1993 Jul. Includes references.

Language: English

Descriptors: Vigna unguiculata; Cultivars; Germplasm; Screening; Herbicide resistance; Bentazone; Tolerance; Phytotoxicity; Varietal susceptibility; Crop damage; Abiotic injuries; Application

73 NAL Call. No.: SB610.W39
Differential competitiveness of sulfonylurea resistant and susceptible prickly lettuce (Lactuca serriola).
Alcocer-Ruthling, M.; Thill, D.C.; Shafii, B.
Champaign, Ill. : The Society; 1992 Apr.
Weed technology : a journal of the Weed Science Society of America v. 6 (2): p. 303-309; 1992 Apr. Includes references.

Language: English

Descriptors: Idaho; Triticum aestivum; Crop weed competition; Lactuca serriola; Herbicide resistant weeds; Sulfonylurea herbicides; Biotypes; Growth rate; Competitive ability

74 NAL Call. No.: 23 AU792
Differential tolerance of annual medics, Nungarin subterranean clover and hedge mustard to broadleaf herbicides.
Young, R.R.; Morthorpe, K.J.; Croft, P.H.; Nicol, H.
East Melbourne : Commonwealth Scientific and Industrial Research Organization; 1992.
Australian journal of experimental agriculture v. 32 (1): p. 49-57; 1992. Includes references.

Language: English

Descriptors: New South Wales; Medicago; Trifolium subterraneum; Crop damage; Herbicide resistance; Phytotoxicity; Sisymbrium; Weed control; 2,4-db; Bromoxynil; Diuron; Mcpa; Terbutryn

75 NAL Call. No.: SB610.W39
Differential tolerance of sweet potato (Ipomoea batatas) clones to metribuzin. Motsenbocker, C.E.; Monaco, T.J.

Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 349-354; 1993 Apr. Includes references.

Language: English

Descriptors: North Carolina; Cabt; Ipomoea batatas; Metribuzin; Herbicide resistance; Phytotoxicity; Clones; Cultivars; Varietal susceptibility; Crop damage; Crop yield; Yield losses; Application date; Timing; Application rates; Genetic variation

76 NAL Call. No.: SB610.W39
Differential toxicity of tralkoxydim in Hordeum species.
Tal, A.; Benyamini, Y.; Rubin, B.
Champaign, Ill. : The Weed Science Society of America; 1993 Oct. Weed technology : a journal of the Weed Science Society of America v. 7 (4): p. 946-948; 1993 Oct. Includes references.

Language: English

Descriptors: Hordeum vulgare; Hordeum glaucum; Hordeum spontaneum; Triticum aestivum; Phytotoxicity; Crop damage; Abiotic injuries; Tralkoxydim; Application rates; Selectivity; Wild plants; Species differences; Herbicide resistance

77 NAL Call. No.: SB951.P49
Direct demonstration of binding-site competition between photosystem II inhibitors at the QB niche of the D1 protein.
Jansen, M.A.K.; Mattoo, A.K.; Malkin, S.; Edelman, M.
Orlando, Fla. : Academic Press; 1993 May.
Pesticide biochemistry and physiology v. 46 (1): p. 78-83; 1993 May. Includes references.

Language: English

Descriptors: Photosystem ii; Membranes; Proteins; Binding site; Electron transfer; Diuron; Inhibitors; Protein degradation; Inhibition; Solanum nigrum; Spirodela oligorhiza; Biotypes; Herbicide resistance

Abstract: Inhibitors of photosystem II function have been shown to block electron flow in vitro by competitively displacing plastoquinone from the Q(B) niche on the D1 protein. Few studies have tested this well-accepted concept in vivo and none in higher plants. The D1 protein degradation assay was used to directly demonstrate, in vivo, the displacement of diuron by bromonitrothymol (BNT) at the level of the Q(B) niche. We show that diuron blocks D1 degradation less effectively in the presence of BNT, and that this effect of BNT can be nullified by increasing the diuron concentration. These data directly demonstrate binding-site competition at the level of the Q(B) niche, under the complex physiological conditions of the intact higher plant.

78 NAL Call. No.: 79.8 W41
Distribution and characteristics of triazine-resistant powell amaranth (Amaranthus powellii) in Idaho.
Eberlein, C.V.; Al-Khatib, K.; Guttieri, M.J.; Fuerst, E.P.
Champaign, Ill. : Weed Science Society of America; 1992.

Weed science v. 40 (4): p. 507-512; 1992. Includes references.

Language: English

Descriptors: Idaho; Amaranthus powellii; Herbicide resistance; Atrazine; Metribuzin; Diuron; Binding site; Thylakoids; Resistance mechanisms; Genetic analysis; Chloroplast genetics; Genes; Mutations; Nucleotide sequences; Amino acid sequences; Biotypes; Geographical distribution

Abstract: A triazine-resistant (TR) biotype of Powell amaranth was discovered in 1989 in a potato field treated with metribuzin. A survey of all agricultural counties in Idaho showed that the TR Powell amaranth infestation was localized in the southeastern corner of Gooding county in southern Idaho. To determine the mechanism of triazine resistance, I50 values for inhibition of photosystem II were determined for atrazine, metribuzin, and diuron using thylakoids isolated from TR and triazine-susceptible (TS) biotypes. TR/TS ratios based on I50 values were 134 for atrazine, 62 for metribuzin, and 1.9 for diuron. Results of binding studies with atrazine and metribuzin were consistent with the I50 studies, indicating that resistance was due to reduced binding of triazines to the thylakoid membrane D1 protein. Sequencing the chloroplast psbA gene from TR and TS biotypes revealed a serine 264 to glycine change in the TR biotype. The mutation presumably resulted in reduced hydrogen bonding between triazine herbicides and the D1 protein.

79 NAL Call. No.: 79.8 W41

DNA sequence variation in domain A of the acetolactate synthase genes of herbicide-resistant and -susceptible weed biotypes.

Guttieri, M.J.; Eberlein, C.V.; Mallory-Smith, C.A.; Thill, D.C.; Hoffman, D.L.

Champaign, Ill. : Weed Science Society of America; 1992.
Weed science v. 40 (4): p. 670-676; 1992. Includes references.

Language: English

Descriptors: Kochia scoparia; Lactuca serriola; Salsola iberica; Herbicide resistant weeds; Biotypes; Chlorsulfuron; Herbicide resistance; Genes; Nucleotide sequences; Amino acid sequences; Genetic variation; Weed biology

Abstract: The DNA sequence of a 196 base pair (bp) region of the acetolactate synthase (ALS) genes of three weed species, kochia, prickly lettuce, and Russian thistle was determined. This region encompasses the coding sequence for Domain A, a region of the amino acid sequence previously demonstrated to play a pivotal role in conferring resistance to herbicides that inhibit ALS. The Domain A DNA sequence from a chlorsulfuron-resistant (R) prickly lettuce biotype from Idaho differed from that of a chlorsulfuron-susceptible (S) biotype by a single point mutation, which substituted a histidine for a proline. The Domain A DNA sequence from an R kochia biotype from Kansas also differed from that of an S biotype by a single point mutation in the same proline codon. This point mutation, however, conferred substitution of threonine for proline. Two different ALS-homologous sequences were isolated from an R biotype of Russian thistle. Neither sequence encoded amino acid substitutions in Domain A that differed from the

consensus S sequence. The DNA sequence variation among the R and S kochia biotypes was used to characterize six Ada County, Idaho, kochia collections for correlation between phenotypic chlorsulfuron susceptibility and restriction digest patterns (RFLPs) of polymerase chain reaction amplification products. Most collections showed excellent correspondence between the RFLP patterns and the phenotypic response to chlorsulfuron application. However, one entirely R collection had the RFLP pattern of the S biotype, suggesting that resistance was not due to mutation in the proline codon.

80 NAL Call. No.: SB249.N6
Documentation of graminicide-resistant johnsongrass in cotton.
Snipes, C.E.; Barrentine, W.L.; Smeda, R.J.
Memphis, Tenn. : National Cotton Council of America, 1991-; 1993. Proceedings / v. 3: p. 1508; 1993. Meeting held January 10-14, 1993, New Orleans, Louisiana.

Language: English

Descriptors: Sorghum halepense; Gossypium; Herbicide resistance

81 NAL Call. No.: 472 N21
Ecology of transgenic oilseed rape in natural habitats.
Crawley, M.J.; Hails, R.S.; Rees, M.; Kohn, D.; Buxton, J.
London : Macmillan Magazines Ltd; 1993 Jun.
Nature v. 363 (6430): p. 620-623; 1993 Jun. Includes references.

Language: English

Descriptors: Brassica napus var. oleifera; Transgenics; Genetic engineering; Ecology

Abstract: Concerns about genetically engineered crop plants centre on three conjectural risks: that transgenic crop plants will become weeds of agriculture or invasive of natural habitats; that their engineered genes will be transferred by pollen to wild relatives whose hybrid offspring will then become more weedy or more invasive; or that the engineered plants will be a direct hazard to humans, domestic animals or beneficial wild organisms (toxic or allergenic, for example). Here we describe an experimental protocol for assessing the invasiveness of plants. The object is to determine whether genetic engineering for herbicide tolerance affects the likelihood of oilseed rape becoming invasive of natural habitats. By estimating the demographic parameters of transgenic and conventional oilseed rape growing in a variety of habitats and under a range of climatic conditions, we obtain a direct comparison of the ecological performance of three different genetic lines (control, kanamycin-tolerant transgenics and herbicide-tolerant transgenic lines). Despite substantial variation in seed survival, plant growth and seed production between sites and across experimental treatments, there was no indication that genetic engineering for kanamycin tolerance or herbicide tolerance increased the invasive potential of oilseed rape. In those cases in which there were significant differences (such as seed survival on burial), transgenic lines were less invasive and less persistent than their conventional counterparts.

82 NAL Call. No.: 56.8 J822
Economic and environmental implications of herbicide-tolerant corn and processing tomatoes.
Hayenga, M.; Thompson, L.C.; Chase, C.; Kaaria, S.
Ankeny, Iowa : Soil and Water Conservation Society of America; 1992 Sep. Journal of soil and water conservation v. 47 (5): p. 411-417; 1992 Sep. Includes references.

Language: English

Descriptors: Zea mays; Lycopersicon esculentum; Hybrid varieties; Herbicide resistance; Crop production; Economic impact; Production costs; Environmental impact; Weed control

83 NAL Call. No.: 450 C16
Effect of diclofop and HOE-6001 on amylolytic enzyme activities of malt. McMullan, P.M.; Noll, J.; Therrien, M.C.
Ottawa : Agricultural Institute of Canada; 1992 Apr. Canadian journal of plant science; Revue canadienne de phytotechnie v. 72 (2): p. 435-438; 1992 Apr. Includes references.

Language: English

Descriptors: Manitoba; Hordeum vulgare; Genotypes; Alpha-amylase; Alpha-glucosidase; Diclofop; Fenoxaprop; Herbicide resistance; Avena fatua; Setaria viridis; Weed control

84 NAL Call. No.: 450 P692
Effect of diclofop on the membrane potentials of herbicide-resistant and -susceptible annual ryegrass root tips.
Shimabukuro, R.H.; Hoffer, B.L.
Rockville, Md. : American Society of Plant Physiologists; 1992 Apr. Plant physiology v. 98 (4): p. 1415-1422; 1992 Apr. Includes references.

Language: English

Descriptors: Australia; Lolium rigidum; Root tips; Plasmalemma; Membrane potential; Diclofop; Herbicide resistance; Susceptibility; Phytotoxicity

Abstract: Electrophysiological measurements were made on root tip cells in the elongation zone of diclofop-methyl-resistant (SR4/84) and -susceptible (SRS2) biotypes of annual ryegrass (Lolium rigidum Gaud.) from Australia. The phytotoxic action of diclofop-methyl (methyl 2-[4-(2',4'-dichlorophenoxy)phenoxy]propanoate) on susceptible whole plants was completely reversed by a simultaneous application of 2,4-dichlorophenoxyacetic acid (dimethylamine salt). The phytotoxic acid metabolite, diclofop (50 micromolar), depolarized membrane potentials of both biotypes to a steady-state level within 10 to 15 minutes. Repolarization of the membrane potential occurred only in the resistant biotype following removal of diclofop. The resistant biotype has an intrinsic ability to reestablish the electrogenic membrane potential, whereas the susceptible biotype required an exogeneous source of IAA to induce partial repolarization. Both biotypes were susceptible to depolarization by carbonylcyanide-m-chlorophenylhydrazone (CCCP), and their membrane potentials recovered upon removal of CCCP. A 15-minute pretreatment with p-chloromercuribenzenesulphonic acid

(PCMBS) blocked the depolarizing action of diclofop in both biotypes. However, PCMBS had no effect on the activity of CCCP. The action of diclofop appears to involve a site-specific interaction at the plasmalemma in both Lolium biotypes to cause the increased influx of protons into sensitive cells. The differential response of membrane depolarization and repolarization to diclofop treatment may be a significant initial reaction in the eventual phytotoxic action of the herbicide.

85 NAL Call. No.: SB610.W39
Effect of ethalfluralin and other herbicides on trifluralin-resistant green foxtail (Setaria viridis).
Beckie, H.J.; Morrison, I.N.
Champaign, Ill. : The Weed Science Society of America; 1993 Jan. Weed technology : a journal of the Weed Science Society of America v. 7 (1): p. 6-14; 1993 Jan. Includes references.

Language: English

Descriptors: Manitoba; Cabt; Setaria viridis; Herbicide resistant weeds; Trifluralin; Herbicide resistance; Biotypes; Weed control; Chemical control; Ethalfluralin; Dinitroaniline herbicides; Oryzalin; Isopropalin; Pendimethalin; Prodiamine; Propyzamide; Pyridine herbicides; Mitosis; Metabolic inhibitors; Propanil; Diclofop; Fenoxaprop; Fluazifop; Dalapon; Sethoxydim; Linuron; Eptc; Cross resistance; Phytotoxicity; Triticum aestivum; Brassica napus

86 NAL Call. No.: 79.8 W41
Effect of field violet (Viola arvensis) growth stage on uptake, translocation, and metabolism of terbacil.
Doohan, D.J.; Monaco, T.J.; Sheets, T.J.
Champaign, Ill. : Weed Science Society of America; 1992 Apr. Weed science v. 40 (2): p. 180-183; 1992 Apr. Includes references.

Language: English

Descriptors: Viola arvensis; Seedling stage; Maturity stage; Terbacil; Absorption; Translocation; Metabolic detoxification; Metabolism; Herbicide resistant weeds; Metabolites; Herbicide resistance; Variation

Abstract: Uptake, translocation, and metabolism of 14C-terbacil was investigated in 12-leaf (tolerant) and 3-leaf (susceptible) field violet plants. Field violets with 12 leaves absorbed less 14C-terbacil g-1 of fresh weight from solution culture than did plants with three leaves. Plants with three leaves translocated twice as much radioactivity to foliage than did plants with 12 leaves. Most 14C in roots (77%) and foliage (57%) of field violet plants with 12 leaves was in polar metabolites. Metabolism studies indicated that most 14C (79%) in foliage extracts from field violet plants with three leaves was 14C-terbacil. Polar metabolites were not detected in roots of field violet plants with three leaves.

87 NAL Call. No.: 450 P693
Effect of four classes of herbicides on growth and acetolactate-synthase activity in several variants of Arabidopsis thaliana.
Mourad, G.; King, J.

Berlin : Springer-Verlag; 1992.
Planta v. 188 (4): p. 491-497; 1992. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Ligases; Enzyme activity; Inhibition; Chlorsulfuron; Sulfonamides; Imazapyr; Benzoic acid herbicides; Mutants; Mutations; Loci; Alleles; Herbicide resistance; Binding site; Cross resistance

Abstract: We have isolated a triazolopyrimidine-resistant mutant csr1-2, of Arabidopsis thaliana (L.) Heynh. Here, we compare csr1-2 with the previously isolated mutants csr1 and csr1-1, and with wild-type Arabidopsis for responses to members of four classes of herbicides, namely, sulfonylureas, triazolopyrimidines, imidazolinones, and pyrimidyl-oxy-benzoates. Two separable herbicide-binding sites have been identified previously on the protein of acetolactate synthase (ALS). Here, the mutation giving rise to csr1, originating in a coding sequence towards the 5' end of the ALS gene, and that in csr1-2, affected the inhibitory action on growth and ALS activity of sulfonylurea and triazolopyrimidine herbicides but not that of the imidazolinones or pyrimidyl-oxybenzoates. The other mutation, in csr1-1, originating in a coding sequence towards the 3' end of the ALS gene, affected the inhibitory action of imidazolinones and pyrimidyl-oxy-benzoates but not that of the sulfonylureas or triazolopyrimidines. Additional, stimulatory effects of some of these herbicides on growth of seedlings was unrelated to their effect on their primary target, ALS. The conclusion from these observations is that one of the two previously identified herbicide-binding sites may bind sulfonylureas and triazolopyrimidines while the other may bind imidazolinones and pyrimidyl-oxybenzoates within a herbicide-binding domain on the ALS enzyme. Such a comparative study using near-isogenic mutants from the same species allows not only the further definition of the domain of herbicide binding on ALS but also could aid investigation of the relationship between herbicide-, substrate-, and allosteric-binding sites on this enzyme.

88 NAL Call. No.: 511 P444AE
Effect of treating plants with abscisic acid on its concentration in leaves and resistance of three pea cultivars to the herbicide 2,4-D. Melekhov, E.I.; Lavrent'ev, A.A.
New York, N.Y. : Consultants Bureau; 1992.
Doklady : botanical sciences - Akademiia nauk SSSR v. 319/321: p. 79-82; 1992. Translated from: Akademiia Nauk SSSR. Doklady. v. 319/321, 1991, p. 1273-1277, (511 P444A). Includes references.

Language: English; Russian

Descriptors: Pisum sativum; Cultivars; Herbicide resistance; 2,4-d; Plants; Treatment; Abscisic acid; Growth chambers; Survival

89 NAL Call. No.: SB610.W39
Effective kill of trifluralin-susceptible and -susceptible agreen foxtail (Setaria viridis).
Beckie, H.J.; Morrison, I.N.
Champaign, Ill. : The Weed Science Society of America; 1993 Jan. Weed technology : a journal of the Weed Science Society of America v. 7 (1): p. 15-22; 1993 Jan. Includes references.

Language: English

Descriptors: Manitoba; Cabt; Triticum aestivum; Brassica napus; Weed control; Setaria viridis; Herbicide resistant weeds; Trifluralin; Herbicide resistance; Biotypes; Application rates; Chemical control; Application methods; Phytotoxicity; Susceptibility

90 NAL Call. No.: 450 J8224
Effects of 4-chloro-2-methylphenoxypropionate (an auxin analogue) on plasma membrane ATPase activity in herbicide-resistant and herbicide-susceptible biotypes of Stellaria media L.
Coupland, D.; Cooke, D.T.; James, C.S.
Oxford : Oxford University Press; 1991 Aug.
Journal of experimental botany v. 42 (241): p. 1065-1071; 1991 Aug. Includes references.

Language: English

Descriptors: Stellaria media; Mecoprop; Herbicide resistant weeds; Herbicide resistance; Adenosinetriphosphatase; Enzyme activity; Plasma membranes; Atp; Hydrolysis; Biotypes; Proton pump; Phospholipids; Sterols

Abstract: ATPase activity was examined in plasma membrane (PM) fractions prepared from mecoprop-resistant and -susceptible biotypes of Stellaria media L. (chickweed). Treatment with the herbicide caused an 18% increase in ATP hydrolysis, but this was not significantly different from control plants and was similar for both biotypes. However, there was an overall significant biotype effect, herbicide-resistant plants having greater enzyme activity than susceptible ones. Proton-pumping was readily demonstrated in PM fractions obtained from both biotypes using the fluorescent probe
amino-chloro-methoxyacridine (ACMA), indicating a relatively large proportion of 'inside-out' vesicles. Proton-pumping was significantly greater in PM preparations obtained from the resistant compared with susceptible plants. The differences in ATPase activity between the two biotypes could not be attributed to differences in the main sterol or phospholipid components of the PM. There were no effects of the herbicide on ATP hydrolysis in vitro, but proton-pumping was affected in a herbicide concentration-dependent manner. At 1.0 mol m-6 mecoprop caused an increase in the rate of proton-pumping, whereas at 10 and 100 mol m-6, an inhibition in this rate was observed. Both biotypes behaved similarly, irrespective of mecoprop concentration. These data indicate that mecoprop resistance in chickweed is unlikely to be due to a direct effect of the herbicide on PM H+ -ATPase activity.

91 NAL Call. No.: 450 P692
Effects of acetyl-coenzyme A carboxylase inhibitors on root cell transmembrane electric potentials in graminicide-tolerant and -susceptible corn (Zea mays L.).
Dotray, P.A.; DiTomaso, J.M.; Gronwald, J.W.; Wyse, D.L.; Kochian, L.V. Rockville, MD : American Society of Plant Physiologists, 1926-; 1993 Nov. Plant physiology v. 103 (3): p. 919-924; 1993 Nov. Includes references.

Language: English

Descriptors: Zea mays; Lines; Herbicides; Tolerance; Susceptibility; Membrane potential; Soil ph

Abstract: Herbicidal activity of aryloxyphenoxypropionate and cyclohexanedione herbicides (graminicides) has been proposed to involve two mechanisms: inhibition of acetyl-coenzyme A carboxylase (ACCase) and depolarization of cell membrane potential. We examined the effect of aryloxyphenoxypropionates (diclofop and haloxyfop) and cyclohexanediones (sethoxydim and clethodim) on root cortical cell membrane potential of graminicide-susceptible and -tolerant corn (Zea mays L.) lines. The graminicide-tolerant corn line contained a herbicide-insensitive form of ACCase. The effect of the herbicides on membrane potential was similar in both corn lines. At a concentration of 50micromolar, the cyclohexanediones had little or no effect on the membrane potential of root cells. At pH 6, 50 micromolar diclofop, but not haloxyfop, depolarized membrane potential, whereas both herbicides (50 micromolar) dramatically depolarized membrane potential at pH 5. Repolarization of membrane potential after removal of haloxyfop and diclofop from the treatment solution was incomplete at pH 5. However, at pH 6 nearly complete repolarization of membrane potential occurred after removal of diclofop. In graminicide-susceptible corn, root growth was significantly inhibited by a 24-h exposure to 1 micromolar haloxyfop or sethoxydim, but cell membrane potential was unaffected. In gramincide-tolerant corn, sethoxydim treatment (1 micromolar, 48 h) had no effect on root growth, whereas haloxyfop (1 micromolar, 48 h) inhibited root growth by 78%. However, membrane potential was the same in roots treated with 1 micromolar haloxyfop or sethoxydim. The results of this study indicate that graminicide tolerance in the corn line used in this investigation is not related to an altered response at the cell membrane level as has been demonstrated with other resistant species.

92 NAL Call. No.: SB951.P49
Effects of isoxaben on sensitive ant tolerant plant cell cultures. I. Metabolic fate of isoxaben.
Corio-Costet, M.F.; Dall'Agnese, M.; Scalla, R.
Orlando, Fla. : Academic Press; 1991 Jul.
Pesticide biochemistry and physiology v. 40 (3): p. 246-254; 1991 Jul. Includes references.

Language: English

Descriptors: Triticum aestivum; Glycine max; Cell suspensions; Cell cultures; Isoxaben; Phytotoxicity; Herbicide resistance; Susceptibility; Line differences; Metabolic detoxification; Metabolites

Abstract: A soybean cell line tolerance to isoxaben was isolated by callus selection in herbicide-containing medium. The growth of tolerant suspension cells was not affected by 10 micromoles isoxaben, which prevented the growth of wild-type cultures. The growth of a wheat cell culture was little affected by isoxaben, in accordance to the tolerance of wheat plants to the herbicide. The metabolic fate of labeled isoxaben in the three types of cultures was examined. By comparison with the sensitive, wild-type soybean cell culture, the tolerance of the selected soybean cell culture and that of wheat cell culture cannot be explained by either quantitative or qualitative differences of herbicide metabolism. These

results favor the hypothesis that the sensitivity or tolerance of the cell cultures is determined at the level of the cellular target of the herbicide.

93 NAL Call. No.: SB951.P49
Effects of isoxaben on senstitive and tolerant plant cell cultures. II. Cellular alterations and inhibition on the synthesis of acid-insoluble cell wall material.
Corio-Costet, M.F.; Lherminier, J.; Scalla, R.
Orlando, Fla. : Academic Press; 1991 Jul.
Pesticide biochemistry and physiology v. 40 (3): p. 255-265; 1991 Jul. Includes references.

Language: English

Descriptors: Triticum aestivum; Glycine max; Cell suspensions; Cell cultures; Lines; Line differences; Susceptibility; Herbicide resistance; Phytotoxicity; Isoxaben; Dichlobenil; Mode of action; Cell walls; Biosynthesis; Metabolic inhibitors; Cell wall components; Cellulose; Glucose; Plasma membranes; Cell ultrastructure

Abstract: The herbicide isoxaben is selectively phytotoxic to dicotyledonous plants, whereas most monocots are tolerant. We previously selected a soybean cell culture tolerant to isoxaben. Some effects of the herbicide on wild-type soybean cells, tolerant soybean cells, and wheat cells were compared. Cytological observations showed that isoxaben induced some disorganization of sensitive soybean cells, especially at the plasma membrane-cell wall interface. Tolerant soybean cells appeared normal in the presence of isoxaben. The growth of wild-type soybean cells was roughly equally sensitive to isoxaben as to dichlobenil, a cellulose synthesis inhibitor. By comparison, the selected soybean line and a wheat cell culture were less sensitive to isoxaben than to dichlobenil. Glucose incorporation into acid-insoluble cell wall material was more inhibited by isoxaben than by dichlobenil in the wild-type soybean cell culture. In the tolerant soybean cell culture, the incorporation was slightly inhibited by isoxaben, but remained sensitive to dichlobenil. In the wheat cell culture, dichlobenil was also more inhibitory but only at high concentrations. Other compounds, inhibitors of cellulose biosynthesis, of glycosylation of lipids or protein, or of cell division, either had no effect on the synthesis of acid-insoluble cell wall material or exerted apparently unspecific inhibitions. The results are consistent with isoxaben inhibiting the synthesis of a cell wall polysaccharide, which could be cellulose.

94 NAL Call. No.: 450 AN7
Effects of mecoprop (an auxin analogue) on ethylene evolution and epinasty in two biotypes of Stellaria media.
Coupland, D.; Jackson, M.B.
London : Academic Press; 1991 Aug.
Annals of botany v. 68 (2): p. 167-172; 1991 Aug. Includes references.

Language: English

Descriptors: Stellaria media; Lycopersicon esculentum; Mecoprop; Herbicide resistance; Phytotoxicity; Ethylene production; Epinasty; Biotypes; Genetic variation

Abstract: Petiolar epinasty and the production of ethylene (ethene) were studied in chickweed biotypes, Stellaria media, treated with the herbicide and auxin analogue (RS)-2-(4-chloro-o-tolyloxy)propionic acid, potassium salt, common name mecoprop. This compound caused severe epinasty and stimulated the production of ethylene from shoot explants. However, when intact plants were treated with ethylene, the leaves became only slightly epinastic. The ethylene precursor, 1-aminocyclopropane-1-carboxylic acid (ACC), at concentrations which stimulated the release of ethylene, was equally ineffective in causing epinasty. Furthermore, 2,5-norbornadiene, a specific, competitive inhibitor of ethylene action, only partly alleviated mecoprop-induced epinasty. The responses observed in chickweed were compared with those produced in tomato plants. ACC induced epinasty in tomato within 2 h and these symptoms were completely inhibited by norbornadiene. However, as in chickweed, the inhibitor gave only partial reversal of mecoprop-induced epinasty, implying that the epinastic response caused by the herbicide was not attributable to ethylene alone. We therefore suggest that mecoprop-induced epinasty is a result of the combined ethylene-stimulating and growth-promoting properties of the herbicide. Mecoprop-stimulated ethylene evolution was initially significantly greater in a herbicide-resistant, compared with a more susceptible biotype of chickweed. The significance of this finding is discussed in relation to the mechanism of mecoprop resistance in chickweed.

95 NAL Call. No.: 450 P692
Effects on photosystem II function, photoinhibition, and plant performance of the spontaneous mutation of serine-264 in the photosystem II reaction center D1 protein in triazine-resistant Brassica napus L.
Sundby, C.; Chow, W.S.; Anderson, J.M.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1993 Sep. Plant physiology v. 103 (1): p. 105-113; 1993 Sep.
Includes references.

Language: English

Descriptors: Brassica napus; Mutations; Photoinhibition; Photosystem ii; Serine; Triazine herbicides; Weed control; Yield losses; Herbicide resistance

Abstract: Wild-type and an atrazine-resistant biotype of Brassica napus, in which a glycine is substituted for the serine-264 of the D1 protein, were grown over a wide range of constant irradiances in a growth cabinet. In the absence of serine-264, the function of photosystem II (PSII) was changed as reflected by changes in chlorophyll fluorescence parameters and in photosynthetic oxygen-evolving activity. The photochemical quenching coefficient was lower, showing that a larger proportion of the primary quinone acceptor is reduced at all irradiances. At low actinic irradiances, the nonphotochemical quenching coefficient was higher, showing a greater tendency for heat emission. Decreased rates of light-limited photosynthesis (quantum yield) and lower oxygen yields per single-turnover flash were also observed. These changes were observed even when the plants had been grown under low irradiances, indicating that the changes in PSII function are direct and not consequences of photoinhibition. In spite of the lowered PSII efficiency under light-limiting conditions, the light-saturated photosynthesis rate of the atrazine-resistant mutant was similar to that of the wild type. An

enhanced susceptibility to photoinhibition was observed for the atrazine-resistant biotype compared to the wild type when plants were grown under high and intermediate, but not low, irradiance. We conclude that the replacement of serine by glycine in the D1 protein has a direct effect on PSII function, which in turn causes increased photoinhibitory damage and increased rates of turnover of the D1 protein. Both the intrinsic lowering of light-limited photosynthetic efficiency and the increased sensitivity to photoinhibition probably contribute to reduced crop yields in the field, to different extents, depending on growth conditions.

96 NAL Call. No.: 442.8 Z8
Engineering 2,4-D resistance into cotton.
Bayley, C.; Trolinder, N.; Ray, C.; Morgan, M.; Quesenberry, J.E.; Ow, D.W. Berlin, W. Ger. : Springer International; 1992.
Theoretical and applied genetics v. 83 (5): p. 645-649; 1992.
Includes references.

Language: English

Descriptors: Gossypium hirsutum; Nicotiana tabacum; Agrobacterium tumefaciens; Alcaligenes; Genetic transformation; Transgenics; Gene transfer; Genes; Oxidoreductases; 2,4-d; Herbicide resistance; Inheritance; Enzyme activity

Abstract: To reduce damage by drift-levels of the herbicide 2,4-dichlorophenoxyacetic acid, we have engineered the 2,4-D resistance trait into cotton (Gossypium hirsutum L.). The 2,4-D monooxygenase gene tfdA from Alcaligenes eutrophus plasmid pJP5 was isolated, modified and expressed in transgenic tobacco and cotton plants. Analyses of the transgenic progeny showed stable transmission of the chimeric tfdA gene and production of active 2,4-D monooxygenase. Cotton plants obtained were tolerant to 3 times the field level of 2,4-D used for wheat, corn, sorghum and pasture crops.

97 NAL Call. No.: QD1.A45
Engineering crop resistance to the naturally occurring glutamine synthetase inhibitor phophinothricin.
Mullner, H.; Eckes, P.; Donn, G.
Washington, D.C. : The Society; 1993.
ACS Symposium series - American Chemical Society (524): p. 38-47; 1993. In the series analytic: Pest control with enhanced environmental safety / edited by S.O. Duke, J.J. Menn, and J.R. Plimmer. Includes references.

Language: English

Descriptors: Weed control; Herbicide resistance; Genetic engineering; Gene transfer; Glufosinate

Abstract: Chemical plant protection will be always needed, but the application of gene technology can reduce the impact of agriculture to the environment and offer new attractive systems for weed control to the farmer. The non-selective herbicide glufosinate exhibit desirable properties, which makes it suitable for weed control in crops. By transferring a microbial resistance gene from the producer of the active principle of glufosinate, sensitive crops like corn, oilseed-rape, soy bean and sugarbeet could be made resistant. In comparison to present, on soil herbicides based weed control

systems, the flexibility in the application of the post-emergent foliar herbicide glufosinate in resistant crops comes closer to an ideal system. The introduction of this new system will be another important step towards an agriculture with reduced impact on the environment.

98 NAL Call. No.: SB123.57.M64
Engineering microbial herbicide detoxification genes in higher plants. Lyon, B.R.
Molecular approaches to crop improvement / edited by E.S. Dennis and D.J. Llewellyn. p. 79-108; 1991. (Plant gene research). Literature review. Includes references.

Language: English

Descriptors: Crops; Nicotiana tabacum; Genetic engineering; Transgenics; Genetic transformation; Herbicide resistance; Herbicides; 2,4-d; Enzymes; Microbial degradation; Oxygenases; Genes; Alcaligenes; Literature reviews

99 NAL Call. No.: 442.8 Z8
Enhanced oxidative-stress defense in transgenic potato expressing tomato Cu,Zn superoxide dismutases.
Perl, A.; Perl-Treves, R.; Galili, S.; Aviv, D.; Shalgi, E.; Malkin, S.; Galun, E.
Berlin, W. Ger. : Springer International; 1993 Jan.
Theoretical and applied genetics v. 85 (5): p. 568-576; 1993 Jan. Includes references.

Language: English

Descriptors: Solanum tuberosum; Lycopersicon esculentum; Genetic transformation; Transgenics; Gene transfer; Dna; Superoxide dismutase; Copper; Zinc; Gene expression; Enzyme activity; Herbicide resistance; Paraquat; Oxygen; Phototoxicity; Photosynthesis; Stress; Roots; Shoots; Organ culture

Abstract: The two cDNAs coding for the cytosolic (cyt) and the chloroplast-located (chl) Cu,Zn superoxide dismutases (SODs) of tomato (Perl-Treves et al. 1988) were cloned into respective binary vectors and mobilized into Agrobacterium strains. Potato tuber discs were infected with either of the two agrobacterial strains and cultured on selective medium containing kanaymcin. The integration of either of the cyt or the chl SOD transgenes was verified by Southern-blot hybridization. The enzymatic activity of the additional tomato chl Cu,Zn SOD could be distinguished from endogenous SOD activity since the latter isozyme migrated faster on SOD-activity gels. Several transgenic potato lines harboring either the cyt or the chl SOD genes of tomato showed elevated tolerance to the superoxide-generating herbicide paraquat (methyl viologen). After exposure of shoots to paraquat, tolerance was recorded either by scoring symptoms visually or by measurements of photosynthesis using the photoacoustic method. Root cultures from transgenic lines that harbored the additional cyt Cu,Zn SOD gene of tomato were tolerant to methyl viologen up to 10(-5) M; a lower tolerance was recorded in roots of transgenic lines that expressed the additional chl Cu,Zn SOD of tomato.

100 NAL Call. No.: SB610.W39

Environmental concerns with the development of herbicide-tolerant plants. Goldburg, R.J.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 647-652; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Forest trees; Herbicide resistance; Herbicides; Weed control; Environmental impact; Groundwater pollution; Public health; Food safety; Nontarget effects; Private sector; Public sector; Policy

101 NAL Call. No.: SB610.W39
EPA's response to resistance management and herbicide--tolerant crop issues. Horne, D.M.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 657-661; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: U.S.A.; Transgenic plants; Herbicide resistance; Public agencies; Biotechnology; Regulation; Legislation

102 NAL Call. No.: HT401.A36
Ethical and environmental consideration in the release of herbicide resistant crops.
Dekker, J.; Comstock, G.
Gainesville, Fla. : Agriculture and Human Values, Inc; 1992.
Agriculture and human values v. 9 (3): p. 31-43; 1992.
Includes references.

Language: English

Descriptors: Herbicide resistance; Ethics; Risk; Crop production; Economic viability

103 NAL Call. No.: SB951.P49
Ethylene biosynthesis following foliar application of picloram to biotypes of wild mustard (Sinapis arvensis L.) susceptible or resistant to auxinic herbicides.
Hall, J.C.; Alam, S.M.M.; Murr, D.P.
Orlando, Fla. : Academic Press; 1993 Sep.
Pesticide biochemistry and physiology v. 47 (1): p. 36-43; 1993 Sep. Includes references.

Language: English

Descriptors: Sinapis arvensis; Biotypes; Herbicide resistance; Susceptibility; Picloram; Biosynthesis; Ethylene production; Acc; Growth regulators; Enzymes; Enzyme activity; Epinasty

Abstract: Following foliar application of picloram (100 g a.i. ha(-1)) to biotypes of wild mustard (Sinapis arvensis L.) resistant (R) or susceptible (S) to auxinic herbicides,

ethylene and its precursors, ACC (1-aminocyclopropane-1-carboxylic acid) and MAAC (1-malonylaminocyclopropane-1-carboxylic acid), as well as ACC synthase were quantified. Severe epinasty occurred within 24 hr after picloram was applied to the S biotype with concomitant increases in ACC synthase, ACC, MACC, and ethylene. No epinasty occurred in the R biotype, nor was there an increase above basal levels of ACC synthase, ACC, MACC, and ethylene in this biotype. Both biotypes became epinastic when fumigated with 120 microliter liter(-1) of ethylene. Furthermore, when the tissues from both biotypes were supplied with exogenous ACC (1 millimole) after pretreatment with aminooxyacetic acid (1 millimole), an inhibitor of ACC synthase, both biotypes produced ethylene thereby indicating that ethylene-forming enzyme was not impaired in the resistant biotype. These results suggest that picloram-induced ethylene biosynthesis in the S biotype of wild mustard results from de novo synthesis of ACC synthase; however, this is not the case in the R biotype. Furthermore, sensitivity differences between the two biotypes are related to regulation of picloram-induced ethylene biosynthesis and resistance may be due to a different interaction of the herbicide with primary target site(s) such as the auxin-binding protein(s).

104 NAL Call. No.: 79.9 W52
Evaluating wild oat seed collections for herbicide resistance.
Trunkle, P.A.; Fay, P.K.; Dyer, W.E.; Davis, E.S.
Reno, Nev. : The Society; 1992.
Proceedings - Western Society of Weed Science v. 45: p. 53-54; 1992. Meeting held March 10-12, 1992, in Salt Lake City, Utah.

Language: English

Descriptors: Avena sativa; Herbicide resistance

105 NAL Call. No.: 450 C16
Evaluation of oat germplasm for resistance to diclofop-methyl.
Kibite, S.; Harker, K.N.
Ottawa : Agricultural Institute of Canada; 1991 Apr.
Canadian journal of plant science; Revue canadienne de phytotechnie v. 71 (2): p. 491-495; 1991 Apr. Includes references.

Language: English

Descriptors: Alberta; Australia; Avena sativa; Avena fatua; Genotypes; Variety trials; Germplasm; Selection; Diclofop; Herbicide resistance; Plant breeding

106 NAL Call. No.: SB951.P49
Evaluation of paraquat resistance mechanisms in Conyza.
Norman, M.A.; Fuerst, E.P.; Smeda, R.J.; Vaughn, K.C.
Orlando, Fla. : Academic Press; 1993 Jul.
Pesticide biochemistry and physiology v. 46 (3): p. 236-249; 1993 Jul. Includes references.

Language: English

Descriptors: Conyza bonariensis; Biotypes; Herbicide resistance; Susceptibility; Paraquat; Resistance mechanisms; Enzymes; Glutathione reductase (nad(p)h); Superoxide

dismutase; Enzyme activity; Metabolic detoxification; Photosystem i

Abstract: Experiments were conducted to determine the mechanism(s) of paraquat 1,1'-dimethyl-4, 4'-bipyridinium ion) resistance in a biotype of hairy fleabane (Conyza bonariensis (L.) Cronq.). Thin-layer chromatographic analysis of leaf extracts indicated that paraquat is not metabolized in either the resistant (R) or the sensitive (S) biotype. Three in vitro studies demonstrated that electron transfer from the photosystem I (PSI) donor FA/FB) to paraquat is similar in both biotypes as was the amount and character of the two FA/FB iron-sulfur clusters. The relative activities of the stromal enzymes superoxide dismutase, ascorbate peroxidase, and glutathione reductase, which can detoxify paraquat-generated noxious oxygen species, were determined following separation by polyacrylamide gel electrophoresis. Of these enzymes, only an increase in ascorbate peroxidase activity (28%) was observed in stromal extracts of the R (relative to S) biotype. These data indicate that the 100-fold level of paraquat resistance observed in leaves of the R biotype of Conyza is not due to metabolic detoxification, an altered insensitive) site of action. and/or enhanced activities of stromal enzymes. Paraquat-induced chlorosis (an indicator of sensitivity) was similar in illuminated chloroplast preparations of both biotypes indicating that the resistance factor is located outside of the chloroplast's envelope. Similar rates of paraquat-induced chlorosis were also observed in illuminated protoplast preparations of both biotypes; however, leaf sections (1 mm width) of the R biotype exhibited a degree of paraquat resistance (81-fold) very similar to that exhibited by whole leaves. These data suggest that resistance is due to a sequestration mechanism that prevents paraquat from diffusing to PSI, the site of paraquat action. The sequestration mechanism appears to require a structurally intact cell wall to be functional.

107 NAL Call. No.: QH301.A76
Evaluation of post-emergence herbicides for forestry seedbeds.
Clay, D.V.; Goodall, J.S.; Williamson, D.R.
Wellesbourne, Warwick : The Association of Applied Biologists; 1992. Aspects of applied biology (29): p. 139-148; 1992. In the series analytic: Vegetation management in forestry, amenity and conservation areas. Paper presented at the conference of the Association, April 7-9, 1992, University of York, England. Includes references.

Language: English

Descriptors: England; Betula pendula; Larix leptolepis; Picea sitchensis; Alnus glutinosa; Forest nurseries; Seedbeds; Field experimentation; Herbicide resistance; Herbicides; Injuries; Phytotoxicity; Pot experimentation

108 NAL Call. No.: SB1.H6
Evaluations and correlated responses for resistance to chloramben herbicide in cucumber.
Staub, J.E.; Knerr, L.D.; Weston, L.A.
Alexandria, Va. : American Society for Horticultural Science; 1991 Jul. HortScience v. 26 (7): p. 905-908; 1991 Jul. Includes references.

Language: English

Descriptors: Wisconsin; Cucumis sativus; Germplasm; Collections; Screening; Herbicide resistance; Chloramben; Crop damage; Phytotoxicity

Abstract: The U.S. cucumber germplasm collection (753 accessions) and U.S. adapted processing cucumber (Cucumis sativus L.) inbreds and hybrids were surveyed for response to 6.7 kg ae/ha of chloramben. Nine plant introductions (PI 165952, 173892, 179676, 275411, 277741, 279464, 279465, 436609, and 482464) were classified as tolerant to chloramben, based on percentage and rate of field emergence and seedling vigor. All adapted strains evaluated were susceptible to chloramben injury. The chloramben-tolerant accessions (C0) were subjected to two cycles of recurrent half-sib family selection that resulted in 11 C2 families. These families, a susceptible adapted line (WI 2870), and the resistant PI 436609 were evaluated in the field (6.7 kg ae/ha) and laboratory (0.0, 0.01, and 0.0001 M) for response to chloramben challenge. Significant (P = 0.05) differences between families were observed for percentage emergence and phytotoxicity ratings. Correlations between emergence and phytotoxicity ratings at two dates were low (r2 = -0.32 and -0.05). Significant (P = 0.05) interfamily differences were also recorded for percentage germination, hypocotyl length, primary root length, and number of lateral roots in the laboratory. Correlated responses between these growth variables were high (r2 = 0.78 to 0.84), but correlations between field and laboratory observations were low (r2 = -0.31 to 0.24). We hypothesize that the genetic response to chloramben challenge under laboratory conditions depends on the concentration of the chemical administered. Chemical name used: 3-amino-2, 5-dichlorobenzoic acid (chloramben).

109 NAL Call. No.: QK710.P62

Expression and stability of amplified genes encoding 5-enolpyruvylshikimate-3-phosphate synthase in glyphosate-tolerant tobacco cells.

Wang, Y.; Jones, J.D.; Weller, S.C.; Goldsbrough, P.B.

Dordrecht : Kluwer Academic Publishers; 1991 Dec.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 17 (6): p. 1127-1138; 1991 Dec. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Genes; Ligases; Nucleotide sequences; Amino acid sequences; Amplification; Glyphosate; Herbicide resistance; Gene expression; Messenger RNA; Cell lines; Regeneration

Abstract: Two distinct cDNAs for 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) were obtained from a glyphosate-tolerant tobacco cell line. The cDNAs were 89% identical and the predicted sequences of the mature proteins were greater than 83% identical with EPSPS proteins from other plants. Tobacco EPSPS proteins were more similar to those from tomato and petunia than Arabidopsis. One cDNA clone, EPSPS-1, represented a gene that was amplified in glyphosate-tolerant cells, while the gene for EPSPS-2 was unaltered in these cells. Consequently, EPSPS-1 mRNA was more abundant in tolerant than unselected cells, whereas EPSPS-2 mRNA was at relatively constant levels in these cell lines. Exposure of unselected cells and tobacco leaves to glyphosate produced a

transient increase in EPSPS mRNA. However, glyphosate-tolerant cells containing amplified copies of EPSPS genes did not show a similar response following exposure to glyphosate. A significant proportion of the EPSPS gene amplification was maintained when tolerant cells were grown in the absence of glyphosate for eight months. Plants regenerated from these cells also contained amplified EPSPS genes.

110 NAL Call. No.: 450 P692
Expression of Erwinia uredovora phytoene desaturase in Synechococcus PCC7942 leading to resistance against a bleaching herbicide.
Windhovel, U.; Geiges, B.; Sandmann, G.; Boger, P.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1994 Jan. Plant physiology v. 104 (1): p. 119-125; 1994 Jan. Includes references.

Language: English

Descriptors: Synechococcus; Erwinia uredovora; Genetic transformation; Structural genes; Oxygenases; Recombinant DNA; Promoters; Gene expression; Herbicide resistance; Norflurazon; Carotenoids; Biosynthesis; Phytoene

Abstract: The gene coding for phytoene desaturase of the bacterium Erwinia uredovora (crtI) was inserted into the chromosome of the cyanobacterium Synechococcus PCC7942 strain R2-PIM8. For expression of crtI in the heterologous host, two constructs with different promoters were introduced into Synechococcus. In the first, crtI was fused to the 5' region of the psbA gene of the xanthophycean microalga Bumilleriopsis filiformis. The second construct carried crtI inserted downstream of the neomycin phosphotransferase II gene (nptII) from the transposon Tn5. Expression of crtI under the control of the respective promoter was shown by immunodetection of the gene product. The functionality of the heterologously expressed phytoene desaturase CRTI in the transformants was demonstrated by enzymic assays. The transformants acquired very strong resistance toward the bleaching herbicide norflurazon.

111 NAL Call. No.: 442.8 G28
Expression of the maize MnSod (Sod3) gene in MnSOD-deficient yeast rescues the mutant yeast under oxidative stress.
Zhu, D.; Scandalios, J.G.
Baltimore, Md. : Genetics Society of America; 1992 Aug. Genetics v. 131 (4): p. 803-809; 1992 Aug. Includes references.

Language: English

Descriptors: Zea mays; Saccharomyces cerevisiae; Structural genes; Superoxide dismutase; Manganese; Genetic transformation; Gene transfer; Gene expression; Mitochondria; Enzyme activity; Oxygen; Free radicals; Paraquat; Herbicide resistance; Stress; Mutants; Induced mutations; Complementation

Abstract: Superoxide dismutases (SOD) are ubiquitous in aerobic organisms and are believed to play a significant role in protecting cells against the toxic, often lethal, effect of oxygen free radicals. However, direct evidence that SOD does in fact participate in such a protective role is scant. The

MnSOD-deficient yeast strain (Sod2d) offered an opportunity to test the functional role of one of several SOD isozymes from the higher plant maize in hopes of establishing a functional bioassay for other SODs. Herein, we present evidence that MnSOD functions to protect cells from oxidative stress and that this function is conserved between species. The maize Sod3 gene was introduced into the yeast strain Sod2d where it was properly expressed and its product processed into the yeast mitochondrial matrix and assembled into the functional homotetramer. Most significantly, expression of the maize Sod3 transgene in yeast rendered the transformed yeast cells resistant to paraquat-induced oxidative stress by complementing the MnSOD deficiency. Furthermore, analyses with various deletion mutants of the maize SOD-3 transit peptide in the MnSOD-deficient yeast strain indicate that the initial portion (about 8 amino acids) of the maize transit peptide is required to direct the protein into the yeast mitochondrial matrix in vivo to function properly. These findings indicate that the functional role of maize MnSOD is conserved and dependent on its proper subcellular location in the mitochondria of a heterologous system.

112 NAL Call. No.: QH442.B5
Fertile, transgenic oat plants.
Somers, D.A.; Rines, H.W.; Gu, W.; Kaeppler, H.F.; Bushnell, W.R. New York, N.Y. : Nature Publishing Company; 1992 Dec.
Bio/technology v. 10 (12): p. 1589-1594; 1992 Dec. Includes references.

Language: English

Descriptors: Avena sativa; Transgenics; Genetic transformation; Callus; Direct DNAuptake; Reporter genes; Beta-glucuronidase; Phosphotransferases; Glufosinate; Herbicide resistance; Regenerative ability; Fertility; Inheritance; Histoenzymology

113 NAL Call. No.: 470 SCI24
First gene-splice wheat.
Washington, D.C. : Science Service :.; 1992 Jun06.
Science news v. 141 (23): p. 379; 1992 Jun06.

Language: English

Descriptors: Triticum aestivum; Genetic engineering; Herbicide resistance

114 NAL Call. No.: SB610.W39
Flurtamone for wild mustard (Sinapis arvensis) control in canola (Brassica napus and B. campestris).
Wall, D.A.
Champaign, Ill. : The Weed Science Society of America; 1992 Oct.
Weed technology : a journal of the Weed Science Society of America v. 6 (4): p. 878-883; 1992 Oct. Includes references.

Language: English

Descriptors: Canada; Cabt; Brassica napus; Brassica campestris; Cultivars; Herbicide resistance; Flurtamone; Application rates; Crop density; Crop yield; Sinapis arvensis; Weed control; Chemical control

115 NAL Call. No.: SB1.J66
Frequency of iron application influences bermudagrass tolerance to herbicides. Carrow, R.N.; Johnson, B.J.
Washington, D.C. : Horticultural Research Institute; 1992 Dec.
Journal of environmental horticulture v. 10 (4): p. 228-231; 1992 Dec. Includes references.

Language: English

Descriptors: Cynodon dactylon; Cynodon; Hybrids; Iron fertilizers; Lawns and turf; Crop damage; Weed control; Chemical control; Herbicide resistance; Imazaquin; Metribuzin; Msma

116 NAL Call. No.: 79.8 W41
Fun with mutants: applying genetic methods to problems of weed physiology. Christianson, M.L.
Champaign, Ill. : Weed Science Society of America; 1991 Jul.
Weed science v. 39 (3): p. 489-496; 1991 Jul. Paper presented at the "Symposium on New Techniques adn Advances in Weed Physiology and Molecular Biology," February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Weeds; Weed biology; Mutants; Herbicide resistance; Mode of action; Chlorsulfuron; Mutagens; Induced mutations; Mutagenesis; Pollen; Seeds; Screening; Selection criteria; Molecular genetics

Abstract: Genetics can be a powerful adjunct to just about any kind of physiological study, including weed physiology or weed/herbicide interactions. Making, mapping, and reverting mutations is simple and straightforward. Making mutants can be as simple as isolating variant individuals from the "wild", as uncomplicated as doing seed mutagenesis in your laboratory, or as sneaky as recovering mutants as sectors in whole plants. The overall principles for successful development of a protocol for seed mutagenesis of weeds are described and potential problem areas noted. These generalities are illustrated with a specific case history, that of chlorsulfuron. Although chlorsulfuron is accurately described as an inhibitor of the synthesis of branched chain amino acids, careful physiological examination suggests that it kills plant cells, not by starvation for amino acids, but by active toxicity of a metabolite, alpha-amino butyric acid, produced from a precursor available for diversion in cells with inhibited acetolactate synthase (EC 4.1.3.18, ALS). The story of dominant resistance due to an altered ALS enzyme is well known; analysis using additional mutants fleshes out the story of how chlorsulfuron works. Such analysis has the potential to help unravel other problems in weed physiology.

117 NAL Call. No.: QK710.P62
Functional analysis of the two homologous psbA gene copies in Synechocystis PCC 6714 and PCC 6803.
Bouyoub, A.; Vernotte, C.; Astier, C.
Dordrecht : Kluwer Academic Publishers; 1993 Jan.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 21 (2): p. 249-258; 1993 Jan. Includes references.

Language: English

Descriptors: Cyanobacteria; Multiple genes; Structural genes; Proteins; Photosystem ii; Mutations; Herbicide resistance; Thylakoids; Photosynthesis; Gene mapping; Restriction mapping; Light intensity

Abstract: The cyanobacteria Synechocystis 6803 and 6714 contain three genes (psbA) coding for the D1 protein. This protein is an essential subunit of photosystem II (PSII) and is the target for herbicides. We have used herbicide-resistant mutants to study the role of the two homologous copies of the psbA genes in both strains (the third copy is not expressed). Several herbicide resistance mutations map within the psbAI gene in Synechocystis 6714 (G. Ajlani et al., Plant Mol. Biol. 13 (1989): 469-479). We have looked for mutations in copy II. Results show that in Synechocystis 6714, only psbAI contains herbicide resistance mutations. Relative expression of psbAI and psbAII has been measured by analysing the proportions of resistant and sensitive D1 in the thylakoid membranes of the mutants. In normal growth conditions, 95% resistant D1 and 5% sensitive D1 were found. In high light conditions, expression of psbAII was enhanced, producing 15% sensitive D1. This enhancement is specifically due to high light and not to the decrease of D1 concentration caused by photoinhibition. Copy I of Synechocystis 6714 corresponds to copy 2 of Synechocystis 6803 since it was always psbA2 which was recombined in Synechocystis 6803 transformants. PSII of the transformant strains was found to be 95% resistant to herbicides as in resistant mutants of Synechocystis 6714.

118 NAL Call. No.: QK710.P68
Functional expression of the Erwinia uredovora carotenoid biosynthesis gene crtl in transgenic plants showing an increase of beta-carotene biosynthesis activity and resistance to the bleaching herbicide norflurazon. Misawa, N.; Yamano, S.; Linden, H.; Felipe, M.R. de; Lucas, M.; Ikenaga, H.; Sandmann, G.
Oxford : Blackwell Scientific Publishers and BIOS Scientific Publishers in association with the Society for Experimental Biology, c1991-; 1993 Nov. The Plant journal : for cell and molecular biology v. 4 (5): p. 833-840; 1993 Nov. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Transgenics; Biosynthesis; Carotenoids; Herbicide resistance; Norflurazon

119 NAL Call. No.: SB610.W39
Future impact of crops with modified herbicide resistance. Wyse, D.L.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 665-668; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance;

Biotechnology; Weed control; Development plans

120 NAL Call. No.: QD341.A2N8
Gene rescue in plants by direct gene transfer of total genomic DNA into protoplasts.
Gallois, P.; Lindsey, K.; Malone, R.; Kreis, M.; Jones, M.G.K.
Oxford : IRL Press; 1992 Aug11.
Nucleic acids research v. 20 (15): p. 3977-3982; 1992 Aug11.
Includes references.

Language: English

Descriptors: Nicotiana tabacum; Arabidopsis thaliana; Beta vulgaris; Gene transfer; Protoplasts; Genes; Isolation; Mutants; Herbicide resistance; Chlorsulfuron; In vitro selection; Electroporation; Genetic transformation; Plasmids; Kanamycin; Drug resistance; Direct DNAuptake; Transgenic plants; Segregation

Abstract: To study the possibility of gene rescue in plants by direct gene transfer we chose the Arabidopsis mutant GH50 as a source of donor DNA. GH50 is tolerant of chlorsulfuron, a herbicide of the sulfonylurea class. Tobacco protoplasts were cotransfected with genomic DNA and the plasmid pHP23 which confers kanamycin resistance. A high frequency of cointegration of the plasmid and the genomic DNA was expected, which would allow the tagging of the plant selectable trait with the plasmid DNA. After transfection by electroporation the protoplasts were cultivated on regeneration medium supplemented with either chlorsulfuron or kanamycin as a selective agent. Selection on kanamycin yielded resistant calluses at an absolute transformation frequency (ATF) of 0.8 X 10(-3). Selection on chlorsulfuron yielded resistant calluses at an ATF of 4.7 X 10(-6). When a selection on chlorsulfuron was subsequently applied to the kanamycin resistant calluses, 8% of them showed resistance to this herbicide. Southern analysis carried out on the herbicide resistant transformants detected the presence of the herbicide resistance gene of Arabidopsis into the genome of the transformed tobacco. Segregation analysis showed the presence of the resistance gene and the marker gene in the progeny of the five analysed transformants. 3 transformants showed evidence of genetic linkage between the two genes. In addition we show that using the same technique a kanamycine resistance gene from a transgenic tobacco could be transferred into sugar beet protoplasts at a frequency of 0.17% of the transformants.

121 NAL Call. No.: 442.8 Z34
Gene SNQ2 of Saccharomyces cerevisiae, which confers resistance to 4-nitroquinoline-N-oxide and other chemicals, encodes a 169 kDa protein homologous to ATP-dependent permeases.
Servos, J.; Haase, E.; Brendel, M.
Berlin, W. Ger. : Springer International; 1993 Jan.
M G G : Molecular and general genetics v. 236 (2/3): p. 214-218; 1993 Jan. The accession number 66732 does not conform to standard format. Includes references.

Language: English

Descriptors: Saccharomyces cerevisiae; Structural genes; Plant proteins; Resistance; Mutagens; Quinolines; Aromatic compounds; Sulfometuron; Herbicide resistance; Nucleotide

sequences; Amino acid sequences; Gene expression; Atp; Binding site

Abstract: The yeast gene SNQ2 confers hyper-resistance to the mutagens 4-nitroquinoline-N-oxide (4-NQO) and Triaziquone, as well as to the chemicals sulphomethuron methyl and phenanthroline when present in multiple copies in transformants of Saccharomyces cerevisiae. Subcloning and sequencing of a 5.5 kb yeast DNA fragment revealed that SNQ2 has an open reading frame of 4.5 kb. The putative encoded polypeptide of 1501 amino acids has a predicted molecular weight of 169 kDa and has several hydrophobic regions. Northern analysis showed a transcript of 5.5 kb. Haploid cells with a disrupted SNQ2 reading frame are viable. The SNQ2-encoded protein has domains believed to be involved in ATP binding and is likely to be membrane associated. It most probably serves as an ATP-dependent permease.

122 NAL Call. No.: TA166.T72
Genes of jeans: biotechnological advances in cotton.
John, M.E.; Stewart, J.M.
New York, N.Y. : Elsevier Science Publishing Co; 1992 May.
Trends in biotechnology v. 10 (5): p. 165-170; 1992 May.
Includes references.

Language: English

Descriptors: Gossypium; Biotechnology; Genetic engineering; Selection criteria; Agronomic characteristics; Crop management; Improvement; Fiber quality; Modification; Genes

Abstract: Cotton is a crop of global economic importance. The impact of advances in cotton genetic engineering will therefore go beyond just altering the patterns of agronomic practice to have a major effect on both economic and social structures. Although the majority of characteristics currently being engineered into cotton (i.e. insect- and herbicide-tolerance) relate to improved crop management, the longer-term goals of modifying fiber are to improve and develop novel properties for the product.

123 NAL Call. No.: 442.8 G28
Genetic interactions among Chlamydomonas reinhardtii mutations that confer resistance to anti-microtubule herbicides.
James, S.W.; Lefebvre, P.A.
Baltimore, Md. : Genetics Society of America; 1992 Feb.
Genetics v. 130 (2): p. 305-314; 1992 Feb. Includes references.

Language: English

Descriptors: Chlamydomonas reinhardtii; Loci; Recessive genes; Alleles; Mutations; Herbicide resistance; Amiprofos-methyl; Oryzalin; Microtubules; Complementation; Gene interaction; Flagella; Deuterium oxide; Genetic change

Abstract: We previously described two types of genetic interactions among recessive mutations in the APM1 and APM2 loci of Chlamydomonas reinhardtii that may reflect a physical association of the gene products or their involvement in a common structure/process: (1) allele-specific synthetic lethality, and (2) unlinked noncomplementation, or dominant enhancement. To further investigate these interactions, we

isolated revertants in which the heat sensitivity caused by the apm2-1 mutation is lost. The heat-insensitive revertants were either fully or partially suppressed for the drug-resistance caused by the apm2-1 allele, In recombination tests the revertants behaved as if the suppressing mutation mapped within the APM2 locus; the partial suppressors of apm2-1 herbicide resistance failed to complement apm2-1, leading to the conclusion that they were likely to be intragenic pseudorevertants. The apm2-1 partial suppressor mutations reversed apm1-apm2-1 synthetic lethality in an allele-specific manner with respect both to apm1-alleles and apm2-1 suppressor mutations. Those apm1- apm2-1rev strains that regained viability also regained heat sensitivity characteristic of the original apm2-1 mutation, even though the apm2-1 suppressor strains were fully heat-insensitive. The Hs+ phenotypes of apm2-1 partial suppressors were also reversed by treatment with the microtubule-stabilizing agent deuterium oxide (D2O). In addition to the above interactions, we observed interallelic complementation and phenotypic enhancement of temperature conditionality among apm1- alleles. Evidence of a role for the products of the two genes in microtubule-based processes was obtained from studying flagellar assembly in apm1- and apm2- mutants.

124 NAL Call. No.: 442.8 G28
Genetic interactions at the FLA10 locus: suppressors and synthetic phenotypes that affect the cell cycle and flagellar function in Chlamydomonas reinhardtii.
Lax, F.G. III; Dutcher, S.K.
Baltimore, Md. : Genetics Society of America; 1991 Jul.
Genetics v. 128 (3): p. 549-561; 1991 Jul. Includes references.

Language: English

Descriptors: Chlamydomonas reinhardtii; Induced mutations; Mutants; Loci; Gene interaction; Flagella; Motility; Temperature; Inhibitor genes; Cell division; Phenotypes; Herbicide resistance; Amiprofos-methyl; Oryzalin; Alleles

Abstract: Through the isolation of suppressors of temperature-sensitive flagellar assembly mutations at the FLA10 locus of Chlamydomonas reinhardtii, we have identified six other genes involved in flagellar assembly. Mutations at these suppressor loci, termed SUF1-SUF6, display allele specificity with respect to which fla10- mutant alleles they suppress. An additional mutation, apm1-122, which confers resistance to the plant herbicides amiprophos-methyl and oryzalin, was also found to interact with mutations at the FLA10 locus. The apm1-122 mutation in combination with three fla10- mutant alleles results in synthetic cold-sensitive cell division defects, and in combination with an additional pseudo-wild-type fla10- allele yields a synthetic temperature-sensitive flagellar motility phenotype. Based upon the genetic interactions of these loci, we propose that the FLA10 gene product interacts with multiple components of the flagellar apparatus and plays a role both in flagellar assembly and in the cell cycle.

125 NAL Call. No.: QH442.J69
Genetic manipulation of crop plants.
Lindsey, K.
Amsterdam : Elsevier Science Publishers B.V.; 1992 Oct.

Journal of Biotechnology v. 26 (1): p. 1-28; 1992 Oct. In the special issue: Plant cell culture / edited by A.H. Scragg. Literature review. Includes references.

Language: English

Descriptors: Crops; Genetic engineering; Genetic transformation; Genetic resistance; Plant development; Herbicide resistance; Literature reviews; Pest resistance

126 NAL Call. No.: 442.8 Z34
Genetic study and further biochemical characterization of a tobacco mutant that overproduces sterols.
Maillot-Vernier, P.; Gondet, L.; Schaller, H.; Benveniste, P.; Belliard, G. Berlin, W. Ger. : Springer International; 1991 Dec.
M G G : Molecular and general genetics v. 231 (1): p. 33-40; 1991 Dec. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Mutants; Mutations; Dominance; Segregation; Phytosterols; Sterol esters; Lipogenesis; Lipids; Droplets; Cytoplasm; Herbicide resistance; Triazole herbicides; Callus

Abstract: A genetic and biochemical characterization is presented of a tobacco mutant that was previously shown to have an increased sterol content with an accumulation of biosynthetic intermediates. We first show that a precise regulation of the membrane sterol composition occurs in this mutant, via a selective esterification process. Indeed, sterols representing the usual end-products of the biosynthetic pathway are preferably integrated into the membranes as free sterols, whereas most of the intermediates pool is esterified and stored in cytoplasmic lipid droplets. It is further demonstrated that overproduction of sterols by the LAB1-4 mutant is due to a single nuclear and semi-dominant mutation. Finally, increase of biosynthesis and esterification of unusual sterols are shown to be responsible for the resistance of LAB1-4 calli to LAB170 250F, the triazole pesticide used to select this mutant. However, differentiated LAB1-4 tissues do not express the resistance trait, suggesting that sterol biosynthesis might not be the only site of action for the triazole at the plant level.

127 NAL Call. No.: 472 N42
Genetic weeding and feeding for tobacco plants.
Bradley, D.
London, Eng. : New Science Publications; 1992 Jan04.
New scientist v. 133 (1802): p. 11; 1992 Jan04.

Language: English

Descriptors: Nicotiana tabacum; Myrothecium verrucaria; Genetic engineering; Herbicide resistance

128 NAL Call. No.: 61.8 SE52
Genetically altered seed & how it will be distributed.
Grooms, L.
Des Plains, Ill. : Scranton Gillette Communications, Inc; 1992 Nov. Seed world v. 130 (12): p. 8-9, 11-13; 1992 Nov.

Language: English

Descriptors: Seeds; Genetic engineering; Distribution; Herbicide resistance; Pest resistance

129 NAL Call. No.: S494.5.B563B554
Genetically engineered plants for herbicide resistance.
Mullineaux, P.M.
Wallingford, Oxford, UK : CAB International; 1992.
Biotechnology in agriculture v. 7: p. 75-107; 1992. In the series analytic: Plant genetic manipulation for crop protection / edited by A.M.R. Gatehouse, V.A. Hilder and Boulter, D. Includes references.

Language: English

Descriptors: Crops; Herbicides; Herbicide resistance; Gene expression; Genetic engineering; Genetic transformation; Vectors; Biochemical pathways; Amino acid metabolism; Protein synthesis; Enzyme activity; Genes; Amplification; Structure activity relationships; Detoxification; Glutathione transferase; Herbicide safeners; Chimerism; Plant protection; Amino acid sequences; Mutations

130 NAL Call. No.: S494.5.B563A382
Genetically-engineered herbicide-resistant crops--a moral imperative for world food production.
Gressel, J.
Milan, Italy : Teknoscienze,; 1992 Nov.
Agrofoodindustry hi-tech v. 3 (6): p. 3-7; 1992 Nov. Includes references.

Language: English

Descriptors: Crops; Herbicide resistance; Genetic engineering; Weed control; Herbicides

131 NAL Call. No.: 442.8 Z34
Glyphosate selected amplification of the 5-enolpyruvylshikimate-3-phosphate synthase gene in cultured carrot cells.
Shyr, Y.Y.J.; Hepburn, A.G.; Widholm, J.M.
Berlin, W. Ger. : Springer International; 1992 Apr.
M G G : Molecular and general genetics v. 232 (3): p. 377-382; 1992 Apr. Includes references.

Language: English

Descriptors: Daucus carota; Structural genes; Transferases; In vitro selection; Glyphosate; Herbicide resistance; Amplification; Gene expression; Messenger RNA; Gene dosage; Tissue culture; Cell suspensions

Abstract: CAR and C1, two carrot (Dacus carota L.) suspension cultures of different genotypes, were subjected to stepwise selection for tolerance to the herbicide glyphosate [(N-phosphonomethyl)glycine]. The specific activity of the target enzyme, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), as well as the mRNA level and copy number of the structural gene increased with each glyphosate selection step. Therefore, the tolerance to glyphosate is due to stepwise amplification

of the EPSPS genes. During the amplification process, DNA rearrangement did not occur within the EPSPS gene of the CAR cell line but did occur during the selection step from 28 to 35 mM glyphosate for the C1 cell line, as determined by Southern hybridization of selected cell DNA following EcoRI restriction endonuclease digestion. Two cell lines derived from a previously selected glyphosate-tolerant cell line (PR), which also had undergone EPSPS gene amplification but have been maintained in glyphosate-free medium for 2 and 5 years, have lost 36 and 100% of the increased EPSPS activity, respectively. Southern blot analysis of these lines confirms that the amplified DNA is relatively stable in the absence of selection. These studies demonstrate that stepwise selection for glyphosate resistance reproducibly produces stepwise amplification of the EPSPS genes. The relative stability of this amplification indicates that the amplified genes are not extrachromosomal.

132 NAL Call. No.: QK710.P62
Glyphosate tolerance of cultured Corydalis sempervirens cell is acquired by an increased rate of transcription of 5-enolpyruvylshikimate 3-phosphate synthase as well as by a reduced turnover of the enzyme.
Hollander-Czytko, H.; Sommer, I.; Amrheim, N.
Dordrecht : Kluwer Academic Publishers; 1992 Dec.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 20 (6): p. 1029-1036; 1992 Dec. Includes references.

Language: English

Descriptors: Corydalis; Transcription; Gene expression; Ligases; Glyphosate; Herbicide resistance; Messenger RNA; Enzyme activity; Genetic regulation; Cell culture

Abstract: Cell cultures of Corydalis sempervirens, tolerant to the herbicide glyphosate, have a 30-40-fold increased level of the herbicide's target enzyme 5-enolpyruvylshikimate 3-phosphate (EPSP) synthase, a ten-fold enhanced level of the corresponding mRNA but no amplification of the gene (Hollander-Czytko et al., Plant Mol Biol 11 (1988) 215-220). The increase at the transcriptional level is due to a higher rate of transcription of the gene, which was observed in run-off transcription assays with isolated nuclei. The further amplification at the protein level is the result of stabilization of the enzyme by the herbicide. In the presence of glyphosate the half-life of EPSP synthase was doubled leading to higher levels of both protein and enzyme activity. Overproduction of the enzyme in adapted cultures is stable at the transcriptional level, as cells from adapted cultures grown in the absence of glyphosate for three years still display an about ten-fold higher enzyme activity and transcript level than non-adapted cultures.

133 NAL Call. No.: SB610.2.B74
Glyphosate-tolerant crops for the future: development, risks and benefits. Waters, S.
Surrey : BCPC Registered Office; 1991.
Brighton Crop Protection Conference-Weeds v. 1: p. 165-170; 1991. Includes references.

Language: English

Descriptors: Crops; Weed control; Herbicide resistance; Tolerance; Glyphosate

134 NAL Call. No.: SB951.P49
Graminicide resistance of acetyl-CoA carboxylase from ornamental grasses. Catanzaro, C.J.; Burton, J.D.; Skroch, W.A.
Orlando, Fla. : Academic Press; 1993 Feb.
Pesticide biochemistry and physiology v. 45 (2): p. 147-153; 1993 Feb. Includes references.

Language: English

Descriptors: Festuca ovina; Festuca; Cultivars; Erianthus; Pennisetum alopecuroides; Panicum virgatum; Sethoxydim; Fluazifop; Herbicide resistance; Susceptibility; Acetyl-coa carboxylase; Enzyme activity; Atp; Weed control

Abstract: Blue fescues [Festuca ovina var. glauca (Lam.) Koch. and F. amethystina L.] are resistant to graminicides, whereas fountain grass [Pennisetum alopecuroides (L.) Spreng.] and most other grasses are sensitive. Evidence suggests that selective control of grasses by the graminicides fluazifop (an aryloxyphenoxypropionate) and sethoxydim (a cyclohexanedione) is often due to differential resistance at the primary site of action, acetyl-CoA carboxylase (ACCase). ACCase activity was obtained from fountain grass and four cultivars of blue fescue to determine whether resistance at the whole plant level correlated with ACCase resistance in vitro. ACCase activity was represented by in vitro incorporation of radioactive bicarbonate into an acid-and heat-stable product. Enzyme activity was dependent on acetyl-CoA and ATP and was inhibited in the presence of avidin, suggesting that activity was due to ACCase. Compared to ACCase from fountain grass, ACCase from fescues was 70 to 88 times more resistant to fluazifop and 216 to 422 times more resistant to sethoxydim. Differences of this magnitude at the enzyme level may be sufficient to explain differential response between blue fescues (resistant) and fountain grass (sensitive) at the whole plant level.

135 NAL Call. No.: 79.9 W52R
Grass tolerance to imazethapyr.
Ferrell, M.A.; Koch, D.W.; Ogg, P.J.; Hruby, F.
S.l. : The Society; 1992.
Research progress report - Western Society of Weed Science. p. III/97-III/98; 1992. Meeting held on March 9-12, 1992, Salt Lake City, Utah.

Language: English

Descriptors: Wyoming; Grasses; Herbicide resistance; Imazethapyr

136 NAL Call. No.: 79.8 W41
Growth response of wheat (Triticum aestivum) callus to imazapyr and in vitro selection for resistance.
Heering, D.C.; Guenzi, A.C.; Peeper, T.F.; Claypool, P.L.
Champaign, Ill. : Weed Science Society of America; 1992 Apr.
Weed science v. 40 (2): p. 174-179; 1992 Apr. Includes references.

Language: English

Descriptors: Triticum aestivum; Herbicide resistance; Mutations; Callus; In vitro selection; Imazapyr; Application rates; Growth rate; Isoleucine; Leucine; Valine; Amino acid metabolism; Enzyme inhibitors

Abstract: Intact wheat plants and wheat calli responded similarly to varying concentrations of imazapyr. Fifty percent growth inhibition of wheat callus occurred with 0.05 micromolar imazapyr after 70 d. As imazapyr concentration increased from 0 to 10 micromolar, the free isoleucine, leucine, and valine decreased from 160 to 35, 260 to 49, and 310 to 59 pmol mg-1, respectively. Resistant calli, which had relative growth rates exceeding a calculated upper prediction interval, were obtained by in vitro selection at 2 and 5 micromolar imazapyr. Resistant calli growing on 2 micromolar imazapyr had free isoleucine, leucine, and valine concentrations intermediate to the control and susceptible callus.

137 NAL Call. No.: 450 AN7
Haploid culture and UV mutagenesis in rapid-cycling Brassica napus for the generation of resistance to chlorsulfuron and Alternaria brassicola. Ahmad, I.; Day, J.P.; MacDonald, M.V.; Ingram, D.S.
London : Academic Press; 1991 Jun.
Annals of botany v. 67 (6): p. 521-525; 1991 Jun. Includes references.

Language: English

Descriptors: Brassica napus; Plant breeding; Selection; Haploids; Mutagenesis; Ultraviolet radiation; Chlorsulfuron; Herbicide resistance; Alternaria brassicicola; Plant pathogenic fungi; Disease resistance

Abstract: The effect of ultra violet (UV) irradiation on cultured isolated microspores of rapid cycling Brassica napus was investigated. The microspores were highly sensitive to UV, with the calculated LD50 being an exposure of 20 s. Viability tests suggested that death of the microspores was not immediate, but occurred during subsequent incubation (7 d). None of the embryos produced following UV-irradiation of microspores showed gross morphological variation. A large number of regenerants was established from embryoids and grown to flowering. These plants set fertile seed after selfing. The progenies were assessed for resistance to Alternaria brassicicola and a small number showed increased resistance to the pathogen, suggesting the generation of novel heritable resistance to this pathogen. In vitro selection revealed heritable resistance to the herbicide 'Glean' (active ingredient chlorsulfuron).

138 NAL Call. No.: 284.28 W15
Hardy crops yield herbicide controversy.
Nazario, S.L.
New York, N.Y. : Dow Jones; 1991 Aug01.
The Wall Street journal. p. B1, B4; 1991 Aug01.

Language: English

Descriptors: U.S.A.; Herbicide resistance; Genetic engineering; Bromoxynil; Environmental impact

139 NAL Call. No.: 450 C16
Harovinton soybean.
Buzzell, R.I.; Anderson, T.R.; Hamill, A.S.; Welacky, T.W.
Ottawa : Agricultural Institute of Canada; 1991 Apr.
Canadian journal of plant science; Revue canadienne de phytotechnie v. 71 (2): p. 525-526; 1991 Apr. Includes references.

Language: English

Descriptors: Ontario; Glycine max; Cultivars; Protein content; Tofu; Disease resistance; Phytophthora megasperma; Herbicide resistance; Metribuzin

140 NAL Call. No.: S544.N6
Herbicide mode of action and injury symptoms.
Gunsolus, J.L.; Curran, W.S.
East Lansing, Mich. : The Service; 1992.
North Central regional extension publication, Cooperative Extension Service v.): 17 p.; 1992.

Language: English

Descriptors: Herbicides; Mode of action; Application methods; Herbicide resistant weeds; Phototoxicity; Injuries; Symptoms

141 NAL Call. No.: S494.5.B563A382
Herbicide resistance.
Howard, J.; Baszczynski, C.
Milan, Italy : Teknoscienze; 1992 Sep.
Agrofoodindustry hi-tech v. 3 (5): p. 3-6; 1992 Sep. Includes references.

Language: English

Descriptors: Crops; Herbicide resistance; Biotechnology; Uses; Applications

142 NAL Call. No.: S79.E37
Herbicide resistance confirmed in johnsongrass biotypes.
Barrentine, W.L.; Snipes, C.E.; Smeda, R.J.
Mississippi State, Miss. : The Station; 1992 Aug.
Research report - Mississippi Agricultural and Forestry Experiment Station v. 17 (5): 5 p.; 1992 Aug. Includes references.

Language: English

Descriptors: Mississippi; Sorghum halepense; Herbicide resistant weeds; Biotypes; Herbicides; Weed control; Trails

143 NAL Call. No.: S397.M57 no.93/10
Herbicide resistance coordination and communication in Western Australia. Martin, R. J.
Western Australia : Dept. of Agriculture,; 1993.
17 p. : ill., map ; 30 cm. (Miscellaneous publication (Western Australia. Dept. of Agriculture) ; no. 93/10.). Cover title. March 17, 1993. Agdex 640.

Language: English

144 NAL Call. No.: 442.8 Z34
Herbicide resistance due to amplification of a mutant acetohydroxyacid synthase gene.
Harms, C.T.; Armour, S.L.; DiMaio, J.J.; Middlesteadt, L.A.; Murray, D.; Negrotto, D.V.; Thompson-Taylor, H.; Weymann, K.; Montoya, A.L.; Shillito, R.D.; Jen, G.C.
Berlin, W. Ger. : Springer International; 1992 Jun.
M G G : Molecular and general genetics v. 233 (3): p. 427-435; 1992 Jun. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Amplification; Structural genes; Multiple genes; Oxo-acid-lyases; Herbicide resistance; Sulfonylurea herbicides; Imazaquin; In vitro selection; Enzyme activity; Mutants; Mutations; Genetic transformation; Transgenics; Protoplasts; Cell suspensions

Abstract: We have selected a tobacco cell line, SU-27D5, that is highly resistant to sulfonylurea and imidazolinone herbicides. This line was developed by selection first on a lethal concentration of cinosulfuron and then on increasing concentrations of primisulfuron, both sulfonylurea herbicides. SU-27D5 was tested against five sulfonylureas and one imidazolinone herbicide and was shown, in every case, to be two to three orders of magnitude more resistant than wild-type cells. The acetohydroxyacid synthase (AHAS) of SU-27D5 was 50- to 780-fold less sensitive than that of wild-type cells to herbicide inhibition. The specific activity of AHAS in the SU-27D5 cell lysate was 6 to 7 times greater than that in wild-type cells. Using Southern analysis, we showed that cell line SU-27D5 had amplified its SuRB AHAS gene about 20-fold while maintaining a normal diploid complement of the SuRA AHAS gene. Genomic clones of both AHAS genes were isolated and used to transform wild-type tobacco protoplasts. SuRB clones gave rise to herbicide-resistant transformants, whereas SuRA clones did not. DNA sequencing showed that all SuRB clones contained a point mutation at nucleotide 588 that converted amino acid 196 of AHAS from proline to serine. In contrast, no mutations were found in the SuRA clones. The stability of SuRB gene amplification was variable in the absence of selection. In one experiment, the withdrawal of selection reduced the copy number of the amplified SuRB gene to the normal level within 30 days. In another experiment, amplification remained stable after extended cultivation on herbicide-free medium. This is the first report of amplification of a mutant herbicide target gene that resulted in broad and strong herbicide resistance.

145 NAL Call. No.: 450 P692
Herbicide resistance in Datura innoxia. Kinetic characterization of acetolactate synthase from wild-type and sulfonylurea-resistant cell variants. Rathinasabapathi, B.; King, J.
Rockville, Md. : American Society of Plant Physiologists; 1991 May. Plant physiology v. 96 (1): p. 255-261; 1991 May. Includes references.

Language: English

Descriptors: Datura fastuosa; Cell cultures; Mutants; Sulfonylurea herbicides; Herbicide resistance; Imidazolinone

herbicides; Ligases; Genetic variation; Cross resistance; Binding site; Amino acids; Biosynthesis

Abstract: Acetolactate synthase (ALS, EC 4.1.3.18), the first enzyme in the biosynthesis of branched-chain amino acids, was isolated from wild-type and sulfonylurea-resistant Datura innoxia cell variants and characterized. Apparent Km values of the ALS for pyruvate from three sulfonylurea-resistant variants (CSR2, CSR6, and CSR10) were manyfold greater than that of the wild type. The inhibition of wild-type and herbicide-resistant ALS activity by chlorsulfuron (CS), a sulfonylurea herbicide, and L-leucine (L-Leu), one of the feedback inhibitors of the enzyme, was examined. ALS from two CS-resistant variants exhibited severalfold greater resistance to CS than did the wild-type enzyme. Inhibition of ALS by L-Leu fitted a partially competitive pattern most closely. It is proposed that the herbicide resistance mutation accentuated the partial inhibition characteristics of ALS by L-Leu. ALS from one of the two CS-resistant variants (CSR6) had a Ki for L-Leu an order of magnitude greater than that of the wild-type enzyme. The alterations in kinetic properties observed in the ALS from sulfonylurea-resistant variants are discussed in relation to the possible evolutionary significance of the herbicide binding site of this enzyme, the physiological effects of such biochemical alterations, and their practical utility in genetic studies.

146 NAL Call. No.: SB951.P49

Herbicide resistance in Setaria viridis conferred by a less sensitive form of acetyl coenzyme A carboxylase.

Marles, M.A.S.; Devine, M.D.; Hall, J.C.

Orlando, Fla. : Academic Press; 1993 May.
Pesticide biochemistry and physiology v. 46 (1): p. 7-14; 1993 May. Includes references.

Language: English

Descriptors: Manitoba; Setaria viridis; Biotypes; Herbicide resistance; Susceptibility; Aryloxyphenoxypropionic herbicides; Cyclohexene oxime herbicides; Mode of action; Uptake; Metabolism; Acetyl-coa carboxylase; Enzyme activity; Inhibition

Abstract: The mechanism of resistance was investigated in a biotype of Setaria viridis resistant to aryloxyphenoxypropanoate and cyclohexanedione herbicides. Uptake of fenoxaprop-ethyl and diclofop-methyl was equal in the resistant and susceptible biotypes. In addition, metabolism of these two herbicides was similar in the resistant and susceptible biotypes, indicating that resistance is not based on altered herbicide metabolism. Fenoxaprop, diclofop, quizalofop, clethodim, sethoxydim, and tralkoxydim inhibited acetyl-coenzyme A carboxylase (ACCase) extracted from the susceptible biotype, with I(50) values ranging from 0.078 to 1.7 micromolar. ACCase from the resistant biotype was much less sensitive to all herbicides, with I(50) values 31 to 60 times higher than for the susceptible biotype. These results indicate that herbicide resistance in this S. viridis biotype is conferred by an altered form of ACCase that is much less sensitive to a wide range of aryloxyphenoxypropanoate and cyclohexanedione herbicides.

147 NAL Call. No.: SB951.4.H443 1991

Herbicide resistance in weeds and crops.
Caseley, J. C.; Cussans, G. W.; Atkin, R. K.
Long Ashton International Symposium 11th : 1989.
Oxford ; Boston : Butterworth-Heinemann,; 1991.
xii, 513 p. : ill. ; 24 cm. "Papers and poster abstracts presented at the Eleventh Long Ashton International Symposium in September 1989"--Pref. Includes bibliographical references and index.

Language: English

Descriptors: Herbicide resistance; Herbicide-resistant crops

148 NAL Call. No.: QH540.A55
Herbicide resistance in weedy plants: physiology and population biology. Warwick, S.I.
Palo Alto, Calif. : Annual Reviews, Inc; 1991.
Annual review of ecology and systematics v. 22: p. 95-114; 1991. Literature review. Includes references.

Language: English

Descriptors: Weeds; Herbicide resistant weeds; Herbicide resistance; Gene flow; Genetic variation; Selection pressure; Natural selection; Triazines; Metabolic detoxification; Plant ecology; Reviews

149 NAL Call. No.: 275.29 M68Ext
Herbicide resistance: prevention and detection.
Byrd, J.D. Jr; Barrentine, W.L.; Shaw, D.R.
State College, Miss. : Cooperative Extension Service, Mississippi State University; 1993 Sep.
Publication / (1907): 4 p.; 1993 Sep.

Language: English

Descriptors: Mississippi; Cabt; Crops; Weed control; Herbicides; Herbicide resistance; Susceptibility; Mode of action

150 NAL Call. No.: SB950.9.C44 v.7
Herbicide resistance--brassinosteroids, gibberellins, plant growth regulators. Adam, G.
Berlin ; New York : Springer-Verlag,; 1991.
176 p. : ill. ; 24 cm. (Chemistry of plant protection ; 7). Includes bibliographical references and index.

Language: English

Descriptors: Herbicide resistance; Gibberellins; Brassinolide; Plant regulators

151 NAL Call. No.: aZ5071.N3
Herbicide resistance--January 1989-March 1991.
Schneider, K.
Beltsville, Md. : The Library; 1991 May.
Quick bibliography series - U.S. Department of Agriculture, National Agricultural Library (U.S.). (91-104): 41 p.; 1991 May. Updates QB 86-51. Bibliography.

Language: English

Descriptors: Herbicide resistance; Bibliographies

152 NAL Call. No.: QH442.B5
Herbicide resistant fertile transgenic wheat plants obtained by microprojectile bombardment of regenerable embryogenic callus. Vasil, V.; Castillo, A.M.; Fromm, M.E.; Vasil, I.K.
New York, N.Y. : Nature Publishing Company; 1992 Jun.
Bio/technology v. 10 (6): p. 662-674; 1992 Jun. Includes references.

Language: English

Descriptors: Triticum aestivum; Genetic transformation; Direct DNAuptake; Transgenics; Gene transfer; Structural genes; Acyltransferases; Plasmids; Herbicide resistance; Glufosinate; Callus; Regenerative ability; Embryogenesis; Reporter genes

153 NAL Call. No.: 79.9 C122
Herbicide resistant in weeds current status and future perspectives. Saari, L.L.
Fremont, Calif. : California Weed Conference; 1991.
Proceedings - California Weed Conference (43rd): p. 37-40; 1991. Meeting held January 21-23, 1991, Santa Barbara, California. Includes references.

Language: English

Descriptors: Herbicide resistant weeds; Weed control; Chemical control

154 NAL Call. No.: 443.8 H42
Herbicide response polymorphism in wild populations of emmer wheat. Snape, J.W.; Nevo, E.; Parker, B.B.; Leckie, D.; Morgunov, A. Oxford : Blackwell Scientific Publications; 1991 Apr.
Heredity v. 66 (pt.2): p. 251-257; 1991 Apr. Includes references.

Language: English

Descriptors: Israel; Triticum dicoccoides; Genes; Genetic resources; Evolution; Herbicide resistance; Difenzoquat; Metoxuron; Genetic polymorphism; Geographical distribution; Wild plants

Abstract: The responses of wild populations of emmer wheat (Triticum dicoccoides), from different ecogeographical areas of Israel, to three herbicides, difenzoquat, chlortoluron and metoxuron, commonly used on cultivated wheats, were studied. Although cultivated wheats are polymorphic for a response to difenzoquat, all families of all populations of the wild species were resistant. The species was, however, polymorphic for response to both chlortoluron and metoxuron. In addition, there appeared to be differentiation between populations in the frequencies of resistant and susceptible morphs for these herbicides. There was also a close correspondence between the responses of individual families to chlortoluron and metoxuron, which suggests a common genetic control. The implications of these findings for understanding the evolution of herbicide resistance, and for developing strategies for breeding for resistance in the cultivated species are

discussed.

155 NAL Call. No.: 442.8 Z8
Herbicide response polymorphisms in wild emmer wheat: ecological and isozyme correlations.
Nevo, E.; Snape, J.W.; Lavie, B.; Beiles, A.
Berlin, W. Ger. : Springer International; 1992.
Theoretical and applied genetics v. 84 (1/2): p. 209-216; 1992. Includes references.

Language: English

Descriptors: Israel; Triticum dicoccoides; Genetic resources; Herbicide resistance; Polymorphism; Metoxuron; Chlorotoluron; Phenotypes; Marker genes; Genotypes; Isoenzymes; Alloenzymes; Enzyme polymorphism; Genetic markers; Ecotypes; Geographical distribution; Gene frequency; Photosynthesis; Plant ecology

Abstract: We demonstrate that the scores and frequencies of chlortoluron (CT) and metoxuron (MX) resistance and susceptible phenotypes of wild emmer wheat, Triticum dicoccoides, are correlated with ecological factors and allozyme markers. Some isozyme markers located on chromosome 6B (e.g. Adh, Est-4 and Got), which also harbours the CT and MX resistance gene, provide good genetic markers for herbicide resistance breeding. Significant correlations between herbicide and photosynthetic characters suggest that the evolution of herbicide resistance polymorphisms may be related to the process of photosynthesis in nature and predated domestication of cultivated wheat.

156 NAL Call. No.: S494.5.B563N33
Herbicide tolerance in crops. 1.
Fehr, W.R.
Ithaca, N.Y. : National Agricultural Biotechnology Council; 1991. NABC report / (3): p. 179-198; 1991. In the series analytic: Agricultural biotechnology at the crossroads: biological, social and institutional concerns. Proceedings of the National Agricultural Biotechnology Council's third annual meeting, May 1991. Includes references.

Language: English

Descriptors: Herbicides; Tolerance; Biotechnology

157 NAL Call. No.: QK658.A54 1992
Herbicide tolerance in maize--genetics and pollen selection.
Gorla, M.S.; Ferrario, S.; Gianfranceschi, L.; Villa, M.
New York : Springer-Verlag; 1992.
Angiosperm pollen and ovules / E. Ottaviano ... [et al., editors]. p. 364-369; 1992. Includes references.

Language: English

Descriptors: Maize; Plant breeding; Selective breeding; Genetic resistance; Herbicides

158 NAL Call. No.: SB610.2.B74
Herbicide tolerance in winter oilseed rape.
Lutman, P.J.W.; Dixon, F.L.
Surrey : BCPC Registered Office; 1991.

Brighton Crop Protection Conference-Weeds v. 1: p. 195-202; 1991. Includes references.

Language: English

Descriptors: Brassica napus; Weed control; Metazachlor; Tolerance; Pyridate; Fluroxypyr

159 NAL Call. No.: 79.9 W52R
Herbicide tolerance of seedling grasses for erosion control in a spotted knapweed infested parkland.
Lass, L.W.; Callihan, R.H.
S.l. : The Society; 1991.
Research progress report - Western Society of Weed Science. p. 24-26; 1991. Meeting held March 12-14, 1991, Seattle, Washington.

Language: English

Descriptors: Centaurea repens; Gramineae; Stand establishment; Weed control; Herbicides

160 NAL Call. No.: SB1.J66
Herbicide tolerance of selected ericaceous species.
Skroch, W.A.; Warren, S.L.; Gallitano, L.B.
Washington, D.C. : Horticultural Research Institute; 1991 Dec.
Journal of environmental horticulture v. 9 (4): p. 196-198; 1991 Dec. Includes references.

Language: English

Descriptors: Ornamental woody plants; Kalmia latifolia; Leucothoe walteri; Oxydendrum arboreum; Rhododendron; Rhododendron catawbiense; Rhododendron obtusum; Herbicide resistance; Herbicide mixtures; Phytotoxicity

161 NAL Call. No.: SB950.2.I3I4
Herbicide tolerant crops.
Graham, J.
Urbana, Ill. : Cooperative Extension Service, Univ of Illinois at Urbana-Champaign; 1991.
Illinois Agricultural Pesticides Conference summaries of presentations January 8, 9, 10, 1991, Urbana, Illinois / Univ of Illinois at Urbana-Champaign, Coop Ext Serv, in coop with the Illinois Natural History Survey. p. 167-169; 1991.
"Proceedings of the 1991 Illinois Agricultural Pesticides Conference," January 8-10, 1991, Urbana, Illinois.

Language: English

Descriptors: Crops; Herbicide resistance; Genetic engineering

162 NAL Call. No.: SB951.P49
Herbicide-insecticide interaction in maize: malathion inhibits cytochrome P450-dependent primisulfuron metabolism.
Kreuz, K.; Fonne-Pfister, R.
Orlando, Fla. : Academic Press; 1992 Jul.
Pesticide biochemistry and physiology v. 43 (3): p. 232-240; 1992 Jul. Includes references.

Language: English

Descriptors: Zea mays; Herbicide resistance; Sulfonylurea herbicides; Interactions; Organophosphorus insecticides; Phytotoxicity; Antagonism; Malathion; Metabolism; Metabolic detoxification; Cytochrome p-450; Enzyme activity; Microsomes; Herbicide mixtures; Pharmacokinetics

Abstract: Tolerance of maize to sulfonylurea herbicides such as primisulfuron has recently been reported to be impaired by the use of some organophosphorus insecticides. In an effort to elucidate the mechanism of this interaction, the effect of the insecticide, malathion, on the metabolism of primisulfuron was studied in whole plants, in excised leaves, and in a microsomal in vitro system from maize. Foliar application of malathion to 7-day-old plants had no influence on leaf uptake and translocation of primisulfuron, but caused a decrease in the rate of herbicide metabolism. In excised leaves, malathion increased the metabolic half-life of primisulfuron. In microsomal preparations, malathion inhibited cytochrome P450-dependent primisulfuron phenyl- and pyrimidinering hydroxylation. Loss of primisulfuron phenyl-ring hydroxylase activity was time-dependent, saturable with respect to malathion concentration, and attenuated in the absence of NADPH. The kinetic data suggest a mechanism-based cytochrome P450 inactivation by malathion. The oxoanalogue of malathion, malaoxon, did not influence the metabolic half-life of primisulfuron in excised leaves and was a poor inhibitor of microsomal primisulfuron hydroxylation. Neither insecticide had any effect in vitro on total microsomal cytochrome P450 content. From the present results it may be concluded that malathion affects primisulfuron tolerance of maize due to the inhibition of cytochrome P450 monooxygenases involved in herbicide metabolism.

163 NAL Call. No.: 381 J825N
Herbicide-resistant crops focus of biotechnology debate.
Baum, R.M.
Washington, D.C. : American Chemical Society; 1993 Mar08.
Chemical and engineering news v. 71 (10): p. 38-41; 1993 Mar08.

Language: English

Descriptors: U.S.A.; Herbicide resistance; Crops; Genetic engineering; Usda; Public opinion

164 NAL Call. No.: QK710.P62
Herbicide-resistant Indica rice plants from IRRI breeding line IR72 after PEG-mediated transformation of protoplasts.
Datta, S.K.; Datta, K.; Soltanifar, N.; Donn, G.; Potrykus, I.
Dordrecht : Kluwer Academic Publishers; 1992 Nov.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 20 (4): p. 619-629; 1992 Nov. Includes references.

Language: English

Descriptors: Oryza sativa; Genetic transformation; Protoplasts; Direct DNAuptake; Polyethylene glycol; Gene transfer; Transgenics; Phosphotransferases; Drug resistance; Hygromycin b; Acyltransferases; Herbicide resistance; Glufosinate; Regenerative ability; Enzyme activity

Abstract: The commercially important Indica rice cultivar Oryza sativa cv. IR72 has been transformed using direct gene transfer to protoplasts. PEG-mediated transformation was done with two plasmid constructs containing either a CaMV 35S promoter/HPH chimaeric gene conferring resistance to hygromycin (Hg) or a CaMV 35S promoter/BAR chimaeric gene conferring resistance to a commercial herbicide (Basta) containing phosphinothricin (PPT). We have obtained so far 92 Hg(r) and 170 PPT(r) IR72 plants from protoplasts through selection. 31 Hg(r) and 70 PPT(r) plants are being grown in the greenhouse to maturity. Data from Southern analysis and enzyme assays proved that the transgene was stably integrated into the host genome and expressed. Transgenic plants showed complete resistance to high doses of the commercial formulations of PPT.

165 NAL Call. No.: 450 P5622
Herbicide-resistant lines of microalgae: growth and fatty acid composition. Cohen, Z.; Reungjitchachawali, M.; Siangdung, W.; Tanticharoen, M.; Heimer, Y.M.
Oxford ; New York : Pergamon Press, 1961-; 1993 Nov.
Phytochemistry v. 34 (4): p. 973-978; 1993 Nov. Includes references.

Language: English

Descriptors: Rhodophyta; Spirulina; Algae; Eicosapentaenoic acid; Fatty acids; Growth; Herbicide resistance; Lines; Linolenic acid

Abstract: Cell lines of Spirulina platensis and Porphyridium cruentum resistant to growth inhibition by the herbicide SAN 9785 had a significantly higher growth rate than their respective wild-type strains. These lines were also shown to overproduce gamma-linolenic acid (GLA) and eicosapentaenoic acid (EPA), respectively, in the presence and absence of the inhibitor, as compared with wild-type cultures under similar conditions. The effect was most conspicuous in polar lipids. Thus, the proportion of GLA in the galactolipid (GL) fraction of the SAN 9785-resistant strain of S. platensis, SRS-1, increased in the absence of the inhibitor from 33.3% in the wild-type to 39.0%. Similarly, the proportion of EPA in the GL fraction of the resistant strain of P. cruentum, SRP, increased in the presence of the inhibitor from 29.1 to 45.4%.

166 NAL Call. No.: 10 J822
Herbicide-resistant weeds: a worldwide perspective.
Moss, S.R.; Rubin, B.
Cambridge : Cambridge University Press; 1993 Apr.
The Journal of agricultural science v. 120 (pt.2): p. 141-148; 1993 Apr. Literature review. Includes references.

Language: English

Descriptors: Herbicide resistant weeds; Incidence; Literature reviews; Models; Resistance mechanisms; Herbicides

167 NAL Call. No.: 275.29 W27Pn
Herbicide-resistant weeds and their management.
Mallory-Smith, C.; Thill, D.; Morishita, D.
Corvallis, Or. : Washington, Oregon, and Idaho State Universities, Cooperative Extension Service; 1993.

PNW [1993?] (437): 4 p.; 1993.

Language: English

Descriptors: Herbicide resistant weeds; Biotypes; Weed control; Herbicides

168 NAL Call. No.: 79.8 W41
Herbicides that inhibit acetohydroxyacid synthase.
Stidham, M.A.
Champaign, Ill. : Weed Science Society of America; 1991 Jul.
Weed science v. 39 (3): p. 428-434; 1991 Jul. Paper presented at the "Symposium on Herbicide Mechanism of Action," February 7, 1990, Montreal, Canada. Includes references.

Language: English

Descriptors: Sulfonylurea herbicides; Imidazolinone herbicides; Mode of action; Enzyme inhibitors; Ligases; Herbicidal properties; Protein synthesis inhibitors; Structure activity relationships; Herbicide resistance; Zea mays; Resistance mechanisms

Abstract: Acetohydroxyacid synthase was discovered as the site of action of imidazolinone and sulfonylurea herbicides over 6 yr ago. In recent years, advances have been made in the understanding of this enzyme as a herbicide target site. Derivatives of both imidazolinones and sulfonylureas have yielded new herbicide chemistry. All of the herbicides display unusual "slow-binding" behavior with the enzyme, and this behavior may help explain efficacy of the herbicides. Resistance to these herbicides has been developed through a number of different procedures, and the mechanism of resistance is through changes in sensitivity of the enzyme to the herbicides. The changes are either selective to only one class of chemistry, or broad to a number of classes of chemistry. These data support the idea that binding sites for the herbicides on the enzyme are only partially overlapping. Progress in purification of AHAS from corn includes discovery of the existence of the enzyme in monomer and oligomer aggregation states. The interaction of the enzyme with the herbicides is affected by enzyme aggregation state.

169 NAL Call. No.: A00109
Herbicide-tolerant crops dominate testing in the industrialized world. Washington, DC : National Biotechnology Policy Center of the National Wildlife Federation; 1993 May.
The gene exchange v. 4 (1): p. 3; 1993 May.

Language: English

Descriptors: Herbicide resistance; Field tests

170 NAL Call. No.: 442.8 Z34
High frequency, heat treatment-induced inactivation of the phosphinothricin resistance gene in transgenic single cell suspension cultures of Medicago sativa.
Walter, C.; Broer, I.; Hillemann, D.; Puhler, A.
Berlin, W. Ger. : Springer International; 1992 Nov.
M G G : Molecular and general genetics v. 235 (2/3): p. 189-196; 1992 Nov. Includes references.

Language: English

Descriptors: Medicago sativa; Genetic transformation; Transgenics; Structural genes; Acyltransferases; Glufosinate; Herbicide resistance; Gene expression; Cell suspensions; Genetic regulation; Heat; Callus; Regenerative ability; Enzyme activity

Abstract: One descendant of the Medicago sativa Ra-3 transformant T304 was analysed with respect to the somatic stability of the synthetic phosphinothricin-N-acetyltransferase (pat) gene which was used as a selective marker and was under the control of the 5'/3' expression signals of the cauliflower mosaic virus (CaMV) gene VI. In order to quantify gene instability, we developed a system for culturing and regenerating individual cells. Single cell suspension cultures derived from T304 and the ancestral non-transgenic M. sativa cultivar Ra-3, were established. The cells were regenerated into monoclonal calli. In transgenic calli, the phosphinothricin (Pt)-resistance phenotype was retained after more than 2 months of non-selective growth. In contrast, up to 12% of the suspension culture cells grown under non-selective conditions and at constant temperature (25 degrees C) lost the herbicide-resistance phenotype within 150 days. Surprisingly, a heat treatment (37 degrees C), lasting for 10 days, during the culture period resulted in an almost complete (95%) loss of the Pt resistance of the suspension culture cells. However, the frequency of cell division was identical in cultures grown under normal and heat treatment conditions. A biochemical test revealed that no phosphinothricin-N-acetyltransferase activity was present in heat treated, Pt-sensitive cells. The resistance level of the Pt-sensitive transgenic cells was equivalent to that of the wild-type cells. A PCR analysis confirmed the presence of the pat gene in heat treated, Pt-sensitive cells. From these results it is concluded that the Pt resistance gene was heat-inactivated at a high frequency in the M. sativa suspension cultures.

171 NAL Call. No.: SB610.W39
History of herbicide--tolerant crops, methods of development and current state of the art--emphasis on glyphosate tolerance.
Kishore, G.M.; Padgette, S.R.; Fraley, R.T.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 626-634; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Literature review. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance; Glyphosate; Weed control; Chemical control; Gene transfer; Biotechnology; Research; Literature reviews

172 NAL Call. No.: SB610.W39
History of identification of herbicide-resistant weeds.
Holt, J.S.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of

America. p. 615-620; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Herbicide resistant weeds; Herbicide resistance; Detection; Biotypes; Cross resistance; Resistance mechanisms; Weed control; Chemical control; History

173 NAL Call. No.: SB1.H6
ID-BR1: sulfonylurea herbicide-resistant lettuce germplasm.
Mallory-Smith, C.; Thill, D.C.; Dial, M.J.
Alexandria, Va. : American Society for Horticultural Science; 1993 Jan. HortScience v. 28 (1): p. 63-64; 1993 Jan. Includes references.

Language: English

Descriptors: Lactuca sativa; Lactuca serriola; Germplasm; Herbicide resistance; Sulfonylurea herbicides; Plant breeding

174 NAL Call. No.: 64.8 C883
Identification and inheritance of metribuzin tolerance in wild soybean. Kilen, T.C.; He, G.
Madison, Wis. : Crop Science Society of America; 1992 May. Crop science v. 32 (3): p. 684-685; 1992 May. Includes references.

Language: English

Descriptors: Glycine max; Wild plants; Metribuzin; Herbicide resistance; Germplasm; Diversity; Genetic regulation; Alleles; Loci; Gene location; Inheritance; Plant breeding

Abstract: An economically important agronomic trait that has not been evaluated extensively in the wild soy (Glycine soja Sieb. & Zucc.) is tolerance to herbicides. Identification and genetic characterization of tolerance to a widely used herbicide, metribuzin [4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4.triazin-5(4H)-one], in G. soja may help provide greater diversity in the gene pool for this trait. This study was conducted to identify tolerance to metribuzin in the wild soybean and to determine the genetic control of the trait. Crosses were made from metribuzin-tolerant G. soja selections and metribuzin-sensitive selections of G. max (L.) Merr. The F1, F2, and F3 populations from these crosses were grown hydroponically, and evaluated for reaction to a concentration of 125 microgram L-1 metribuzin. The F1 plants were tolerant, the F2 population segregated in a 3 tolerant: 1 sensitive ratio, and the F2 population segregated in 1 tolerant: 2 segregating: 1 sensitive ratio, suggesting a single dominant gene controlling tolerance. The F2 populations from crosses between metribuzin-tolerant G. soja accessions and the metribuzin-tolerant cultivar Tracy-M were all tolerant. This indicates that tolerance to metribuzin in these two wild soybean accessions is controlled by alleles at the same locus as the Hm gene in Tracy-M. Therefore, the metribuzin tolerance in the wild soybean is probably the same as that found in most of the cultivated soybean accessions and in most commercial cultivars. The significance of identifying

tolerance to a currently used herbicide in the wild soybean is the suggestion that other useful traits needed in modern agriculture may be found in this primitive gene pool.

175 NAL Call. No.: SB610.W39
Imazaquin absorption, translocation, and metabolism in flue-cured tobacco. Walls, F.R. Jr; Corbin, F.T.; Collins, W.K.; Worsham, A.D.; Bradley, J.R. Jr Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 370-375; 1993 Apr. Includes references.

Language: English

Descriptors: North Carolina; Cabt; Nicotiana tabacum; Herbicide resistance; Imazaquin; Leaves; Absorption; Translocation; Metabolism; Seedling stage; Source sink relations; Roots; Shoots; Foliar application; Soil treatment; Weed control; Chemical control; Phytotoxicity

176 NAL Call. No.: SB951.P49
Increased detoxification is a mechanism of simazine resistance in Lolium rigidum.
Burnet, M.W.M.; Loveys, B.R.; Holtum, J.A.M.; Powles, S.B. Orlando, Fla. : Academic Press; 1993 Jul.
Pesticide biochemistry and physiology v. 46 (3): p. 207-218; 1993 Jul. Includes references.

Language: English

Descriptors: Lolium rigidum; Biotypes; Weeds; Herbicide resistance; Susceptibility; Simazine; Resistance mechanisms; Metabolic detoxification; Metabolism; Metabolites; Metabolic inhibitors; Thylakoids; Oxygen; Uptake; Translocation; Heritability

Abstract: Biotypes of Lolium rigidum Gaud. (annual ryegrass) resistant to the triazine herbicides were studied to determine the mechanism of resistance. The resistant biotypes have different histories of exposure to the herbicide atrazine but both exhibit greater resistance to the structurally similar triazine herbicide simazine. Simazine resistance is not due to a change at the target site, as a similar concentration of simazine is required for a 50% reduction in electron transport by thylakoids isolated from resistant and susceptible biotypes. Uptake of simazine from nutrient solution and distribution of simazine between the roots and the shoots are similar in resistant and susceptible biotypes. Following application to the roots, more than 95% of the absorbed simazine was translocated to the shoots in both resistant and susceptible biotypes. Resistant biotypes metabolized [14C)simazine at a greater rate than susceptible plants when simazine was supplied as either a 12-hr pulse or continuously over 7 days. Over a 7-day exposure to simazine (3 micromolar), susceptible plants accumulated simazine in their shoot tissues, whereas resistant plants maintained a low and stable amount of simazine by metabolizing simazine at a greater rate than the susceptible plants. The primary products of simazine metabolism were tentatively identified as N-de-ethyl derivatives. Up to eight other minor metabolites were also observed. The cytochrome P450 inhibitor 1-aminobenzotriazole (ABT) (70 micromolar) in combination with simazine (3 micromolar) for 7 days caused a greater reduction in dry

weight of resistant plants than simazine applied alone. ABT inhibited the metabolism of simazine by all biotypes whether applied as a 12-hr pulse or over a 7-day period. In the presence of ABT the amount of simazine in the resistant shoot tissue was similar to that in susceptible plants treated with simazine alone. The nature of the metabolites and the inhibition of metabolism by ABT suggest the involvement of oxidative enzymes in the mechanism of resistance to simazine.

177 NAL Call. No.: 500 N21P
Increased resistance to oxidation stress in transgenic plants that overexpress chloroplastic Cu/Zn superoxide dismutase. Gupta, A.S.; Heinen, J.L.; Holaday, A.S.; Burke, J.J.; Allen, R.D. Washington, D.C. : The Academy; 1993 Feb15.
Proceedings of the National Academy of Sciences of the United States of America v. 90 (4): p. 1629-1633; 1993 Feb15.
Includes references.

Language: English

Descriptors: Nicotiana tabacum; Transgenics; Chloroplasts; Gene expression; Genetic code; Oxidation; Photoinhibition; Stress; Superoxide dismutase; Herbicide resistance

Abstract: Transgenic tobacco plants that express a chimeric gene that encodes chloroplast-localized Cu/Zn superoxide dismutase (SOD) from pea have been developed. To investigate whether increased expression of chloroplast-targeted SOD could after the resistance of photosynthesis to environmental stress, these plants were subjected to chilling temperatures and moderate (500 micromole of quanta per m2 per s) or high (1500 micromole of quanta per m2 per s) light intensity. During exposure to moderate stress, transgenic SOD plants retained rates of photosynthesis approximately 20% higher than untransformed tobacco plants, implicating active oxygen species in the reduction of photosynthesis during chilling. Unlike untransformed plants, transgenic SOD plants were capable of maintaining nearly 90% of their photosynthetic capacity (determined by their photosynthetic rates at 25 degrees C) following exposure to chilling at high light intensity for 4 hr. These plants also showed reduced levels of light-mediated cellular damage from the superoxide-generating herbicide methyl viologen. These results demonstrate that SOD is a critical component of the active-oxygen-scavenging system of plant chloroplasts and indicate that modification of SOD expression in transgenic plants can improve plant stress tolerance.

178 NAL Call. No.: 450 P693
Increased sterol biosynthesis in tobacco calli resistant to a triazole herbicide which inhibits demethylation of 14alpha-methyl sterols. Schaller, H.; Maillot-Vernier, P.; Belliard, G.; Benveniste, P. Berlin : Springer-Verlag; 1992.
Planta v. 187 (3): p. 315-321; 1992. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Callus; Sterols; Biosynthesis; Triazole herbicides; Herbicide resistance; Biochemical pathways; Methylation

Abstract: The gamma-keto triazole derivative 4,4-dimethyl-1-(2-methoxyphenyl)-1-(1,2,4-triazol-1-yl)-1-

penten-3-one is toxic to Nicotiana tabacum L. cv. Xanthi plants or cell cultures. Analysis of the sterol composition of treated wild-type plant material demonstrates that this herbicide is an inhibitor of the C-14 alpha-methyl demethylation process in sterol biosynthesis. Selection experiments, consisting of screening large populations of microcalli derived from UV-mutagenized tobacco protoplasts for resistance to a lethal dose (1 mg.l-1) of the gamma-keto triazole, have resulted in the recovery of two groups of resistant calli. In the first group, selected calli show a sterol composition in the absence or presence of the inhibitor very similar to that of wild-type sensitive calli, whereas in the second group the main feature of the selected calli is a new sterol profile. These calli present an overproduction of sterols with a concomitant esterification of overproduced metabolites, just as it was demonstrated for calli previously selected in our laboratory for resistance to LAB 170250F, a triazole fungicide (Maillot-Vernier et al., 1991, Mol. Gen. Genet. 231, 33-40).

179 NAL Call. No.: TA166.T72
Indiscriminate use of selectable markers--sowing wild oats?.
Gressel, J.
New York, N.Y. : Elsevier Science Publishing Co; 1992 Nov.
Trends in biotechnology v. 10 (11): p. 382; 1992 Nov.
Includes references.

Language: English

Descriptors: Avena fatua; Genetic markers; Marker genes; Herbicide resistance; Glufosinate; Gene transfer; Avena sativa; Transgenics; Biotechnology

180 NAL Call. No.: SB951.P49
Induced microsomal oxidation of diclofop, triasulfuron, chlorsulfuron, and linuron in wheat.
Frear, D.S.; Swanson, H.R.; Thalacker, F.W.
Orlando, Fla. : Academic Press; 1991 Nov.
Pesticide biochemistry and physiology v. 41 (3): p. 274-287; 1991 Nov. Includes references.

Language: English

Descriptors: Triticum aestivum; Seedlings; Shoots; Metabolic detoxification; Diclofop; Chlorsulfuron; Triasulfuron; Linuron; Herbicide resistance; Phytotoxicity; Selectivity; Oxidation; Microsomes; Enzyme activity; Monophenol monooxygenase; Nadh dehydrogenase; Cytochrome p-450; Oxygenases; Characterization; Pharmacokinetics

Abstract: Microsomal fractions from shoot tissues of etiolated wheat seedlings catalyzed the oxidation of diclofop, chlorsulfuron, triasulfuron, chlortoluron, and linuron. Microsomal oxidation products of chlorsulfuron, triasulfuron, and linuron were isolated and identified by mass spectrometry and cochromatography with reference standards. Oxidation was dependent on NADPH and molecular oxygen and was inhibited by CO in the presence of oxygen. Triasulfuron hydroxylation was inhibited to varying degrees by other known inhibitors of cytochrome P-450 enzymes and by several different postemergence herbicides. Enzyme activity was increased 2- to 3-fold by the removal of endogenous inhibitors and stimulated an additional 5- to 20-fold by the treatment of germinating

seedlings with naphthalic anhydride, ethanol, or phenobarbital. In contrast to marked increases in monooxygenase activities following induction, microsomal cytochrome P-450 levels and NADPH cytochrome c reductase activities were not increased to a significant extent. Ethanol and phenobarbital were more effective than naphthalic anhydride as inducers of microsomal hydroxylase activity. The combined effect of naphthalic anhydride and ethanol as inducers of diclofop and triasulfuron hydroxylases was additive. Apparent Km values for triasulfuron, chlorsulfuron, and diclofop with constitutive and induced microsomal hydroxylases were compared. Differences in the response of herbicide monooxygenases to selected inhibitors, inducers, and substrates support the hypothesis that wheat microsomes contain a number of distinct cytochrome P-450-dependent monooxygenases with different substrate specificities and kinetic properties. These enzymes serve as important factors in the tolerance and selectivity of a broad spectrum of herbicides used in wheat production systems.

181 NAL Call. No.: SB349.D44 1992
Induced plant cell modifications analysis of herbicide-resistant tomato cells possessing altered cell wall composition.. Induces plant cell wall modifications
Delmer, Deborah P.; Lamport, D. T. A.
United States-Israel Binational Agricultural Research and Development Fund Bet Dagan, Israel : BARD,; 1992.
1 v. (various pagings) : ill. ; 29 cm. Cover title: Induces plant cell wall modifications. Final report. Project no. IS-1386-87. Includes bibliographical references.

Language: English

Descriptors: Tomatoes; Plant cell walls

182 NAL Call. No.: MdULD3231.M70d Bandaranayake, H.A.D.
Induction, transformation and characterization of herbicide resistance in Nicotiana.
Bandaranayake, Hema Anura Divale
University of Maryland at College Park, Dept. of Botany 1992; 1992.
vii, 84 leaves : ill. ; 29 cm. Thesis research directed by Dept. of Botany. Includes bibliographical references (leaves 70-84).

Language: English

Descriptors: Tobacco; Plants, Effect of herbicides on

183 NAL Call. No.: SB610.W39
An industry perspective on herbicide-tolerant crops.
Giaquinta, R.T.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 653-656; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance;

Biotechnology; Industry; Weed control

184 NAL Call. No.: 79.8 W412
Influence of light intensity on growth of triazine-resistant rapeseed (Brassica napus).
Hart, J.J.; Radosevich, S.R.; Stemler, A.
Oxford : Blackwell Scientific Publications; 1992 Oct.
Weed research v. 32 (5): p. 349-356; 1992 Oct. Includes references.

Language: English

Descriptors: Brassica napus; Lines; Selection criteria; Herbicide resistance; Triazines; Crossing; Light intensity; Growth; Dry matter accumulation; Responses; Greenhouse culture; Growth chambers; Photosynthesis; Performance

185 NAL Call. No.: 23 AU783
Influence of rainfall and temperature on sensitivity of barley (Hordeum vulgare) to Chlorsulfuron.
Lemerle, D.
Melbourne : Commonwealth Scientific and Industrial Research Organization; 1993.
Australian journal of agricultural research v. 44 (1): p. 23-32; 1993. Includes references.

Language: English

Descriptors: New South Wales; Hordeum vulgare; Cultivars; Crop damage; Herbicide resistance; Phytotoxicity; Chlorsulfuron; Rain; Temperature

186 NAL Call. No.: 442.8 Z8
Inheritance of bipyridyl herbicide resistance in Arctotheca calendula and Hordeum leporinum.
Purba, E.; Preston, C.; Powles, S.B.
Berlin, W. Ger. : Springer International; 1993 Dec.
Theoretical and applied genetics v. 87 (5): p. 598-602; 1993 Dec. Includes references.

Language: English

Descriptors: Arctotheca calendula; Hordeum murinum subsp. leporinum; Inheritance; Herbicide resistance; Paraquat; Diquat; Segregation; Biotypes; Genes; Dominance; Herbicide resistant weeds

Abstract: The mode of inheritance of resistance to bipyridyl herbicides in bipyridyl-resistant biotypes of Arctotheca calendula and of Hordeum leporinum was investigated. F1 plants from reciprocal crosses between diquat-resistant and -susceptible plants of A. calendula showed an intermediate response to diquat application that was nuclearly inherited. Treatment of F2 plants with 100 g ai ha-1 of diquat or 800 g ai ha-1 of paraquat killed all homozygous-susceptible plants, caused severe injury to heterozygous plants but only slight or no injury to homozygous-resistant plants. Back crosses of F1 to susceptible plants exhibited intermediate and susceptible phenotypes. The observed segregation ratios in F2 and test-cross populations fitted predicted segregation ratios, 1:2:1 (R:I:S) and 1:1 (I:S) respectively, showing that bipyridyl resistance is conferred by a single incompletely-dominant

gene. Biotypes of paraquat-resistant and -susceptible H. leporinum were crossed reciprocally. F1 plants from reciprocal crosses showed an intermediate response to paraquat application. The F2 progeny showed segregation ratios that fitted the predicted segregation ratio of 1:2:1 (R:I:S) for inheritance of resistance being governed by a single partially-dominant gene.

187 NAL Call. No.: 470 C16C
Inheritance of two mutations conferring glyphosate tolerance in the fern Ceratopteris richardii.
Chun, P.T.; Hickok, L.G.
Ottawa, Ont. : National Research Council of Canada; 1992 May.
Canadian journal of botany; Journal canadien de botanique v. 70 (5): p. 1097-1099; 1992 May. Includes references.

Language: English

Descriptors: Ceratopteris; Genotypes; Herbicide resistance; Inheritance; Mutations; Glyphosate

188 NAL Call. No.: SB951.P47
Inhibition of acetolactate synthase in susceptible and resistant biotypes of Stellaria media.
Devine, M.D.; Marles, M.A.S.; Hall, L.M.
Essex : Elsevier Applied Science Publishers; 1991.
Pesticide science v. 31 (3): p. 273-280; 1991. Includes references.

Language: English

Descriptors: Alberta; Stellaria media; Lyases; Biotypes; Cross resistance; Enzyme inhibitors; Herbicide resistance; Susceptibility; Chlorsulfuron; Sulfonylurea herbicides; Weed control

Abstract: Acetolactate synthase (ALS) from one susceptible and two chlorsulfuron-resistant biotypes of Stellaria media (L.) Vill. was assayed in the presence of eight known ALS inhibitors. As expected, ALS from the chlorsulfuron-resistant biotypes (R1 and R2) showed reduced sensitivity to chlorsulfuron and other sulfonylurea herbicides. The patterns of cross-resistance varied, however, indicating that the alteration in ALS that confers chlorsulfuron resistance does not confer the same level of resistance to other sulfonylurea herbicides. The resistant biotypes were highly cross-resistant to sulfometuron-methyl and DPX-A7881, but less cross-resistant to triasulfuron. Both R1 and R2 were highly cross-resistant to DTPS (N-[2,6-dichlorophenyl]-5,7-dimethyl-1,2,4-triazolo[1,5a]pyrimidine-2-sulfonamide), but only slightly cross-resistant to imazamethabenz, an imidazolinone herbicide. The differences in the patterns of cross-resistance observed presumably reflect differences in the binding affinity of the herbicides for the altered ALS. The data presented suggest, but do not confirm, that R1 and R2 contain the same ALS mutation.

189 NAL Call. No.: SB123.57.I55 1992
Instability of herbicide resistance in transgenic suspension cultures and plants.
Broer, I.; Droge, W.; Hillemann, D.; Neumann, K.; Walter, C.; Puhler, A. Braunschweig, Germany : Biologische Bundesanstalt

fur Land- und Forstwirtschaft; 1992.
Proceedings of the 2nd International Symposium on the Biosafety Results of Field Tests of Genetically Modified Plants and Microorganisms : May 11-14, 1992, Goslar, Germany : edited by R. Casper and J. Landsmann. p. 230-238; 1992.
Includes references.

Language: English

Descriptors: Plants; Transgenics; Genetic engineering; Herbicide resistance

190 NAL Call. No.: SB610.W39
International organization for resistant pest management (IOPRM)-- a step toward rational resistance management recommendations.
Lebaron, H.M.; Gressel, J.; Smale, B.C.; Horne, D.M.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 765-770; 1992 Jul. Includes references.

Language: English

Descriptors: International organizations; Herbicide resistant weeds; Weed control; Pest management; Pest resistance

191 NAL Call. No.: QH431.G452
Interspecific hybrids between a transgenic rapeseed (Brassica napus) and related species: cytogenetical characterization and detection of the transgene.
Kerlan, M.C.; Chevre, A.M.; Eber, F.
Ottawa, Ontario, Canada : National Research Council Canada; 1993 Dec. Genome / v. 36 (6): p. 1099-1106; 1993 Dec.
Includes references.

Language: English

Descriptors: Brassica napus; Brassica oleracea; Brassica oleracea var. capitata; Brassica; Brassica nigra; Sinapis arvensis; Raphanus raphanistrum; Interspecific hybridization; Hybrids; Transgenic plants; Introgression; Reporter genes; Acyltransferases; Cytogenetics; Chromosome pairing; Meiosis; Glufosinate; Herbicide resistance

Abstract: In interspecific hybrids produced between a transgenic rapeseed, an allotetraploid species, resistant to herbicide, phosphinotricin, and five diploid related species. the risk for gene introgression in weed genomes was explored through cytogenetic and bar gene characterizations. Among the 75 hybrids studied, most had the expected triploid structure, with the exception of B. napus--B. oleracea amphidiploid plants and one B. napus--S. arvensis amphidiploid plant. In triploid hybrid plants, the reciprocal hybrids did not exhibit any difference in their meiotic behavior. The comparison of the percentage of chromosome pairing in the hybrids with that of haploid rapeseed permit to conclude that allosyndesis between AC genomes and related species genomes took place. This possibility of recombination was confirmed by the presence of multivalent associations in all the interspecific hybrids. Nevertheless, in B. napus--B. adpressa hybrids a control of chromosome pairing seemed to exist. The possibility of amphidiploid plant production directly obtained in the F1 generation increased the risk of gene dispersal. The B. napus-

-B. oleracea amphidiploid plant presented a meiotic behavior more regular than that of the B. napus--S. arvensis amphidiploid plant. Concerning the herbicide bar gene characterization, the presence of the gene detected by DNA amplification was correlated with herbicide resistance, except for two plants. Different hypotheses were proposed to explain these results. A classification of the diploid species was established regarding their gene dispersal risk based on the rate of allosyndesis between chromosomes of AC genomes of rapeseed and the genomes of the related species.

192 NAL Call. No.: Videocassette no.1003
Introduction to genetics and biotechnology DNA technology by Paul J. Bottino ; directed/recorded by Ron Young.. NAL genetics lecture DNA technology Bottino, P. J.
National Agricultural Library (U.S.)
Beltsville, Md.? : National Agricultural Library,; 1991.
2 videocassettes (190 min.) : sd., col. ; 1/2 in. (NAL lecture series ; series no. 1). VHS. June 17, 1991. Title on cassette label: NAL genetics lecture. Susan McCarthy, Coordinator, Plant Genome Data and Information Center.

Language: English

Descriptors: Genetics; Restriction enzymes, DNA; Plant genetic engineering

Abstract: Discusses restriction enzymes and how they are used to cut DNA, restriction sites, enzyme recognition, bacterial plasmids, use of complementary base pairing, enzymology, and gel electrophoresis. Also discusses how DNA technology is use for plant disease, virus and herbicide resistance and for gene therapy.

193 NAL Call. No.: SB951.P49
Investigation of the mechanism of diclofop resistance in two biotypes of Avena fatua.
Devine, M.D.; MacIsaac, S.A.; Romano, M.L.; Hall, J.C.
Orlando, Fla. : Academic Press; 1992 Jan.
Pesticide biochemistry and physiology v. 42 (1): p. 88-96; 1992 Jan. Includes references.

Language: English

Descriptors: Avena fatua; Biotypes; Physiological races; Herbicide resistance; Diclofop; Absorption; Translocation; Metabolism; Metabolic detoxification; Pharmacokinetics; Metabolites; Phytotoxicity; Enzyme activity; Acetyl-coa carboxylase

Abstract: The mechanism of diclofop resistance was investigated in two biotypes of wild oat (Avena fatua L.) that show approximately 12-fold resistance to diclofop compared to a typical susceptible biotype. Absorption and translocation of 14C following application of [14C]diclofop-methyl did not differ among the three biotypes; approximately 95% of the applied diclofop-methyl was absorbed into the foliage 48 hr after application, and most of this (> 80%) was retained in the treated area in all biotypes. Metabolism of diclofop-methyl, examined by TLC and HPLC, did not differ among the three biotypes. Although results of the TLC and HPLC analyses differed slightly, the amount of free diclofop (acid) was generally consistent among the three biotypes. There were no

apparent differences in the nature of the polar metabolites formed in the susceptible and tolerant biotypes. Wheat, which is tolerant of diclofop-methyl, metabolized the herbicide considerably faster than the three wild oat biotypes. Acetyl-coenzyme A carboxylase extracted from the resistance and susceptible biotypes was equally sensitive to diclofop in the range 10(-7) to 10(-4) M, indicating that diclofop resistance is not due to differences at the herbicide target site. Further research is required to explain diclofop resistance in these wild oat biotypes.

194 NAL Call. No.: S79 .E3
Kenaf tolerance to various postemergence herbicides registered for other crops grown in the delta of Mississippi.
Kurtz, M.E.; Weill, S.W.
State College, Miss. : Mississippi State University, Agricultural and Forestry Experiment Station, 1970-; 1993 May. Bulletin (997): 7 p.; 1993 May. Includes references.

Language: English

Descriptors: Mississippi; Cabt; Hibiscus cannabinus; Herbicide resistance; Herbicides; Weed control; Phytotoxicity; Growth effects; Field tests

195 NAL Call. No.: SB610.2.B74
Kinetics of chlorophyll fluorescence decay in triazine-resistant and -susceptibile weeds.
Benyamini, Y.; Schonfeld, M.; Rubin, B.
Surrey : BCPC Registered Office; 1991.
Brighton Crop Protection Conference-Weeds v. 3: p. 1103-1110; 1991. Meeting held November 18-21, 1991, Brighton, England. Includes references.

Language: English

Descriptors: Weeds; Chlorophyll; Fluorescence; Herbicide resistance; Susceptibility; Weed biology

196 NAL Call. No.: 450 P692
Lack of cross-resistance of imazaquin-resistant Xanthium strumarium acetolactate synthase to flumetsulam and chlorimuron.
Schmitzer, P.R.; Eilers, R.J.; Cseke, C.
Rockville, MD : American Society of Plant Physiologists, 1926-; 1993 Sep. Plant physiology v. 103 (1): p. 281-283; 1993 Sep. Includes references.

Language: English

Descriptors: Xanthium strumarium; Cross resistance; Herbicide resistant weeds; Imazaquin; Lyases; Weed control; Chlorimuron; Herbicides

Abstract: Acetolactate synthase (ALS) was isolated from a field population of cocklebur (Xanthium strumarium) that developed resistance to the herbicide Scepter following three consecutive years of application. The active ingredient of Scepter, imazaquin, gave an inhibitor concentration required to produce 50% inhibition of the enzyme activity that was more than 300 times greater for the resistant enzyme than for the wild-type cocklebur ALS. Tests with flumetsulam and

chlorimuron show that the resistant ALS was not cross-resistant to these two other classes of ALS inhibitors.

197 NAL Call. No.: A00109
The latest on transgenic herbicide-tolerant crops.
Washington, DC : National Biotechnology Policy Center of the National Wildlife Federation; 1991 Jun.
The gene exchange v. 2 (2): p. 10; 1991 Jun.

Language: English

Descriptors: U.S.A.; Herbicide resistance; Transgenics; Crops; Usda; Field tests

198 NAL Call. No.: 10 J822
The location and effects of genes modifying the response of wheat to the herbicide difenzoquat.
Leckie, D.; Snape, J.W.
Cambridge : Cambridge University Press; 1992 Feb.
The Journal of agricultural science v. 118 (pt.1): p. 9-15; 1992 Feb. Includes references.

Language: English

Descriptors: Triticum; Polyploidy; Gene transfer; Genotypes; Herbicide resistance; Susceptibility; Difenzoquat

199 NAL Call. No.: QK710.P55
Magnesium deficiency enhances resistance to paraquat toxicity in bean leaves. Cakmak, I.; Marschner, H.
Oxford : Blackwell Scientific Publications; 1992 Oct.
Plant, cell and environment v. 15 (8): p. 955-960; 1992 Oct. Includes references.

Language: English

Descriptors: Phaseolus vulgaris; Paraquat; Phytotoxicity; Magnesium; Mineral deficiencies; Herbicide resistance; Leaves; Light intensity; Oxygen; Free radicals; Chlorophyll; Degradation

200 NAL Call. No.: SB951.P49
Mechanism of diclofop resistance in an Italian ryegrass (Lolium multiflorum Lam.) biotype.
Gronwald, J.W.; Eberlein, C.V.; Betts, K.J.; Baerg, R.J.; Ehlke, N.J.; Wyse, D.L.
Orlando, Fla. : Academic Press; 1992 Oct.
Pesticide biochemistry and physiology v. 44 (2): p. 126-139; 1992 Oct. Includes references.

Language: English

Descriptors: Oregon; Lolium multiflorum; Biotypes; Herbicide resistance; Diclofop; Haloxyfop; Sethoxydim; Quizalofop; Cyclohexene oxime herbicides; Herbicide resistant weeds; Enzyme activity; Acetyl-coa carboxylase; Resistance mechanisms; Pharmacokinetics; Translocation; Metabolism

Abstract: The biochemical basis for diclofop resistance in an Italian ryegrass (Lolium multiflorum Lam.) biotype discovered in Oregon was examined. Herbicide rates that inhibited shoot

growth by 50% (GR50 values) were determined for two aryloxyphenoxypropionic acid herbicides (diclofop, haloxyfop) and one cyclohexanedione herbicide (sethoxydim). As compared to a wild type Italian ryegrass biotype, the GR50 values for diclofop, haloxyfop, and sethoxydim were approximately 130-, 22-, and 2-fold greater, respectively, for the resistant biotype. There were little or no differences in the retention, absorption, translocation, or metabolism of diclofop-methyl in resistant and susceptible biotypes. The susceptibility of acetyl-CoA carboxylase (ACCase) to inhibition by selected graminicide herbicides was evaluated in extracts from etiolated shoots of both resistant and susceptible biotypes. The herbicide concentrations that inhibited ACCase activity by 50% (I50 values) for diclofop, haloxyfop, and quizalofop were approximately 28-, 9-, and 10-fold greater, respectively, for the enzyme from the resistant biotype. For the cyclohexanedione herbicides, sethoxydim and clethodim, the I50 values for ACCase were similar for both biotypes. It is concluded that resistance to diclofop and other aryloxyphenoxypropionic acid herbicides in the Italian ryegrass biotype from Oregon is due to the presence of a tolerant form of ACCase. This modification confers tolerance to the aryloxyphenoxypropionic acids but little or no tolerance to the cyclohexanediones.

201 NAL Call. No.: 79.8 W41
Mechanism of inheritance of diclofop resistance in Italian ryegrass (Lolium multiflorum).
Betts, K.J.; Ehlke, N.J.; Wyse, D.L.; Gronwald, J.W.; Somers, D.A. Champaign, Ill. : Weed Science Society of America; 1992 Apr. Weed science v. 40 (2): p. 184-189; 1992 Apr. Includes references.

Language: English

Descriptors: Oregon; Lolium multiflorum; Herbicide resistance; Herbicide resistant weeds; Diclofop; Biotypes; Inheritance; Maternal effects; Phenotypes; Susceptibility; Enzyme activity; Acetyl-coa carboxylase

Abstract: A diclofop-methyl-resistant biotype of Italian ryegrass was characterized to determine the expression and inheritance of herbicide resistance and whether this trait was due to the presence of a diclofop-insensitive form of acetyl-coenzyme A carboxylase (ACCase). At the whole plant level, the resistant biotype was > 93-fold more resistant to diclofop-methyl than the susceptible biotype. Crosses of diclofop-resistant and -susceptible plants were performed to produce F1 plants. No maternal effects were evident in responses of reciprocal F1 plants to diclofop. GR50 diclofop rates determined for resistant, F1, and susceptible plants were 15, 6.3, and 0.16 kg ha-1, respectively. F2 populations treated with a 7.5 kg ha-1 rate of diclofop exhibited three injury response phenotypes 3 wk after treatment: a susceptible (S) phenotype which was killed, an intermediate resistance (I) phenotype with severe injury, and a resistant (R) phenotype with little or no injury. Testcross progeny exhibited only I and S phenotypes. Observed segregation of phenotypes in F2 and testcross populations conformed to segregation ratios predicted for a trait with inheritance controlled by a single partially dominant nuclear gene. ACCase activity determined in crude cell-free extracts of resistant, F1, and susceptible biotypes exhibited I50 values of 50, 20, and 0.7 micromolar diclofop, respectively. A positive relationship between the

injury response phenotype and site of action (ACCase) response to diclofop was evident in both F1 and F2 populations. In extracts from R, I, and S phenotype F2 plants, 20 micromolar diclofop acid inhibited ACCase-mediated incorporation of 14C by 27.1, 45.1, and 78.9%, respectively. The ACCase data are consistent with the hypothesis that diclofop resistance in Italian ryegrass is conferred by a diclofop-insensitive form of ACCase.

202 NAL Call. No.: 450 J8224
Mechanism of isoxaben tolerance in Agrostis palustris var. Penncross. Heim, D.R.; Bjelk, L.A.; James, J.; Schneegurt, M.A.; Larrinua, I.M. Oxford : Oxford University Press; 1993 Jul.
Journal of experimental botany v. 264 (44): p. 1185-1189; 1993 Jul. Includes references.

Language: English

Descriptors: Agrostis stolonifera var. palustris; Arabidopsis thaliana; Isoxaben; Herbicide resistance; Cellulose; Carbohydrate metabolism; Uptake; Binding site; Interactions; Metabolism; Cell wall components

Abstract: Previous work has demonstrated that isoxaben tolerant mutants of Arabidopsis thaliana var. Columbia are most likely altered at the site of isoxaben binding. The salient question becomes whether or not species selectivity to this herbicide might also be a result of differential target site binding. Grasses are generally more tolerant to isoxaben than dicots. In this communication we show that Agrostis palustris var. Penncross, a grass, is 83-fold more tolerant in a soil incorporation test and 170-fold more tolerant to inhibition of glucose incorporation into cellulose than is Arabidopsis, a dicot. Cell wall fractionation of Agrostis shows a specific effect on cellulose biosynthesis. At most, 5-fold of the 170-fold tolerance exhibited by Agrostis in terms of cellulose biosynthesis can be attributed to decreased isoxaben uptake under the test conditions. Furthermore, Agrostis is unable to metabolize isoxaben to any significant degree. Therefore, we suggest that the major portion of the tolerance in Agrostis might be due to differences in isoxaben binding.

203 NAL Call. No.: QK1.A57
Mechanisms and agronomic aspects of herbicide resistance. Holt, J.S.; Powles, S.B.; Holtum, J.A.M.
Palo Alto, Calif. : Annual Reviews, Inc; 1993.
Annual review of plant physiology and plant molecular biology v. 44: p. 203-209; 1993. Literature review. Includes references.

Language: English

Descriptors: Crops; Herbicide resistance; Herbicide resistant weeds; Reviews; Plant physiology

204 NAL Call. No.: SB249.N6
Mechanisms for resistance of weeds to herbicides. Duke, S.O.
Memphis, Tenn. : National Cotton Council of America, 1991-; 1993. Proceedings / v. 3: p. 1509-1511; 1993. Meeting held

January 10-14, 1993, New Orleans, Louisiana. Includes references.

Language: English

Descriptors: Weeds; Herbicide resistance

205 NAL Call. No.: 79.9 W52
Mechanisms of resistance to acetolactate synthase/acetohydroxyacid synthase inhibitors.
Shaner, D.L.
Reno, Nev. : The Society; 1991.
Proceedings - Western Society of Weed Science v. 44: p. 122-125; 1991. Meeting held March 12-14, 1991, Seattle Washington. Includes references.

Language: English

Descriptors: Herbicide resistance; Herbicides; Mode of action; Enzyme inhibitors; Ligases; Resistance mechanisms

206 NAL Call. No.: SB957.R474 1991
Mechanisms of resistance to herbicides.
Dodge, A.D.
London : Published for SCI by Elsevier Applied Science; 1991.
Resistance '91, Achievement and Developments in Combating Pesticide Resistance / edited by Ian Denholm, Alan L. Devonshire, and Derek W. Hollomon. p. 203-217; 1991.
Proceedings of the SCI Symposium "Resistance '91: Achievements and Developments in Combating Pesticide Resistance," 15-17 July 1991, Rothamsted Experimental Station, Harpenden, UK. Includes references.

Language: English

Descriptors: Weed control; Herbicide resistance; Metabolism

207 NAL Call. No.: 450 P692
Membrane response to diclofop acid is pH dependent and is regulated by the protonated form of the herbicide in roots of pea and resistant and susceptible rigid ryegrass.
DiTomaso, J.M.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1993 Aug. Plant physiology v. 102 (4): p. 1331-1336; 1993 Aug. Includes references.

Language: English

Descriptors: Pisum sativum; Lolium rigidum; Diclofop; Organic acids; Herbicidal properties; Ph; Electrophysiology; Plasma membranes; Membrane potential; Roots; Cell walls; Herbicide resistance; Biotypes

Abstract: Electrophysiological studies in roots of pea (Pisum sativum L.) and rigid ryegrass (Lolium rigidum Gaud.) seedlings were conducted to elucidate the mechanism involved in the membrane response to the herbicide diclofop. In pea, a dicotyledonous plant insensitive to diclofop, membrane depolarization at varying pH values and herbicide concentrations increased at higher concentrations of the protonated form of diclofop acid (pKa 3.57). In unbuffered nutrient solution (pH 5.7), diclofop acid (50 micromolars)

depolarized the membrane potential (Em) in roots of both resistant and susceptible biotypes of rigid ryegrass, whereas recovery of Em occurred only in the resistant biotype following removal of the herbicide. This differential response was correlated with an increase (450%) in the rate of acidification of the external solution by the susceptible biotype, and the Em differences between biotypes were eliminated in solutions buffered at pH 5.0 or 6.0. In addition, p-chloromercuribenzene-sulfonic acid did not prevent the depolarization of Em by 50 micromolars diclofop acid. It is concluded that the differential membrane response to diclofop acid in herbicide-resistant and -susceptible biotypes of rigid ryegrass is due to pH differences at the cell wall/plasmalemma interface. Although the membrane response is probably not involved in the primary inhibitory effect of diclofop on plant growth, it could reduce the concentration of the permeant protonated form of the herbicide and possibly could contribute to increased tolerance to diclofop and other weak acid herbicides.

208 NAL Call. No.: 500 N813
Metabolism of metribuzin in somaclonal variants of tomato.
Breiland, K.; Davis, D.G.; Swanson, H.R.; Frear, D.S.; Secor, G. Grand Forks, N.D. : The Academy; 1991 Apr.
Proceedings of the North Dakota Academy of Science v. 45: p. 36; 1991 Apr. Paper presented at the 83rd Annual Meeting, April 25-26, 1991, Minot, North Dakota. Includes references.

Language: English

Descriptors: Lycopersicon esculentum; Somaclonal variation; Cultivars; Herbicide resistance; Metribuzin

209 NAL Call. No.: 381 J8223
Metabolism of sulfometuron-methyl in wheat and its possible role in wheat intolerance.
Anderson, J.J.; Swain, R.S.
Washington, D.C. : American Chemical Society; 1992 Nov.
Journal of agricultural and food chemistry v. 40 (11): p. 2279-2283; 1992 Nov. Includes references.

Language: English

Descriptors: Triticum aestivum; Sulfonylurea herbicides; Metabolism; Metabolic detoxification; Herbicide resistance

Abstract: [phenyl-(U)-(14)C]Sulfometuron-methyl was metabolized in excised wheat (sensitive to sulfometuron-methyl) to [(14)C]methyl 2-[[[[(4-(hydroxymethyl)-6-methylpyrimindin-2-yl)amino] carbonyl]amino]sulfonyl]benzoate (HM-SM) and its carbohydrate conjugate. This metabolic pathway is consistent with sulfometuron-methyl metabolism in tolerant species such as Bermuda grass. Sulfometuron-methyl was metabolized at a slower rate than metsulfuron-methyl in wheat. When plantswere exposed to [(14)C]methyl 4-hydroxy-2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)ami no]carbonyl]amino] sulfonyl]benzoate (HP-MM) and [(14)C]HM-SM the primary hydroxylated wheat metabolites of metsulfuron-methyl and sulfometuron-methyl, respectively), the rate of glucose conjugation of HP-MM was much faster than the rate of glucose conjugation of HM-SM. Along with their parent compounds, both HM-SM and HP-MM are potent inhibitors of wild mustard acetolactate synthase. These results indicate that

wheat intolerance to sulfometuron-methyl but tolerance to the structurally closely related (metsulfuron-methyl) reflects not only a reduced ability to hydroxylate the parent molecule but also a reduced ability to conjugate the primary toxic metabolite to a nontoxic moiety.

210 NAL Call. No.: QK710.P55
Mode of action of paraquat in leaves of paraquat-resistant Conyza canadensis (L.) Cronq.
Lehoczki, E.; Laskay, G.; Gaal, I.; Szigeti, Z.
Oxford : Blackwell Scientific Publications; 1992 Jun.
Plant, cell and environment v. 15 (5): p. 531-539; 1992 Jun.
Includes references.

Language: English

Descriptors: Conyza canadensis; Paraquat; Herbicidal properties; Herbicide resistance; Herbicide resistant weeds; Biotypes; Phytotoxicity; Photosynthesis; Chlorophyll; Fluorescence; Ethanol production; Oxygen; Gas production; Light; Leaves; Light intensity

211 NAL Call. No.: SB957.R474 1991
Modelling herbicide resistance--a study of ecological fitness.
Mortimer, A.M.; Ulf-Hansen, P.F.; Putwain, P.D.
London : Published for SCI by Elsevier Applied Science; 1991.
Resistance '91, Achievement and Developments in Combating Pesticide Resistance / edited by Ian Denholm, Alan L. Devonshire, and Derek W. Hollomon. p. 148-164; 1991.
Proceedings of the SCI Symposium "Resistance '91: Achievements and Developments in Combating Pesticide Resistance," 15-17 July 1991, Rothamsted Experimental Station, Harpenden, UK.
Includes references.

Language: English

Descriptors: Alopecurus myosuroides; Herbicide resistance

212 NAL Call. No.: 472 N42
Modified wheat paves the way to bumper harvest.
Coghlan, A.
London, Eng. : New Science Publications; 1992 Jul27.
New scientist v. 134 (1827): p. 19; 1992 Jul27.

Language: English

Descriptors: Florida; Triticum aestivum; Genetic engineering; Herbicide resistance

213 NAL Call. No.: LU378.76 L930d 1991 sath
The molecular basis of imidazolinone herbicide resistance in arabidopsis thalian var. columbia.
Sathasivan, Kanagasabapathi,
1991; 1991.
x, 67 leaves : ill. ; 29 cm. Vita. Abstract. Includes bibliographical references (leaves 60-62).

Language: English

Descriptors: Plants, Effect of herbicides on; Herbicides; Imidazoline

214 NAL Call. No.: 450 P692
Molecular basis of imidazolinone herbicide resistance in Arabidopsis thaliana var Columbia.
Sathasivan, K.; Haughn, G.W.; Murai, N.
Rockville, Md. : American Society of Plant Physiologists; 1991 Nov. Plant physiology v. 97 (3): p. 1044-1050; 1991 Nov. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Imidazolinone herbicides; Herbicide resistance; Plant breeding; Genetic transformation; Gene transfer; Mutants; Genetic variation

Abstract: Acetolactate synthase (ALS), the first enzyme in the biosynthetic pathway of leucine, isoleucine, and valine, is inhibited by imidazolinone herbicides. To understand the molecular basis of imidazolinone resistance, we isolated the ALS gene from an imazapyr-resistant mutant GH90 of Arabidopsis thaliana. DNA sequence analysis of the mutant ALS gene demonstrated a single-point mutation from G to A at nucleotide 1958 of the ALS-coding sequence. This would result in Ser to Asn substitution at residue 653 near the carboxyl terminal of the matured ALS. The mutant ALS gene was introduced into tobacco using Agrobacterium-mediated transformation. Imidazolinone-resistant growth of transformed calli and leaves of transgenic plants was 100-fold greater than that of nontransformed control plants. The relative levels of imidazolinone-resistant ALS activity correlated with the amount of herbicide-resistant growth in the leaves of transgenic plants. Southern hybridization analysis confirmed the existence of transferred ALS gene in the transformant showing high imazapyr resistance. The results demonstrate that the mutant ALS gene confers resistance to imidazolinone herbicides. This is the first report, to our knowledge, of the molecular basis of imidazolinone resistance in plants.

215 NAL Call. No.: QK710.P62
The molecular basis of resistance to the herbicide norflurazon. Chamovitz, D.; Pecker, I.; Hirschberg, J.
Dordrecht : Kluwer Academic Publishers; 1991 Jun. Plant molecular biology : an international journal on fundamental research and genetic engineering v. 16 (6): p. 967-974; 1991 Jun. Includes references.

Language: English

Descriptors: Synechococcus; Genes; Cloning; Nucleotide sequences; Enzymes; Norflurazon; Herbicide resistance; Amino acid sequences; Models; Plants; Restriction mapping; Mutations

Abstract: We have cloned and sequenced a gene, pds, from the cyanobacterium Synechococcus PCC7942 that is responsible for resistance to the bleaching herbicide norflurazon. A point mutation in that gene, leading to an amino acid substitution from valine to glycine in its polypeptide product, was found to confer this resistance. Previous studies with herbicide-resistant mutants have indicated that this gene encodes phytoene desaturase (PDS), a key enzyme in the biosynthesis of carotenoids. A short amino acid sequence that is homologous to conserved motifs in the binding sites for NAD(H) and NADP(H) was identified in PDS, suggesting the involvement of these

dinucleotides as cofactors in phytoene desaturation.

216 NAL Call. No.: SB610.W39
Monitoring the occurrence of sulfonylurea-resistant prickly lettuce (Lactuca serriola).
Alcocer-Ruthling, M.; Thill, D.C.; Mallory-Smith, C.
Champaign, Ill. : The Society; 1992 Apr.
Weed technology : a journal of the Weed Science Society of America v. 6 (2): p. 437-440; 1992 Apr. Includes references.

Language: English

Descriptors: Idaho; Lactuca serriola; Herbicide resistant weeds; Sulfonylurea herbicides; Herbicide resistance; Metsulfuron; Sulfometuron; Surveys; Biotypes; Population dynamics

217 NAL Call. No.: 64.8 C883
Monogenic dominant sulfonylurea resistance in sugarbeet from somatic cell selection.
Saunders, J.W.; Acquaah, G.; Renner, K.A.; Doley, W.P.
Madison, Wis. : Crop Science Society of America; 1992 Nov.
Crop science v. 32 (6): p. 1357-1360; 1992 Nov. Includes references.

Language: English

Descriptors: Beta vulgaris; Herbicide resistance; Chlorsulfuron; Inheritance; Cell culture; Culture media; Somatic mutations; Dominance; Genes; Somaclonal variation

Abstract: Injury to sugarbeet, Beta vulgaris L., from sulfonylurea herbicide residues from preceding cropping years has kindled interest in developing resistant cultivars. This study was conducted to obtain chlorsulfuron (2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl] benzenesulfonamide) resistance from cell cultures and to determine its inheritance and magnitude. Utilizing annual diploid sugarbeet clone REL-1, dispersed suspension cultures were initiated from callus induced on leaf disks cultured on a modified Murashige and Skoog (MS) agar medium + 1.0 mg L-1 N6-benzyladenine (BA) and placed in the liquid form of the same medium. Unmutagenized cell clusters were plated on solid medium containing 2.8 micromolar chlorsulfuron in MS + 1.0 mg L-1 BA. A single colony arose, from which shoots were regenerated. Shoots were resistant to 28 nM chlorsulfuron, a concentration that killed similar shoots of REL-1. Resistance (designated Sur) was inherited as a monogenic dominant. In vitro shoot resistance to chlorsulfuron was 300 to 1000-fold greater than in REL-1. Resistance was also expressed in leaf disk expansion in vitro with MS + 1.0 mg L-1 BA.

218 NAL Call. No.: 442.8 Z34
Multiple resistance to sulfonylureas and imidazolinones conferred by an acetohydroxyacid synthase gene with separate mutations for selective resistance.
Hattori, J.; Rutledge, R.; Labbe, H.; Brown, D.; Sunohara, G.; Miki, B. Berlin, W. Ger. : Springer International; 1992 Mar.
M G G : Molecular and general genetics v. 232 (2): p. 167-173; 1992 Mar. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Nicotiana tabacum; Genetic transformation; Transgenics; Genes; Oxo-acid-lyases; Alleles; Mutants; Herbicide resistance; Chlorsulfuron; Imidazolinone herbicides; Nucleotide sequences; Enzyme activity; Amino acid sequences; Induced mutations

Abstract: The acetohydroxyacid synthase (AHAS) gene from the Arabidopsis thaliana mutant line GH90 carrying the imidazolinone resistance allele imr1 was cloned. Expression of the AHAS gene under the control of the CaMV 35S promoter in transgenic tobacco resulted in selective imidazolinone resistance, confirming that the single base-pair change found near the 3' end of the coding region of this gene is responsible for imidazolinone resistance. A chimeric AHAS gene containing both the imr1 mutation and the csr1 mutation, responsible for selective resistance to sulfonylurea herbicides, was constructed. It conferred on transgenic tobacco plants resistance to both sulfonylurea and imidazolinone herbicides. The data illustrate that a multiple-resistance phenotype can be achieved in an AHAS gene through combinations of separate mutations, each of which individually confers resistance to only one class of herbicides.

219 NAL Call. No.: Q11.J68
Mutant weeds of Iowa. V. S-triazine resistant Setaria faberi Herrm. Thornhill, R.; Dekker, J.
Cedar Falls, Iowa : The Academy; 1993 Mar.
The Journal of the Iowa Academy of Science : JIAS v. 100 (1): p. 13-14; 1993 Mar. Includes references.

Language: English

Descriptors: Iowa; Setaria faberi; Herbicide resistant weeds; Mutants; Triazine herbicides

220 NAL Call. No.: QH301.J6
A mutation in the alpha 1-tubulin gene of Chlamydomonas reinhardtii confers resistance to anti-microtubule herbicides.
James, S.W.; Silflow, C.D.; Stroom, P.; Lefebvre, P.A.
Cambridge : The Company of Biologists Limited; 1993 Sep.
Journal of cell science v. 106 (pt.1): p. 209-218; 1993 Sep.
Includes references.

Language: English

Descriptors: Chlamydomonas reinhardtii; Induced mutations; Tubulin; Structural genes; Alleles; Gene mapping; Linkage groups; Herbicide resistance; Amiprofos-methyl; Oryzalin; Microtubules; Semidominance; Segregation; Nucleotide sequences

221 NAL Call. No.: 442.8 Z8
Mutations in corn (Zea mays L.) conferring resistance to imidazolinone herbicides.
Newhouse, K.; Singh, B.; Shaner, D.; Stidham, M.
Berlin, W. Ger. : Springer International; 1991.
Theoretical and applied genetics v. 83 (1): p. 65-70; 1991.
Includes references.

Language: English

Descriptors: Zea mays; Induced mutations; Oxo-acid-lyases;

Alleles; Semidominant genes; Enzyme activity; Herbicide resistance; Imazethapyr; Imazaquin; Sulfometuron; Inheritance; Crossing; Inbred lines

Abstract: Three corn (Zea mays L.) lines resistant to imidazolinone herbicides were developed by in vitro selection and plant regeneration. For all three lines, resistance is inherited as a single semidominant allele. The resistance alleles from resistant lines XA17, XI12, and QJ22 have been crossed into the inbred line B73, and in each case homozygotes are tolerant of commercial use rates of imidazolinone herbicides. All resistant selections have herbicide-resistant forms of acetohydroxyacid synthase (AHAS), the known site of action of imidazolinone herbicides. The herbicide-resistant phenotypes displayed at the whole plant level correlate directly with herbicide insensitivity of the AHAS activities of the selections. The AHAS activities from all three selections have normal feedback regulation by valine and leucine, and plants containing the mutations display a normal phenotype.

222 NAL Call. No.: 450 N42
Natural tolerance of cyanobacteria to the herbicide glyphosate. Powell, H.A.; Kerby, N.W.; Rowell, P.
Cambridge : Cambridge University Press; 1991 Nov.
The New phytologist v. 119 (3): p. 421-426; 1991 Nov.
Includes references.

Language: English

Descriptors: Anabaena variabilis; Glyphosate; Phytotoxicity; Herbicide resistance

223 NAL Call. No.: SB957.R474 1991
The needs for new herbicide-resistant crops.
Gressel, J.
London : Published for SCI by Elsevier Applied Science; 1991.
Resistance '91, Achievement and Developments in Combating Pesticide Resistance / edited by Ian Denholm, Alan L. Devonshire, and Derek W. Hollomon. p. 283-294; 1991.
Proceedings of the SCI Symposium "Resistance '91: Achievements and Developments in Combating Pesticide Resistance," 15-17 July 1991, Rothamsted Experimental Station, Harpenden, UK.
Includes references.

Language: English

Descriptors: Plant breeding; Genetic resistance; Herbicide resistance

224 NAL Call. No.: SB951.P47
Negative cross-resistance to bentazone and pyridate in atrazine-resistant Amaranthus cruentus and Amaranthus hybridus biotypes.
Prado, R. de; Sanchez, M.; Jorrin, J.; Dominguez, C.
Essex : Elsevier Applied Science Publishers; 1992.
Pesticide science v. 35 (2): p. 131-136; 1992. Includes references.

Language: English

Descriptors: Spain; Amaranthus cruentus; Amaranthus hybridus;

Herbicide resistance; Cross resistance; Atrazine; Cyanazine; Acetochlor; Alachlor; Bentazone; Propachlor; Pyridate; Mcpa; Phytotoxicity; Photosynthesis; Inhibition; Chloroplasts; Chlorophyll

Abstract: Plants of Amaranthus cruentus and Amaranthus hybridus resistant to atrazine and cyanazine were found in maize fields in north-eastern Spain. Both resistant biotypes survived doses of 5 kg ha-1 of atrazine and 2-4 kg ha-1 of cyanazine but were controlled by lower doses of bentazone and pyridate than were susceptible biotypes. Such a negative cross-resistance was not found for chloroacetamides and MCPA. Chlorophyll fluorescence studies revealed that atrazine, bentazone, cyanazine and pyridate (10 mg litre-1) caused inhibition of photosynthetic electron transport in susceptible leaves, while in resistant plants, atrazine and cyanazine had no effect. Conversely, bentazone and pyridate inhibited photosynthesis to a greater extent in resistant than in susceptible biotypes. Isolated chloroplast membranes from resistant biotypes showed resistance factors of 366 and 501 to atrazine and 39 and 60 to cyanazine for A. hybridus and A. cruentus, respectively. Bentazone and pyridate were found to be more effective in chloroplasts of the resistant biotypes than those of the susceptible plants. It is suggested that enhanced susceptibility to bentazone and pyridate in triazine-resistant A. cruentus and A. hybridus biotypes may be associated with the alteration of the D-1 polypeptide subunit of photosystem II, as found in triazine-resistant plants.

225 NAL Call. No.: SB610.2.B74
Nitrodiphenyl ether and phenylimide resistance of a tobacco biotype is due to enhanced inducibility of its antioxidant systems.
Gullner, G.; Kiraly, L.; Komives, T.
Surrey : BCPC Registered Office; 1991.
Brighton Crop Protection Conference-Weeds v. 3: p. 1111-1118; 1991. Meeting held November 18-21, 1991, Brighton, England. Includes references.

Language: English

Descriptors: Nicotiana; Antioxidants; Biotypes; Herbicide resistance

226 NAL Call. No.: SB951.P49
A novel pattern of herbicide cross-resistance in a trifluralin-resistant biotype of green foxtail [Setaria viridis (L.) Beauv.].
Smeda, R.J.; Vaughn, K.C.; Morrison, I.N.
Orlando, Fla. : Academic Press; 1992 Mar.
Pesticide biochemistry and physiology v. 42 (3): p. 227-241; 1992 Mar. Includes references.

Language: English

Descriptors: Manitoba; Setaria viridis; Biotypes; Herbicide resistance; Herbicide resistant weeds; Cross resistance; Trifluralin; Herbicides; Dinitroaniline herbicides; Resistance mechanisms; Propyzamide; Terbucarb; Amiprofos-methyl; Propham; Chlorthal-dimethyl; Barban; Chlorpropham

Abstract: A trifluralin-resistant (R) biotype of Setaria viridis is found in areas of Manitoba, Canada where

trifluralin is utilized its the principal or sole herbicide. In this study, we examine the cross-resistance pattern of this biotype to other mitotic disrupter herbicides utilizing growth measurements and electron microscopy to monitor the resistance. Compared to a trifluralin-susceptible (S) biotype, the R biotype is cross-resistant to all dinitroaniline herbicides tested, with I50 R/S ratios [the concentration of herbicide required to inhibit root growth of the R biotype by 50% divided by the concentration which induces the same effect for the S biotype] ranging from 1.6 to 14.8. This R biotype is also cross-resistant at about the same level to amiprophosmethyl and dithiopyr, but exhibits no resistance to pronamide, sindone B, barban, or the microtubule stabilizer taxol. The highest level of resistance is to the structurally unrelated herbicides DCPA (I50, R/S > 50) and terbutol (I50 R/S = 13.4). This is the first reported incidence of resistance to these two herbicides. Ultrastructural observations show herbicide-induced abnormalities are either reduced or absent in the R biotype. The S biotype is actually less susceptible to chlorpropham and propham (R/S I50) = 0.7) than the R biotype. The high level of resistance to the phragmoplast-disrupting microtubule herbicide DCPA, as well as terbutol, and a lower level of resistance to a number of other tubulin-interacting microtubule disrupters, indicate that the R biotype may contain an alteration in a cytoskeletal protein that stabilizes phragmoplast microtubule arrays.

227 NAL Call. No.: QD435.D57
Nucleotide sequence of a 2kb plasmid from Pseudomonas cepacia implicated in the degradation of phenylcarbamate herbicides.
Gaubier, P.; Vega, D.; Cooke, R.
Chur ; New York : Harwood Academic Publishers, 1990-; 1992.
DNA sequence : the journal of DNA sequencing and mapping v. 2 (4): p. 269-271; 1992. Includes references.

Language: English

Descriptors: Pseudomonas cepacia; Plasmids; Nucleotide sequences; Herbicide resistance; Carbamate herbicides; Microbial degradation; Amino acid sequences

Abstract: The complete nucleotide sequence of a very small plasmid whose presence and level in Pseudomonas cepacia have been linked to herbicide resistance is presented. The structural features of the plasmid are discussed.

228 NAL Call. No.: QK710.P62
Nucleotide sequence of the phytoene desaturase gene from Synechocystis sp. PCC 6803 and characterization of a new mutation which confers resistance to the herbicide norflurazon.
Martinez-Ferez, I.M.; Vioque, A.
Dordrecht : Kluwer Academic Publishers; 1992 Mar.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 18 (5): p. 981-983; 1992 Mar. Includes references.

Language: English

Descriptors: Cyanobacteria; Genes; Enzymes; Nucleotide sequences; Mutations; Herbicide resistance; Norflurazon; Amino acid sequences

229 NAL Call. No.: 450 P692
On the mechanism of resistance to paraquat in Hordeum glaucum and H. leporinum: Delayed inhibition of photosynthetic O2 evolution after paraquat application.
Preston, C.; Holtum, J.A.M.; Powles, S.B.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1992 Oct. Plant physiology v. 100 (2): p. 630-636; 1992 Oct. Includes references.

Language: English

Descriptors: Hordeum glaucum; Hordeum murinum subsp. leporinum; Paraquat; Herbicide resistance; Herbicide resistant weeds; Photosynthesis; Oxygen; Gas production; Biotypes; Translocation; Leaves; Diquat

Abstract: The mechanism of resistance to paraquat was investigated in biotypes of Hordeum glaucum Steud. and H. leporinum Link. with high levels of resistance. Inhibition of photosynthetic O2 evolution after herbicide application was used to monitor the presence of paraquat at the active site. Inhibition of photosynthetic O2 evolution after paraquat application was delayed in both resistant biotypes compared with the susceptible biotypes; however, this differential was more pronounced in the case of H. glaucum than in H. leporinum. Similar results could be obtained with the related herbicide diquat. Examination of the concentration dependence of paraquat-induced inhibition of evolution showed that the resistant H. glaucum biotype was less affected by herbicide compared with the susceptible biotype 3 h after treatment at most rates. The resistant H. leporinum biotype, in contrast, was as inhibited as the susceptible biotype except at the higher rates. In all cases photosynthetic evolution was dramatically inhibited 24 h after treatment. Measurement of the amount of paraquat transported to the young tissue of these plants 24 h after treatment showed 57% and 53% reductions in the amount of herbicide transported in the case of the resistant H. glaucum and H. leporinum biotypes, respectively, compared with the susceptible biotypes. This was associated with 62% and 66% decreases in photosynthetic evolution of young leaves in the susceptible H. glaucum and H. leporinum biotypes, respectively, a 39% decrease in activity for the resistant H. leporinum biotype, but no change in the resistant H. glaucum biotype. Photosynthetic evolution of leaf slices from resistant H. glaucum was not as inhibited by paraquat compared with the susceptible biotype; however, those of resistant and susceptible biotypes of H. leporinum were equally inhibited by paraquat. Paraquat resistance in these two biotypes appears to be a consequence of reduced movement of the herbicide in the resistant plants; however, the mechanism involved is not the same in H. glaucum as in H. leporinum.

230 NAL Call. No.: 442.8 Z8
The origin and evolution of weed beets: consequences for the breeding and release of herbicide-resistant transgenic sugar beets.
Boudry, P.; Morchen, M.; Saumitou-Laprade, P.; Vernet, P.; Van Dijk, H. Berlin, W. Ger. : Springer International; 1993 Dec. Theoretical and applied genetics v. 87 (4): p. 477-478; 1993 Dec. Includes references.

Language: English

Descriptors: France; Cabt; Beta vulgaris; Beta vulgaris var. saccharifera; Weeds; Biotypes; Evolution; Mitochondrial DNA; Chloroplasts; Dna; Restriction fragment length polymorphism; Annual habit; Alleles; Dominance; Pollination; Hybridization; Cultivars; Life cycle; Weed biology; Maternal effects; Chloroplast genetics; Genotypes; Mitochondrial genetics; Cytoplasmic male sterility

Abstract: Populations of weed beets have expanded into European sugar beet production areas since the 1970s, thereby forming a serious new weed problem for this crop. We sampled seeds in different French populations and studied mitochondrial DNA, chloroplast DNA and life-cycle variability. Given the maternal inheritance of the mitochondrial and chloroplastic genomes and the nuclear determinism of the annual habit, we were able to determine the maternal origin and evolution of these weed beet populations. Our study shows that they carry the dominant allele "B" for annual habit at high frequency. The main cytoplasmic DNA type found in northern weed beet populations is the cytoplasmic male-sterile type characteristic of sugar beets. We were able to determine that these populations arise from seeds originating from the accidental pollinations of cultivated beets by adventitious beets in the seed production area, which have been transported to the regions where sugar beets are cultivated. These seeds are supposedly the origin of the weed forms and a frequently disturbed cultivated environment has selected for annual habit and early flowering genotypes. We discuss the consequences of the weed beet populations for the breeding, seed production and release of herbicide-resistant transgenic sugar beets.

231 NAL Call. No.: SB1.H6
Ornamental grass tolerance to postemergence grass herbicides.
Hubbard, J.; Whitwell, T.
Alexandria, Va. : The American Society for Horticultural Science; 1991 Dec. HortScience : a publication of the American Society for Horticultural Science v. 26 (12): p. 1507-1509; 1991 Dec. Includes references.

Language: English

Descriptors: Grasses; Ornamental herbaceous plants; Herbicide resistance; Calamagrostis; Cortaderia; Eragrostis; Erianthus; Miscanthus; Sorghastrum; Spartina; Panicum; Sethoxydim; Fenoxaprop; Fluazifop-p; Phytotoxicity; Application rates; Abiotic injuries

Abstract: Twelve ornamental grasses from the genera Calamagrostis, Cortaderia, Eragrostis, Erianthus, Miscanthus, Sorghastrum, Spartina, Panicum, and Pennisetum were evaluated for tolerance to the postemergence herbicides fenoxaprop-ethyl, fluazifop-P, and sethoxydim at 0.4 kg a.i./ha. Calamagrostis was uninjured by fenoxaprop-ethyl as measured by visual injury ratings, height, and foliage dry weight. Greenhouse studies evaluated the tolerance of three Calamagrostis cultivars to fenoxaprop-ethyl rates of 0.4 to 3.2 kg a.i./ha with no observed visual injury from any treatment. However, the expansion rate of the youngest Calamagrostis leaf was reduced linearly with increasing herbicide rates each day after application. The highest rate (3.2 kg a.i./ha) reduced the leaf expansion rate by 1 day and all other rates by 3 days after treatment. Leaf expansion rate differed between Calamagrostis cultivars at different times

after herbicide treatment. Dry weight of Calamagrostis arundinacea 'Karl Foerster' was reduced at 4 weeks after treatment but not at 10 weeks after treatment.

232 NAL Call. No.: 442.8 Z34
Overproduction by gene amplification of the multifunctional arom protein confers glyphosate tolerance to a plastid-free mutant of Euglena gracilis. Reinbothe, S.; Ortel, B.; Parthier, B.
Berlin, W. Ger. : Springer International; 1993 Jun.
Molecular & general genetics : MGG v. 239 (3): p. 416-424; 1993 Jun. Includes references.

Language: English

Descriptors: Euglena gracilis; Amplification; Genes; Plant proteins; Glyphosate; Herbicide resistance; Enzyme activity; Alkyl (aryl) transferases; Alcohol oxidoreductases; Kinases; Messenger RNA; Plastids; Mutants; Amino acid metabolism; Amino acids

Abstract: Cells of the plastid-free mutant line of Euglena gracilis var. bacillaris, W10BSmL, can be adapted to glyphosate [N-(phosphonomethyl)glycine] by gradually increasing the concentration of the herbicide in the culture medium. The molecular basis of glyphosate tolerance is the selective ca. ten-fold overproduction of the multifunctional arom protein catalyzing steps 2-6 in the pre-chorismate pathway. Determination of 5-enolpyru-vylshikimate-3-phosphate (EPSP) synthase (E.C.2.5.1.19), shikimate:NADP+ oxidoreductase (E.C.1.1.1.25) and shikimate kinase (E.C.2.7.1.71) activities after non-denaturing gel electrophoresis, in combination with two-dimensional separations, revealed an increase in all three enzyme activities associated with overproduction of a 165 kDa protein in cells adapted to 6 mM glyphosate. Further evidence for an involvement of the multifunctional arom protein in aromatic amino acid synthesis in the plastid-free W10BSmL cells was obtained by Northern hybridization with ARO1-, aroA-, aroL- and aroE-specific Saccharomyces cerevisiae gene probes encoding the entire arom protein or parts of the EPSP synthase, shikimate: NADP+ oxidoreductase and shikimate kinase domains, respectively. Overproduction in adapted relative to control cells of a 5.3 kb transcript that cross-hybridized with all of the different probes could be demonstrated. The elevated content of the arom transcript correlated with a selective amplification of two out of five genomic sequences that hybridized with the S. cerevisiae ARO1 gene probe in Southern blots. One of the amplified genomic fragments is assumed to encode the previously identified monofunctional 59 kDa EPSP synthase, which is thought to be an organellar protein, that accumulates to a certain extent in its enzymatically active precursor form of 64.5 kDa in the plastid-free W10BSmL cells.

233 NAL Call. No.: 450 P692
Overproduction of gamma-linolenic and eicosapentaenoic acids by algae. Cohen, Z.; Didi, S.; Heimer, Y.M.
Rockville, Md. : American Society of Plant Physiologists; 1992 Feb. Plant physiology v. 98 (2): p. 569-572; 1992 Feb. Includes references.

Language: English

Descriptors: Spirulina; Algae; Biosynthesis; Linolenic acid; Eicosapentaenoic acid; Genetic regulation; Cell lines; Herbicide resistance; Plant breeding; Selection; High yielding varieties

Abstract: The pharmaceutical interest and limited availability of gamma-linolenic acid (GLA) and eicosapentaenoic acid (EPA) prompted the search for genetic means for increasing the production of these fatty acids from algal sources. Cell lines of Spirulina platensis and Porphyridium cruentum resistant to the growth inhibition of the herbicide Sandoz 9785 were selected by serial transfers of the culture in the presence of increasing concentrations of the herbicide. The resistant cell lines of S. platensis overproduced GLA and those of P. cruentum overproduced EPA and were stable for at least 50 generations in the absence of the inhibitor.

234 NAL Call. No.: 100 L939
Overtop applications of Buctril controls broadleaf weeds in transgenic cotton. Crawford, S.H.
Baton Rouge, La. : The Station; 1993.
Louisiana agriculture - Louisiana Agricultural Experiment Station v. 36 (1): p. 23; 1993.

Language: English

Descriptors: Louisiana; Gossypium hirsutum; Weed control; Bromoxynil; Transgenics; Herbicide resistance; Field tests

235 NAL Call. No.: SB950.A1P3
Oxyflurofen tolerance and weed control in young papaya. Nishimoto, R.K.
London : Taylor & Francis Ltd., 1993-; 1993 Jul.
International journal of pest management v. 39 (3): p. 366-369; 1993 Jul. Includes references.

Language: English

Descriptors: Hawaii; Cabt; Carica papaya; Herbicide resistance; Age of trees; Plant height; Susceptibility; Chemical control; Weed control; Bidens pilosa; Oxyfluorfen; Phytotoxicity; Abiotic injuries

236 NAL Call. No.: SB951.P49
Paraquat resistance and its inheritance in seed germination of the foliar-resistant biotypes of Erigeron canadensis L. and E. sumatrensis Retz. Yamasue, Y.; Kamiyama, K.; Hanioka, Y.; Kusanagi, T.
Orlando, Fla. : Academic Press; 1992 Sep.
Pesticide biochemistry and physiology v. 44 (1): p. 21-27; 1992 Sep. Includes references.

Language: English

Descriptors: Erigeron sumatrensis; Conyza canadensis; Biotypes; Herbicide resistant weeds; Paraquat; Herbicide resistance; Inheritance; Seed germination; Foliar application; Genes; Pharmacokinetics

Abstract: Seeds of the foliar-resistant biotypes of Erigeron canadensis L. and E. sumatrensis Retz. to paraquat (1,1'-

dimethyl-4,4'-bipyridinium ion) were studied with respect to resistance at germination. Threshold concentrations of the herbicide in foliar susceptibility of seedlings were 10(-4) and 10(-6) M for the resistant and susceptible biotypes of E. canadensis, respectively. The concentrations in seed susceptibility at germination were 10(-5) and 10(-7) M for the respective biotypes. Seeds of the resistant biotype of E. sumatrensis showed less resistance at seed germination than those of E. canadensis. The resistant and susceptible biotypes of E. canadensis were reciprocally crossed to make a comparison in inheritance between the foliar resistance and seed resistance at germination. In the F2 generation, the ratios of foliar-resistant and susceptible seedlings at 10(-5) M fitted well to a 3:1 ratio, indicating that the resistance was controlled by a single nuclear gene. In seed resistance, three-fourths of the F2 seeds were resistant at 10(-5) M, suggesting that a single gene also controlled the resistance. These results suggested the possibility that a common mechanism of paraquat resistance exists between the photosynthetic and nonphotosynthetic organs.

237 NAL Call. No.: QK725.P54
Paraquat tolerance in a photomixotrophic culture of Chenopodium rubrum. Bhargava, S.
Berlin, W. Ger. : Springer International; 1993.
Plant cell reports v. 12 (4): p. 230-232; 1993. Includes references.

Language: English

Descriptors: Chenopodium rubrum; Cell cultures; Paraquat; Herbicide resistance; Weed biology; Growth; Chemical composition; Chlorophyll; Photosystem i; Enzyme activity; Superoxide dismutase; Peroxidase; Catalase; Lines; Genetic variation; Metabolic detoxification

Abstract: A paraquat tolerant line of Chenopodium rubrum has been compared with paraquat susceptible cultures, in terms of growth, chlorophyll content, photosystem I partial reactions, and the activities of some enzymes involved in detoxification of harmful oxygen radicals. Results indicate that paraquat tolerance is manifested through increased activity of superoxide dismutase, peroxidase and catalase, in the tolerant line, only in the presence of paraquat. The behaviour of the paraquat tolerant and susceptible cultures in the absence of paraquat is quite similar.

238 NAL Call. No.: 79.8 W41
Photoacoustic spectroscopy as a tool for monitoring herbicide effects on triazine-resistant and -susceptible biotypes of black nightshade (Solanum nigrum).
Fuks, B.; Homble, F.; Van Eycken, F.; Figeys, H.; Lannoye, R.L. Champaign, Ill. : Weed Science Society of America; 1992 Jul. Weed science v. 40 (3): p. 371-377; 1992 Jul. Includes references.

Language: English

Descriptors: Solanum nigrum; Biotypes; Herbicide resistant weeds; Atrazine; Diuron; Herbicide resistance; Detection; Monitoring; Spectroscopy; Photosynthesis

Abstract: Photoacoustic spectroscopy was used to study

effects of atrazine and diuron on excised leaves of triazine-susceptible (S) and -resistant (R) biotypes of black nightshade. Changes of oxygen and photothermal components were compared to photochemical fluorescence quenching obtained by fluorimetry. After 1 h incubation in an aqueous solution of atrazine (0 to 200 micromole), oxygen component of the photoacoustic signal was strongly decreased in the S biotype while the R biotype was not affected. Also, reoxidation of the primary quinone acceptor (QA(-1)) of photosystem (PS) II of the S biotype was lower than that of the R biotype. With diuron treatments, changes in the characteristics of these biophysical signals were the same in both R and S biotypes. Both oxygen component and photochemical fluorescence quenching were decreased in treated leaves of the R and S biotypes. By using modulated oxygen and heat emissions, and the ratio of the initial inflection point (I) to the fluorescence maximum (P) as herbicide bioassay indicators, we showed that the photoacoustic spectroscopy was also a reliable technique for whole plant studies. Inhibition of photosynthesis was maximal 2 d after onset of treatment with atrazine (200 micromole). Inhibitors of PSII did not induce a significant increase of heat emission in leaves which otherwise showed phytotoxic symptoms after treatment. By using the photoacoustic technique, it was possible to obtain useful information on photosynthetic activity under herbicide stress, suggesting that pulsed oxygen emitted by leaves could be used to quantify susceptibility or to detect resistance to many types of photosynthetic inhibitors in weeds and crop plants.

239 NAL Call. No.: 450 P692
Physiological basis for differential sensitivities of plant species to protoporphyrinogen oxidase-inhibiting herbicides.
Sherman, T.D.; Becerril, J.M.; Matsumoto, H.; Duke, M.V.; Jacobs, J.M.; Jacobs, N.J.; Duke, S.O.
Rockville, Md. : American Society of Plant Physiologists; 1991 Sep. Plant physiology v. 97 (1): p. 280-287; 1991 Sep.
Includes references.

Language: English

Descriptors: Abutilon theophrasti; Cucumis sativus; Brassica hirta; Chenopodium album; Amaranthus retroflexus; Medicago sativa; Fagopyrum tataricum; Ipomoea lacunosa; Cassia obtusifolia; Datura stramonium; Spinacia oleracea; Herbicide resistance; Porphyrins; Biosynthesis; Acifluorfen; Phytotoxicity; Weed control; Herbicidal properties

Abstract: With a leaf disc assay, 11 species were tested for effects of the herbicide acifluorfen on porphyrin accumulation in darkness and subsequent electrolyte leakage and photobleaching of chlorophyll after exposure to light. Protoporphyrin IX (Proto IX) was the only porphyrin that was substantially increased by the herbicide in any of the species. However, there was a wide range in the amount of Proto IX accumulation caused by 0.1 millimolar acifluorfen between species. Within species, there was a reduced effect of the herbicide in older tissues. Therefore, direct quantitative comparisons between species are difficult. Nevertheless, when data from different species and from tissues of different age within a species were plotted, there was a curvilinear relationship between the amount of Proto IX caused to accumulate during 20 hours of darkness and the amount of electrolyte leakage or chlorophyll photobleaching caused after 6 and 24 hours of light respectively, following the dark

period. Herbicidal damage plateaued at about 10 nanomoles of Proto IX per gram of fresh weight. Little difference was found between in vitro acifluorfen inhibition of protoporphyrinogen oxidase (Protox) of plastid preparations of mustard, cucumber, and morning glory, three species with large differences in their susceptibility at the tissue level. Mustard, a highly tolerant species, produced little Proto IX in response to the herbicide, despite having a highly susceptible Protox. Acifluorfen blocked carbon flow from delta-aminolevulinic acid to protochlorophyllide in mustard, indicating that it inhibits Protox in vivo. Increasing delta-aminolevulinic acid concentrations (33-333 micromolar) supplied to mustard with 0.1 millimolar acifluorfen increased Proto IX accumulation and herbicidal activity, demonstrating that mustard sensitivity to Proto IX was similar to other species. Differential susceptibility to acifluorfen of the species examined in this study appears to be due in large part to differences in Proto IX accumulation in response to the herbicide. In some cases, differences in Proto IX accumlation appear to be due to differences in activity of the porphyrin pathway.

240 NAL Call. No.: 79.8 W41
Phytoene desaturase, the essential target for bleaching herbicides. Sandmann, G.; Schmidt, A.; Linden, H.; Boger, P. Champaign, Ill. : Weed Science Society of America; 1991 Jul. Weed science v. 39 (3): p. 474-479; 1991 Jul. Paper presented at the "Symposium on Herbicide Mechanism of Action," February 7, 1990, Montreal, Canada. Includes references.

Language: English

Descriptors: Fluridone; Norflurazon; Flurtamone; Herbicides; Mode of action; Herbicidal properties; Enzyme inhibitors; Phytoene; Biosynthesis; Biochemical pathways; Herbicide resistance; Molecular genetics; Genes; Cyanobacteria; Cloning; Mutants

Abstract: Many bleaching herbicides with different core structures inhibit phytoene desaturase (PD), a membrane-bound enzyme in the carotenogenic pathway catalyzing the hydrogen abstraction step at the first C40 precursor of beta-carotene. Prospects are good that new PD-active herbicides will be discovered by screening for bleaching activity. Accordingly, interest in PD enzymology and molecular genetics has increased. Although active carotenogenic cell-free systems are available, no isolation of PD has been achieved since the enzyme cannot be detected in its isolated form due to complete loss of activity. A portion of the Rhodobacter PD gene was incorporated into an appropriate plasmid which could be expressed in E. coli. This system was used to produce an antibody specific against PD from higher plants as well as Rhodobacter. All PDs assayed had an apparent molecular weight of 52 to 55 kDa. A Rhodobacter gene probe hybridized with a 3.1 kbBamHI fragment from Aphanocapsa which allowed us to sequence the PD gene from this cyanobacterium. Its DNA sequence matched with the apparent molecular weight of the PD band in the western blot, and a fusion-gene product was found to be immunoreactive with the Rhodobacter PD antibody, Anacystis mutants were produced exhibiting cross-resistance against nornurazon and fluorochloridone. Apparently, this resistance is due to an altered PD with concurrent decrease of inhibitor binding affinity. Cloning of the resistant gene into the wild type is in progress.

241 NAL Call. No.: 79.8 W41
Plant cell and tissue culture techniques for weed science research. Smeda, R.J.; Weller, S.C.
Champaign, Ill. : Weed Science Society of America; 1991 Jul.
Weed science v. 39 (3): p. 497-504; 1991 Jul. Paper presented at the "Symposium on New Techniques adn Advances in Weed Physiology and Molecular Biology," February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Weeds; Weed biology; Laboratory methods; Tissue culture; Cell culture; Screening; Herbicide resistance; Metabolism; Herbicides; Mode of action; Uptake; Translocation; In vitro selection

Abstract: Tissue and cell culture offer weed scientists many opportunities to research herbicide effects on plants. This review will discuss examples in which plant cells grown in vitro have been used to study herbicide action. Plant cell and tissue culture have many advantages over the use of whole plants; however, several disadvantages that exist are discussed. Cell cultures can be established for most plant species and provide a relatively homogeneous system for studying herbicide action. Responses of plant cells to herbicides are usually correlated with responses at the whole plant level, and cells have the advantage of posing fewer physical barriers to herbicide uptake and translocation. Cell culture techniques discussed include: screening candidate herbicide compounds; investigating herbicide efficacy, mechanism of action, metabolism, and uptake; and ascertaining mechanisms of herbicide resistance, selecting for resistance, and regenerating crops.

242 NAL Call. No.: QK725.P54
A plant selectable marker gene based on the detoxification of the herbicide dalapon.
Buchanan-Wollaston, V.; Snape, A.; Cannon, F.
Berlin, W. Ger. : Springer International; 1992.
Plant cell reports v. 11 (12): p. 627-631; 1992. Includes references.

Language: English

Descriptors: Nicotiana plumbaginifolia; Leaves; Agrobacterium tumefaciens; Genetic transformation; Gene transfer; Marker genes; Selective breeding; Dalapon; Herbicide resistance; Phytotoxicity; Enzymes; Degradation; Plasmids; Pseudomonas putida

Abstract: A gene from Pseudomonas putida coding for a dehalogenase capable of degrading 2,2 dichloropropionic acid (2,2DCPA). the active ingredient of the herbicide dalapon, has been isolated and characterised. In plant transformation experiments the gene was shown to confer resistance to 2,2DCPA at a tissue culture level where 2,2DCPA could be used to select for transformants. At the whole plant level, transformed plants showed resistance to 2,2DCPA at concentrations up to 5 times the recommended dose rate of dalapon when it was sprayed on their leaves. At lower concentrations, the herbicide caused a non-lethal yellowing of sensitive plants which clearly distinguished them from resistant plants. The mode of action of chlorinated aliphatic

acids is not known but they probably affect many enzyme pathways. The results described here are the first example of engineering a plant resistant to a herbicide that does not have one specific enzyme as its target site. This gene has several advantages as a marker in plant breeding and genetic studies. For example, the herbicide is readily available and has low toxicity, transformants can be selected at both the tissue culture and the whole plant level, a large number of transformed plants can easily be screened even in the field, and there is a very low probability of selecting spontaneous mutants.

243 NAL Call. No.: 450 P692
Pleiotropy in triazine-resistant Brassica napus. Ontogenetic and diurnal influences on photosynthesis.
Dekker, J.H.; Burmester, R.G.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1992 Dec. Plant physiology v. 100 (4): p. 2052-2058; 1992 Dec. Includes references.

Language: English

Descriptors: Brassica napus; Pleiotropy; Mutations; Structural genes; Herbicide resistance; Triazine herbicides; Photosynthesis; Chloroplast genetics; Diurnal variation; Crop growth stage; Biotypes

Abstract: Studies were conducted that supported the hypothesis that the mutation to the psbA plastid gene that confers S-triazine resistance (R) in Brassica napus also results in an altered diurnal pattern of photosynthetic carbon assimilation (A) relative to that of the susceptible (S) wild type, and that these patterns change over the ontogeny of a plant. Photosynthetic photon flux density, under closely controlled environmental conditions, was incrementally increased and decreased on either side of the midday maxima of 1150 to 1300 micromoles quanta m-2 s-1. In all experiments, A approximately tracked the increasing and decreasing diurnal light levels. Younger (3- to 4-leaf) R plants had greater photosynthetic rates early and late in the diurnal light period, whereas those of S plants were greater during midday as well as during the photoperiod as a whole. These relative photosynthetic characteristics of R and S plants changed in several ways with ontogeny. As the plants aged during the vegetative phase of development, S plants gradually assimilated more carbon in the early, and then in the late, part of the day. At the end of the vegetative phase of development, R plant carbon assimilation was less relative to S plants at most times of the day, and was never greater. This relationship between the two biotypes dramatically changed with the onset of the reproductive phase (8 1/2 to 9 1/2 leaf) of plant development: R plants assimilated more carbon than S plants during all periods of the diurnal light period with the exception of the late part of the day. In addition to these differences in A, R plant stomatal function differed from that in S plants. R plant leaves were always cooler than S plant leaves under the same environmental and diurnal conditions. Correlated with this difference in leaf temperature were equal or greater total conductances to water vapor and intercellular CO_2 partial pressures in R compared to S leaves in most instances. These studies indicate a more complex pattern of photosynthetic carbon assimilation than previously observed. The photosynthetic superiority of one biotype relative to the other was a function of the time of day and the age of the

plant. These studies also suggest that R plants may have an adaptive advantage over S plants in certain unfavorable ecological niches independent of the presence of S-triazine herbicides, such as cool, low-light environments early and late in the day, as well as late in the plants' development. This advantage could result in R biotypes appearing in populations of a species in greater numbers than plastidic mutation alone could cause.

244 NAL Call. No.: 450 P692
Pollen expression of herbicide target site resistance genes in annual ryegrass (Lolium rigidum).
Richter, J.; Powles, S.B.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1993 Jul. Plant physiology v. 102(3): p. 1037-1041; 1993 Jul. Includes references.

Language: English

Descriptors: Lolium rigidum; Herbicide resistant weeds; Herbicide resistance; Sulfometuron; Triasulfuron; Imazapyr; Diclofop; Haloxyfop; Sethoxydim; Pollen; Screening; Gene expression; Structural genes; Oxo-acid-lyases; Acetyl-coa carboxylase; Bitypes; Pollen germination

Abstract: Herbicide resistance can occur either through target-site insensitivity or by nontarget site-based mechanisms. Two herbicide-resistant biotypes of Lolium rigidum Gaud., one resistant to acetolactate synthase (ALS)-inhibiting herbicides (biotype WLR1) and the other resistant to acetyl CoA carboxylase (ACCase)-inhibiting herbicides (biotype WLR96) through target-site insensitivity at the whole plant and enzymic levels, were found to express this resistance in the pollen. Pollen produced by resistant biotypes grew uninhibited when challenged with herbicide, whereas that from a susceptible biotype was inhibited. A third biotype, SLR31, resistant to ACCase-inhibiting and certain ALS-inhibiting herbicides at the whole plant level through nontarget site-based mechanisms, did not exhibit this expression in the pollen. The technique described may form the basis for a rapid screen for certain nuclear-encoded, target site-based herbicide-resistance mechanisms.

245 NAL Call. No.: SB317.5.H6
Potential benefits and risks of herbicide-resistant crops produced by biotechnology.
Dyer, W.E.; Hess, F.D.; Holt, J.S.; Duke, S.O.
New York, NY : John Wiley & Sons, Inc. Press; 1993. Horticultural reviews v. 15: p. 367-408; 1993. Includes references.

Language: English

Descriptors: Herbicide resistance; Crops; Biotechnology; Detoxification; Selection; Screening; Hybridization; Gene transfer; Environmental protection; Economic impact; Reviews

246 NAL Call. No.: 100 T31P
'Prairie' buffalograss response to selected pre-and post-emergence herbicides--update.
Marcum, K.B.; Engelke, M.C.
College Station, Tex. : The Station; 1992 Sep.

PR - Texas Agricultural Experiment Station (5002): p. 65-66; 1992 Sep. In the series analytic: Texas turfgrass research--1992.

Language: English

Descriptors: Texas; Buchloe dactyloides; Herbicide resistance; Herbicides; Application rates; Crop damage

247 NAL Call. No.: QH301.N32
Producing herbicide tolerant populus using genetic transformation mediated by Agrobacterium tumefaciens C58: a summary of recent research. Riemenschnedier, D.E.; Haissig, B.E.
New York, N.Y. : Plenum Press; 1991.
NATO ASI series : Series A : Life sciences v. 210: p. 247-263; 1991. In the series analytic: Woody plant biotechnology / edited by M.R. Ahuja. Proceedings of a Workshop at the Institute of Forest Genetics, USDA Forest Service, October 15-19, 1989, Placerville, California. Literature review. Includes references.

Language: English

Descriptors: Populus alba; Populus grandidentata; Crosses; Cultivars; Genetic transformation; Glyphosate; Herbicide resistance; Agrobacterium tumefaciens; Literature reviews

248 NAL Call. No.: 442.8 Z8
Production and characterization of asymmetric somatic hybrids between Arabidopsis thaliana and Brassica napus.
Bauer-Weston, B.; Keller, W.; Webb, J.; Gleddie, S.
Berlin, W. Ger. : Springer International; 1993 Apr.
Theoretical and applied genetics v. 86 (2/3): p. 150-158; 1993 Apr. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Brassica napus; Somatic hybridization; Intergeneric hybridization; Protoplast fusion; X radiation; Gene transfer; In vitro selection; Herbicide resistance; Chlorsulfuron; Hybrids; Plant morphology; Plant breeding

Abstract: Cell suspension-derived protoplasts of a chlorsulfuron-resistant (GH50) strain of Arabidopsis thaliana cv Columbia were X-irradiated at 60 or 90 krad, to facilitate the elimination of GH50 donor chromosomes in fusion products. Irradiated GH50 protoplasts were fused, with polyethylene glycol, to protoplasts derived from stem epidermal strips of Brassica napus cv Westar. Chlorsulfuron-resistant colonies were selected in vitro and then transferred to shoot and root regeneration medium. Seventeen hybrid lines were regenerated in vitro, and eight were successfully established in the greenhouse, where they flowered. These eight asymmetric hybrids were intermediate in vegetative morphology between Arabidopsis and Brassica. The flowers from these hybrids were male-sterile with abnormal petal and pistil structures. Zymograms for phosphoglucomutase, esterase, and peroxidase showed the presence of all parental isozymes in each of the hybrids tested. Nuclear hybridity was also confirmed for the ribosomal RNA genes using a wheat rDNA probe; however, the chloroplast genome in each of the hybrids was derived solely

from the Brassica parent. All selected somatic hybrids were capable of rooting at levels of chlorsulfuron which were inhibitory to unfused Brassica plantlets. The degree of herbicide resistance in the hybrid shoots is presently being evaluated.

249 NAL Call. No.: S494.5.B563B554
Promoting crop protection by genetic engineering and conventional plant breeding: problems and prospects.
Woolhouse, H.W.
Wallingford, Oxford, UK : CAB International; 1992.
Biotechnology in agriculture v. 7: p. 249-256; 1992. In the series analytic: Plant genetic manipulation for crop protection / edited by A.M.R. Gatehouse, V.A. Hilder and Boulter, D.

Language: English

Descriptors: Crops; Genetic engineering; Genetic improvement; Plant breeding; Defense mechanisms; Insect control; Varietal resistance; Plant viruses; Herbicide resistance; Mixed cropping; Gene mapping; Breeding programs

250 NAL Call. No.: 442.8 IN82
Properties and uses of photoautotrophic plant cell cultures.
Widholm, J.M.
San Diego, Calif. : Academic Press; 1992.
International review of cytology v. 132: p. 109-175; 1992.
Includes references.

Language: English

Descriptors: Plants; Cell cultures; Growth; Photosynthesis; Cell differentiation; Metabolism; Molecular biology; Genetic engineering; Herbicide resistance

251 NAL Call. No.: QH301.N32
PS II inhibitor binding, Q(B)-mediated electron flow and rapid degradation are separable properties of the D1 reaction centre protein.
Jansen, M.A.K.; Driesenaar, A.R.J.; Kless, H.; Malkin, S.; Mattoo, A.K.; Edelman, M.
New York, N.Y. : Plenum Press; 1992.
NATO ASI series : Series A : Life sciences v. 226: p. 303-311; 1992. In the series analytic: Regulation of chloroplast biogenesis / edited by J.H. Argyroudi-Akoyunoglou. Proceedings of a NATO Advanced Research Workshop, July 28-August 3, 1991, Crete, Greece. Includes references.

Language: English

Descriptors: Spirodela oligorhiza; Mutants; Herbicide resistance; Light; Photosystem ii; Plant proteins; Biodegradation; Cytochromes; Electron transfer

252 NAL Call. No.: 450 P693
Purification and properties of a glyphosate-tolerant 5-enolpyruvylshikimate 3-phosphate synthase from the cyanobacterium Anabaena variabilis. Powell, H.A.; Kerby N.W.; Rowell, P.; Mousdale, D.M.; Coggins, J.R. Berlin : Springer-Verlag; 1992.

Planta v. 188 (4): p. 484-490; 1992. Includes references.

Language: English

Descriptors: Anabaena variabilis; Alkyl (aryl) transferases; Purification; Enzyme activity; Glyphosate; Herbicide resistance; Tolerance

Abstract: 5-Enolpyruvylshikimate 3-phosphate (EPSP) synthase (3-phosphoshikimate 1-carboxyvinyltransferase; EC 2.5.1.9) from the glyphosate-tolerant cyanobacterium Anabaena variabilis (ATCC 29413) was purified to homogeneity. The enzyme had a similar relative molecular mass to other EPSP synthases and showed similar kinetic properties except for a greatly elevated K(i) for the herbicide glyphosate (approximately ten times higher than that of enzymes from other sources). With whole cells, the monoisopropylamine salt of glyphosate was more toxic than the free acid but the effects of the free acid and monoisopropylamine salt on purified EPSP synthase were identical.

253 NAL Call. No.: S51.E2
Purple nutsedge control with imazaquin in bermudagrass turf.
Johnson, B.J.; Murphy, T.R.
Athens, Ga. : The Stations; 1992 Feb.
Research bulletin - University of Georgia, Agricultural Experiment Stations (408): 12 p.; 1992 Feb. Includes references.

Language: English

Descriptors: Georgia; Cynodon dactylon; Cyperus rotundus; Imazaquin; Lawns and turf; Weed control; Field tests; Herbicides; Herbicide resistance

254 NAL Call. No.: 100 F663
Pursuit: advantages and disadvantage in lettuce production.
Dusky, J.A.; Al-Henaid, J.
Belle Glade, Fla. : The Center; 1993 Feb.
Belle Glade EREC research report EV - Florida University Agricultural Research and Education Center (1993-2): p. 127-132; 1993 Feb. Paper presented at the Lettuce Research Workshop, February 4, 1993, Belle Glade, Florida.

Language: English

Descriptors: Florida; Lactuca sativa; Imazethapyr; Weed control; Amaranthus spinosus; Amaranthus lividus; Herbicide resistance; Application rates; Bioassays; Soil analysis; Rotations; Application date; Crop yield

255 NAL Call. No.: SB951.P49
Pyridate is not a two-site inhibitor, and may be more prone to evolution of resistance than other phenolic herbicides.
Gressel, J.; Evron, Y.
Orlando, Fla. : Academic Press; 1992 Oct.
Pesticide biochemistry and physiology v. 44 (2): p. 140-146; 1992 Oct. Includes references.

Language: English

Descriptors: Lactuca sativa; Pyridate; Mode of action;

Pharmacodynamics; Photosynthesis; Herbicide resistance; Photosystem ii; Inhibitors; Binding site

Abstract: Target site resistance has evolved to only those herbicides affecting a single system. Extensive resistance has evolved to photosystem II inhibitors, especially atrazine, but not to the phenolic-type herbicides (e.g., dinoseb), which both affect photosystem II and purportedly uncouple mitochondrial phosphorylation and photophosphorylation. Pyridate, which has been classified as a "phenolic"-type herbicide, is highly effective in controlling triazine-resistant weeds. We demonstrate here that the active de-S-octyl derivative of pyridate does not have this second target site; photophosphorylation was only affected at 100 times greater concentration than photosystem II activity. From this point of view, pyridate may be more prone to evolution of resistance than phenolic-type herbicides with two sites of action.

256 NAL Call. No.: 23 AU783
Radiometry accurately measures chlorsulfuron injury to barley.
Lemerle, D.; Fisher, J.A.; Hinkley, R.B.
Melbourne : Commonwealth Scientific and Industrial Research Organization; 1993.
Australian journal of agricultural research v. 44 (1): p. 13-21; 1993. Includes references.

Language: English

Descriptors: New South Wales; Hordeum vulgare; Cultivars; Crop damage; Herbicide resistance; Phytotoxicity; Chlorsulfuron

257 NAL Call. No.: QK710.P63
A rapid assay for chloroplast-encoded triazine resistance in higher plants. Cheung, W.Y.; Cote, J.C.; Benoit, D.L.; Landry, B.S.
Athens, Ga. : International Society for Plant Molecular Biology, University of Georgia; 1993 Jun.
Plant molecular biology reporter - ISPMB v. 11 (2): p. 142-155; 1993 Jun. Includes references.

Language: English

Descriptors: Plant breeding; Genetic analysis; Chloroplasts; Genetic code; Triazine herbicides; Herbicide resistance; Laboratory methods; Rapid methods; Polymerase chain reaction; Dna amplification

258 NAL Call. No.: SB610.W39
Rapid diagnosis of ALS/AHAS-resistant weeds.
Gerwick, B.C.; Mireles, L.C.; Eilers, R.J.
Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 519-524; 1993 Apr. Includes references.

Language: English

Descriptors: Herbicide resistant weeds; Biotypes; Detection; Assays; Herbicide resistance; Mode of action; Ligases; Enzyme inhibitors; Imazaquin; Abutilon theophrasti; Xanthium strumarium; Amaranthus retroflexus; Chenopodium album; Sorghum

bicolor; Isomerases; Acetoin; Plant composition

259 NAL Call. No.: 79.8 W41
Rapid germination of sulfonylurea-resistant Kochia seoparia L. accessions is associated with elevated seed levels of branched chain amino acids. Dyer, W.E.; Chee, P.W.; Fay, P.K.
Champaign, Ill. : Weed Science Society of America; 1993 Jan.
Weed science v. 41 (1): p. 18-22; 1993 Jan. Includes references.

Language: English

Descriptors: Kochia scoparia; Herbicide resistance; Susceptibility; Sulfonylurea herbicides; Seed germination; Soil temperature; Free amino acids; Isoleucine; Valine; Leucine; Enzymes; Enzyme activity

Abstract: Field observations indicate that sulfonylurea-resistant kochia may germinate at lower soil temperatures and/or germinate more rapidly than susceptible kochia in the absence of herbicide. To investigate this possibility, seeds from three resistant and two susceptible kochia accessions were germinated at temperatures ranging from 4.6 to 13.2 degrees C on thermal gradient plates. At 4.6 and 13.2 degrees C, germination rates of all resistant accessions were higher than susceptible accessions, while germination rates of one resistant accession were higher than susceptible accessions at 7.2 and 10.5 degrees C. Percent germination of all resistant accessions was significantly higher than susceptible accessions after 48 h at 4.6 degrees C. At higher temperatures, percent germination of some resistant accessions was higher after 12 or 24 h, but germination of all accessions was similar at later times. HPLC analysis revealed that seeds from resistant accessions contained about 2-fold higher free levels of branched chain amino acids than seeds from susceptible accessions. The results indicate that mutations conferring resistance to sulfonylurea herbicides in these kochia accessions may concomitantly reduce or abolish acetolactate synthase sensitivity to normal feedback inhibition patterns, resulting in elevated levels of branched chain amino acids available for cell division and growth during early germination.

260 NAL Call. No.: SB951.P49
Rapid metabolic inactivation is the basis for cross-resistance to chlorsulfuron in diclofop-methyl-resistant rigid ryegrass (Lolium rigidum) biotype SR4/84.
Cotterman, J.C.; Saari, L.L.
Orlando, Fla. : Academic Press; 1992 Jul.
Pesticide biochemistry and physiology v. 43 (3): p. 182-192; 1992 Jul. Includes references.

Language: English

Descriptors: Lolium rigidum; Biotypes; Herbicide resistant weeds; Herbicide resistance; Diclofop; Cross resistance; Chlorsulfuron; Metabolism; Metabolic detoxification; Pharmacokinetics; Oxo-acid-lyases; Enzyme activity; Metabolites

Abstract: Experiments were conducted to determine the mechanism of cross-resistance to chlorsulfuron (2-chloro-N-[[(4-methoxy-6-methyl-1,3,5-triazin-2-

yl)amino]carbonyl] benzenesulfonamide) in diclofop-methyl (methyl (+/-)-2-[4-(2,4-dichlorophenoxy)phenoxy]propanoic acid)-resistant rigid ryegrass (Lolium rigidum Gaudin). In excised shoots and roots, [14C]chlorsulfuron was metabolized with a half-life of 1 and 3 hr, respectively, in the resistant biotype (SR4/84) versus 4 and 13 hr respectively, in the susceptible biotype (SRS2). Based on coelution with standards in high performance liquid chromatography (HPLC) and treatment with beta-glucosidase followed by HPLC, the major chlorsulfuron metabolite in shoots and roots of both biotypes was identified as the herbicidally-inactive glucose conjugate of hydroxy-chlorsulfuron. Acetolactate synthase (ALS, the target enzyme of chlorsulfuron) isolated from both biotypes was inhibited to the same degree by chlorsulfuron. The glucose conjugate of hydroxy-chlorsulfuron was inactive at the enzyme level, as it required greater than or equal to 36-fold higher concentrations compared to chlorsulfuron to inhibit the ALS from both biotypes. When [14C]chlorsulfuron was applied to the leaf surface, approximately 50% was absorbed within 48 hr by both biotypes. Of the radioactivity absorbed, less than 10% was translocated out of the treated leaf in either biotype. Based on these results, chlorsulfuron resistance in SR4/84 is due to enhanced metabolic inactivation of the herbicide, specifically to the glucose conjugate, compared to the sensitive biotype. Resistance is not due to reduced sensitivity of ALS or increased uptake or translocation in SR4/84.

261 NAL Call. No.: QH442.B5
Rapid production of transgenic wheat plants by direct bombardment of cultured immature embryos.
Vasil, V.; Srivastava, V.; Castillo, A.M.; Fromm, M.E.; Vasil, I.K. New York, N.Y. : Nature Publishing,; 1993 Dec.
Bio/technology v. 11 (13): p. 1553-1558; 1993 Dec. Includes references.

Language: English

Descriptors: Triticum aestivum; Genetic transformation; Plant embryos; Transgenic plants; Reporter genes; Beta-glucuronidase; Acyltransferases; Herbicide resistance; Plasmid vectors; Inheritance; Segregation; Glufosinate; Callus; Embryogenesis; In vitro selection

262 NAL Call. No.: SB610.W39
Rationale for developing herbicide-resistant crops.
Burnside, O.C.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 621-625; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance; Genotypes; Biotechnology; Weed control; Risk

263 NAL Call. No.: 64.8 C883
Recurrent selection for glyphosate tolerance in birdsfoot

trefoil. Boerboom, C.M.; Ehlke, N.J.; Wyse, D.L.; Somers, D.A.
Madison, Wis. : Crop Science Society of America; 1991 Sep.
Crop science v. 31 (5): p. 1124-1129; 1991 Sep. Includes references.

Language: English

Descriptors: Lotus corniculatus; Weed control; Cirsium arvense; Chemical control; Glyphosate; Herbicide resistance; Selection criteria; Recurrent selection; Enzyme activity; Ligases

Abstract: Glyphosate [N-(phosphonomethyl)glycine] tolerant birdsfoot trefoil (Lotus corniculatus L.) would allow selective herbicide control of Canada thistle [Cirsium arvense (L.) Scop.] and other dicot weeds in seed production fields. The objectives of this research were to determine if recurrent selection can increase the level of glyphosate tolerance in birdsfoot trefoil and if increased glyphosate tolerance is associated with increased 5-enolpyruvylshikimate 3-phosphate (EPSP) synthase activity. Two cycles of selection for glyphosate tolerance were made in three birdsfoot trefoil germplasms, Leo', Norcen', and MU-81' by selecting seedlings following treatment with 0.56 kg ae/ha (kg acid equivalents per hectare) of glyphosate. To evaluate tolerance, seedings with eight leaves of the selected and parental populations were either untreated or treated with 0.56 kg ae/ha of glyphosate plus surfactant in a greenhouse. Shoot fresh weights were measured 14 days after treatment (DAT) and regrowth was measured 35 DAT. Treated shoot weights of the three C2 populations were from 44 to 85% greater than their C0 populations, indicating increased glyphosate tolerance. The evaluation of regrowth weights also showed 44 to 127% increases in the C0 populations. Tolerant plants from C2 populations had greater EPSP synthase-specific activity (the primary site of action of glyphosate) than susceptible C0 plants. This suggested that tolerance was at least partially conferred by increased EPSP synthase activity. Genetic variance should allow continued progress from selection for increased glyphosate tolerance in birdsfoot trefoil.

264 NAL Call. No.: QK725.P54
Regeneration of herbicide resistant transgenic rice plants following microprojectile-mediated transformation of suspension culture cells. Cao, J.; Duan, X.L.; McElroy, D.; Wu, R.
Berlin, W. Ger. : Springer International; 1992.
Plant cell reports v. 11 (11): p. 586-591; 1992. Includes references.

Language: English

Descriptors: Oryza sativa; Cell suspensions; Genetic transformation; Dna; Gene transfer; Plasmids; Herbicide resistance; Glufosinate; Gene expression; Selection; Gene mapping; Nucleotide sequences

Abstract: Suspension cells of Oryza sativa L. (rice) were transformed, by microprojectile bombardment, with plasmids carrying the coding region of the Streptomyces hygroscopicus phosphinothricin acetyl transferase (PAT) gene (bar) under the control of either the 5' region of the rice actin 1 gene (Act1) or the cauliflower mosaic virus (CaMV) 35S promoter. Subsequently regenerated plants display detectable PAT

activity and are resistant to BASTA, a phosphinothricin (PPT)-based herbicide. DNA gel blot analyses showed that PPT resistant rice plants contain a bar-hybridizing restriction fragment of the expected size. This report shows that expression of the bar gene in transgenic rice plants confers resistance to PPT-based herbicide by suppressing an increase of ammonia in plants after spraying with the herbicide.

265 NAL Call. No.: QK882.P5577 1993
Regulation of electron transport at the acceptor side of photosystem II by herbicides, bicarbonate and formate.
Rensen, J.S. van
Dordrecht : Kluwer Academic Publishers; 1993.
Photosynthesis : photoreactions to plant productivity / edited by Yash Pal Abrol, Prasanna Mohanty, Govindjee. p. 157-180; 1993. Literature review. Includes references.

Language: English

Descriptors: Photosynthesis; Photosystem ii; Electron transfer; Quinones; Herbicides; Herbicidal properties; Formic acid; Organic anions; Carbon; Anions; Herbicide resistance; Binding site; Literature reviews; Plant proteins

Abstract: The photosystem II reaction center can be considered as a water-plastoquinone oxido-reductase. Using four photons it transfers four electrons from two molecules of water to plastoquinone producing molecular oxygen and two molecules of doubly reduced plastoquinone. Our understanding of the structure and function of this complex has greatly increased during the recent years. The basis of the reaction center of photosystem II is formed by the D1 and D2 proteins, both having a molecular mass of about 32 kDa. The D1 protein contains not only the binding site for the physiological electron carrier QB, but also the binding sites for several classes of herbicides and for bicarbonate and formate. Both the diuron-type and the phenol-type herbicides act by replacing the physiological electron carrier QB from its binding site at the D1 protein. Because the herbicides cannot be reduced, the electron flow is interrupted between the primary electron acceptor of photosystem II QA, and the plastoquinone pool. There appears a relation between the residence time of a herbicide at the D1 protein and its activity as an inhibitor of electron flow. Incubation of isolated chloroplasts with formate, while flushing them with nitrogen gas, results in full inhibition of electron flow activity, which can be restored by addition of bicarbonate. This antagonistic action of formate and bicarbonate is located at the D1 protein and affects electron flow between QA and the plastoquinone pool. The advances in this field should encourage future work on the mechanism of the action of formate and bicarbonate at the molecular level as well as on their action in vivo. The study of triazine-resistance in weeds and herbicide-resistance in algae and photosynthetic bacteria has resulted in the recognition of a common binding niche for QB, herbicides, formate and bicarbonate at the D1 protein including the hydrophobic transmembrane helices IV and V and the parallel helix connecting these on the matrix side of the D1 protein.

266 NAL Call. No.: 450 P692
Regulation of photosynthesis in trizaine-resistant and -susceptible Brassica napus.

Dekker, J.H.; Sharkey, T.D.
Rockville, Md. : American Society of Plant Physiologists; 1992 Mar. Plant physiology v. 98 (3): p. 1069-1073; 1992 Mar. Includes references.

Language: English

Descriptors: Brassica napus; Photosynthesis; Regulation; Triazines; Net assimilation rate; Chlorophyll; Fluorescence; Temperature; Biotypes; Herbicide resistance

Abstract: The response of photosynthetic carbon assimilation and chlorophyll fluorescence quenching to changes in intercellular CO2 partial pressure (C(i)), O2 partial pressure, and leaf temperature (15-35 degrees C) in triazine-resistant and -susceptible biotypes of Brassica napus were examined to determine the effects of the changes in the resistant biotype on the overall process of photosynthesis in intact leaves. Three categories of photosynthetic regulation were observed. The first category of photosynthetic response, ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco)-limited photosynthesis, was observed at 15, 25, and 35 degrees C leaf temperatures with low C(i). When the carbon assimilation rate was Rubisco-limited, there was little difference between the resistant and susceptible biotypes, and Rubisco activity parameters were similar between the two biotypes. A second category, called feedback-limited photosynthesis, was evident at 15 and 25 degrees C above 300 microbars C(i). The third category, photosynthetic electron transport-limited photosynthesis, was evident at 25 and 35 degrees C at moderate to high CO2. At low temperature, when the response curves of carbon assimilation to C(i) indicated little or no electron transport limitation, the carbon assimilation rate was similar in the resistant and susceptible biotypes. With increasing temperature, more electron transport-limited carbon assimilation was observed, and a greater difference between resistant and susceptible biotypes was observed. These observations reveal the increasing importance of photosynthetic electron transport in controlling the overall rate of photosynthesis in the resistant biotype as temperature increases. Photochemical quenching of chlorophyll fluorescence (q(p)) in the resistant biotype never exceeded 60%, and triazine resistance effects were more evident when the susceptible biotype had greater than 60% q(p), but not when it had less than 60% q(p).

267 NAL Call. No.: 79.8 W41
Relationship of leaf surface characteristics to acifluorfen tolerance in tomato (Lycopersicon esculentum) and related species.
Ricotta, J.A.; Masiunas, J.B.
Champaign, Ill. : Weed Science Society of America; 1992 Jul. Weed science v. 40 (3): p. 402-407; 1992 Jul. Includes references.

Language: English

Descriptors: Lycopersicon esculentum; Weed control; Solanum; Genotypes; Herbicide resistance; Screening; Acifluorfen; Leaves; Cuticle; Waxes; Trichomes; Density; Stomata

Abstract: Fourteen tomato genotypes, eastern black nightshade, and 35 Lycopersicon accessions were screened for tolerance to acifluorfen. Tolerant and susceptible genotypes

occurred in most species. Fifteen genotypes were chosen for further study depending on their fresh weight after acifluorfen treatment. Over all 15 genotypes, there was no correlation between trichome density and acifluorfen tolerance; however, in L. esculentum, cultivars with the most trichomes were the most tolerant. There was an inverse relationship between stomata density and tolerance. Amount and composition of epicuticular wax and cuticle thickness did not correlate to acifluorfen tolerance.

268 NAL Call. No.: 450 P693
Relationships among the herbicide and functional sites of acetohydroxy acid synthase from Chlorella emersonii.
Landstein, D.; Arad, S.M.; Barak, Z.; Chipman, D.M.
Berlin ; New York : Springer-Verlag, 1925-; 1993.
Planta v. 191 (1): p. 1-6; 1993. Includes references.

Language: English

Descriptors: Chlorella; Oxo-acid-lyases; Enzyme activity; Inhibition; Sulfometuron; Mutants; Herbicide resistance; Anilide herbicides; Imidazolinone herbicides; Binding site; Amino acid sequences

Abstract: The properties of acetohydroxy acid synthase (AHAS, EC 4.1.3.18) from wild-type Chlorella emersonii (var. Emersonii, CCAP-211/11n) and two spontaneous sulfometuron methyl (SMM)-resistant mutants were examined. The AHAS from both mutants was resistant to SMM and cross-resistant to imazapyr (IM) and the triazolopyrimidine sulfonanilide herbicide XRD-498 (TP). The more-SMM-resistant mutant had AHAS with altered catalytic parameters (Km, specificity), but unchanged sensitivity to the feedback inhibitors valine and leucine. The second mutant enzyme was less sensitive to the feedback inhibitors, but had otherwise unchanged kinetic parameters. Inhibition-competition experiments indicated that the three herbicides (SMM, IM, TP) bind in a mutually exclusive manner, but that valine can bind simultaneously with SMM or TP. The three herbicide classes apparently bind to closely overlapping sites. We suggest that the results with C. emersonii and other organisms can all be explained if there are separate binding sites for herbicides, feedback inhibitors and substrates.

269 NAL Call. No.: QH301.A76
Residual herbicides for newly planted farm woodlands: efficacy and tree tolerance.
Britt, C.P.
Wellesbourne, Warwick : The Association of Applied Biologists; 1992. Aspects of applied biology (29): p. 211-218; 1992. In the series analytic: Vegetation management in forestry, amenity and conservation areas. Paper presented at the conference of the Association, April 7-9, 1992, University of York, England. Includes references.

Language: English

Descriptors: England; Acer pseudoplatanus; Fraxinus excelsior; Prunus avium; Survival; Weed control; Weeds; Farm woodlands; Herbicide mixtures; Herbicide residues; Herbicide resistance

270 NAL Call. No.: SB957.R47

Resistance of giant foxtail (Setaria faberi Herrm.) and large crabgrass [Digitaria sanguinalis (L.) Scop.] biotypes to acetyl-coenzyme A carboxylase inhibitors.
Wiederholt, R.J.; Stoltenberg, D.E.
East Lansing, Mich. : Pesticide Research Center, Michigan State University,; 1993.
Resistant pest management v. 5 (2): p. 17-18; 1993.

Language: English

Descriptors: Wisconsin; Cabt; Setaria faberi; Digitaria sanguinalis; Biotypes; Herbicide resistant weeds; Herbicide resistance; Enzyme inhibitors; Acetyl coenzyme a

271 NAL Call. No.: SB610.W39
Resistance of Palmer amaranth (Amaranthus palmeri) to the dinitroaniline herbicides.
Gossett, B.J.; Murdock, E.C.; Toler, J.E.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 587-591; 1992 Jul. Includes references.

Language: English

Descriptors: South Carolina; Amaranthus palmeri; Biotypes; Trifluralin; Herbicide resistance; Susceptibility; Cross resistance; Herbicides; Application rates; Weed control; Chemical control

272 NAL Call. No.: SB610.W39
Resistance of selected ornamental grasses to graminicides.
Catanzaro, C.J.; Skroch, W.A.; Burton, J.D.
Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 326-330; 1993 Apr. Includes references.

Language: English

Descriptors: Ornamental plants; Panicum virgatum; Festuca ovina; Pennisetum alopecuroides; Festuca; Erianthus; Herbicide resistance; Fenoxaprop; Fluazifop-p; Quizalofop; Sethoxydim; Phytotoxicity

273 NAL Call. No.: 450 P692
Resistance to acetolactate synthase-inhibiting herbicides in annual ryegrass (Lolium rigidum) involves at least two mechanisms.
Christopher, J.T.; Powles, S.B.; Holtum, J.A.M.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1992 Dec. Plant physiology v. 100 (4): p. 1909-1913; 1992 Dec. Includes references.

Language: English

Descriptors: Lolium rigidum; Herbicide resistant weeds; Chlorsulfuron; Sulfonylurea herbicides; Imidazolinone herbicides; Oxo-acid-lyases; Enzyme activity; Cross resistance; Diclofop; Herbicidal properties; Metabolism; Biotypes

Abstract: WLR1, a biotype of Lolium rigidum Gaud. that had

been treated with the sulfonylurea herbicide chlorsulfuron in 7 consecutive years, was found to be resistant to both the wheat-selective and the nonselective sulfonylurea and imidazolinone herbicides. Biotype SLR31, which became cross-resistant to chlorsulfuron following treatment with the aryloxyphenoxypropionate herbicide diciofop-methyl, was resistant to the wheat-selective, but not the nonselective, sulfonylurea and imidazolinone herbicides. The concentrations of herbicide required to reduce in vitro acetolactate synthase (ALs) activity 50% with respect to control assays minus herbicide for biotype WLR1 was greater than those for susceptible biotype VLR1 by a factor of >30, >30, 7, 4, and 2 for the herbicides chlorsulfuron, sulfometuron-methyl, imazapyr, imazathapyr, and imazamethabenz, respectively. ALS activity from biotype SLR31 responded in a similar manner to that of the susceptible biotype VLR1. The resistant biotypes metabolized chlorsulfuron more rapidly than the susceptible biotype. Metabolism of 50% of [phenyl-U-14C] chlorsulfuron in the culms of two-leaf seedlings required 3.7 h in biotype SLR31, 5.1 h in biotype WLR1, and 7.1 h in biotype VLR1. In all biotypes the metabolism of chlorsulfuron in the culms was more rapid than that in the leaf lamina. Resistance to ALS inhibitors in L. rigidum may involve at least two mechanisms, increased metabolism of the herbicide and/or a herbicide-insensitive ALS.

274 NAL Call. No.: 79.8 W41
Resistance to aryloxyphenoxypropionate herbicides in two wild oat species (Avena fatua and Avena sterilis ssp. ludoviciana).
Mansooji, A.M.; Holtum, J.A.; Boutsalis, P.; Matthews, J.M.; Powles, S.B. Champaign, Ill. : Weed Science Society of America; 1992.
Weed science v. 40 (4): p. 599-605; 1992. Includes references.

Language: English

Descriptors: Australia; Avena fatua; Avena sterilis subsp. ludoviciana; Herbicide resistant weeds; Herbicide resistance; Cross resistance; Diclofop; Biotypes; Fluazifop; Haloxyfop; Fenoxaprop; Quizalofop; Propaquizafop; Sethoxydim; Cycloxydim; Tralkoxydim

Abstract: Resistance to the methyl ester of diclofop, an aryloxyphenoxypropionate graminicide, was shown for a wild oat (Avena fatua) population from Western Australia, and marked resistance to a range of aryloxyphenoxypropionate and cyclohexanedione graminicides was detected in a winter wild oat (Avena sterilis ssp. ludoviciana) population from South Australia. The A. sterilis biotype exhibited high levels of resistance to the aryloxyphenoxypropionate herbicides diclofop, fluazifop, haloxyfop, fenoxaprop, quizalofop, propaquizafop, and quinfurop and low levels of resistance to the cyclohexanedione herbicides sethoxydim, tralkoxydim, and cycloxydim. Ratios of LD50 values for responses of resistant and susceptible A. sterilis to the aryloxyphenoxypropionate herbicides were between 20 for propaquizafop and > 1,000 for fluazifop, and were between 2.5 and 3 for the cyclohexanedione herbicides. The LD50 value for diclofop for the A. fatua biotype was 442 g ai ha-1 which was 2.7-fold that of a susceptible control. Thirty-three percent of the plants survived at the registered rate of application.

275 NAL Call. No.: 450 P692
Resistance to the herbicide paraquat and increased tolerance to photoinhibition are not correlated in several weed species.
Preston, C.; Holtum, J.A.M.; Powles, S.B.
Rockville, Md. : American Society of Plant Physiologists; 1991 May. Plant physiology v. 96 (1): p. 314-318; 1991 May. Includes references.

Language: English

Descriptors: Australia; Hordeum glaucum; Conyza bonariensis; Hordeum murinum subsp. leporinum; Arctotheca calendula; Herbicide resistant weeds; Paraquat; Biotypes; Photoinhibition; Resistance

Abstract: Photoinhibition was examined in paraquat-resistant and paraquat-susceptible biotypes of Hordeum glaucum Steud., Hordeum leporinum Link., Arctotheca calendula (L.) Levyns., and Conyza bonariensis (L.) Cronq. Plants were photoinhibited at low temperature, and the extent of photoinhibition determined by O2 evolution and 77 K fluorescence. No difference in the degree of photoinhibition was detected between paraquat-resistant and paraquat-susceptible biotypes for any of the species examined. C. bonariensis plants were also photoinhibited by treatment without CO2 at either 21% (volume/volume) O2 or 4% (volume/volume) O2, and again no difference was observed between the paraquat-resistant and paraquat-susceptible biotypes in reduction of the ratio of variable fluorescence to maximal fluorescence. This is in contrast to a recent report (MAK Jansen, Y Shaaltiel, D Kazzes, 0 Canaani, S Malkin, J Gressel, [1989] Plant Physiol 91: 1174-1178 in which it was claimed that a paraquat-resistant biotype of C. bonariensis was more tolerant of photoinhibition than a paraquat-susceptible biotype. We conclude that paraquat-resistant biotypes of these plant species are not more tolerant of photoinhibition when compared with the paraquat-susceptible biotypes.

276 NAL Call. No.: 64.8 C883
Resistance to the sulfonylurea herbicides chlorsulfuron, amidosulfuron, and DPX-R9674 in transgenic flue-cured tobacco.
Brandle, J.E.; Labbe, H.; Zilkey, B.F.; Miki, B.L.
Madison, Wis. : Crop Science Society of America; 1992 Jul. Crop science v. 32 (4): p. 1049-1053; 1992 Jul. Includes references.

Language: English

Descriptors: Canada; Nicotiana tabacum; Herbicide resistance; Sulfonylurea herbicides; Transgenics; Agrobacterium; Genetic transformation; Genotypes; Application rates; Seedlings; Treatment; Selection criteria; Gene expression; Genetic analysis

Abstract: Only one herbicide is currently available for preemergence broadleaf weed control in flue-cured tobacco (Nicotiana tabacum L.) grown in Canada. The high cost of registration, coupled with the small crop size, has resulted in few new products becoming available. Herbicide resistance introduced into tobacco by Agrobacterium-mediated transformation formation may allow the use of products with existing or impending registrations. We used two new, low-residual sulfonylurea herbicides: amidosulfuron (3-(4, 6-dimethoxyprymidin-2-yl)-l-(N-methyl-N-methylsulfonyl-

aminosulfonylurea) and DPX-R9674, which is a mixture of thifensulfuron (methyl-3-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino) carbonyl] amino] sulfonyl]-2-thiophenecarboxylate) and tribenuron (methyl 2[[[[N-4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylaminol carbonyl] amino] sulfonyl] benzoate). These two and chlorsulfuron (2-chloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) aminocarbonyl] benzenesulfonamide) were applied to two transgenic tobacco genotypes harboring the csr1-1 gene for chlorsulfuron resistance and compared with an untransformed control. Our purpose was to determine if transgenic seedlings were resistant to DPX-R9674 and amidosulfuron. The experiment was a factorial in a completely randomized design with 25 replications. The three herbicides were applied to the transgenic and control seedlings at three rates. The transgenic seedlings had significantly higher leaf area, top dry weight, and root dry weight than the untransformed control when sprayed with any of the three herbicides. Seedlings were highly resistant to amidosulfuron and chlorsulfuron. Resistance to DPX-R9674 in the transgenic seedlings was minimal, which was unexpected, considering that an analysis of AHAS activity revealed high levels of cross-resistance to chlorsulfuron, DPX-R9674, and amidosulfuron. It is possible that DPX-R9674 is metabolized into products that are herbicidally active at different AHAS binding sites. One of transgenic lines was more resistant to herbicide application than the other indicating that selection for maximum gene expression among transgenic lines is necessary part of transgenic cultivar development. It was conclued that DPX-R9674 would not be suitable for use with transgenic crops harboring the csr1-1 gene for chlorsulfuron resistance. The other low-residual sulfonylurea, amidosulfuron, was more promising.

277 NAL Call. No.: 79.8 W41
Response of a chlorsulfuron-resistant biotype of Kochia scoparia to sulfonylurea and alternative herbicides.
Friesen, L.F.; Morrison, I.N.; Rashid, A.; Devine, M.D.
Champaign, Ill. : Weed Science Society of America; 1993 Jan.
Weed science v. 41 (1): p. 100-106; 1993 Jan. Includes references.

Language: English

Descriptors: Manitoba; Cabt; Kochia scoparia; Biotypes; Chlorsulfuron; Herbicide resistance; Herbicide resistant weeds; Cross resistance; Susceptibility; Herbicides; Weed control

Abstract: Kochia growing on an industrial site where chlorsulfuron was applied repeatedly over several seasons was confirmed to be resistant to chlorsulfuron and several other acetolactate synthase (ALS) -inhibiting herbicides. In growth room experiments, resistant (R) plants were 2 to > 180 times more resistant to five sulfonylurea herbicides and one imidazolinone herbicide (imazethapyr) than susceptible (S) plants, as measured by the ratio of dosages required to inhibit shoot dry matter accumulation by 50% (GR50 R/S). Similarly, in vitro assays of ALS activity indicated that from 3 to 30 times more herbicide was required to inhibit the enzyme from R plants than from S plants. Results of ALS enzyme assays indicated that R kochia was approximately equally

resistant to metsulfuron, triasulfuron, and thifensulfuron, and 2.5 times more resistant to tribenuron than thifensulfuron. However, the response of R kochia growing in a spring wheat crop in the field was not consistent with results of the ALS enzyme assays. In field experiments, thifensulfuron at 32 g ai ha-1 had little effect on R kochia. In contrast, metsulfuron, triasulfuron, and tribenuron at 8 g ha-1 did not reduce R kochia seedling densities, but caused severe stunting such that 2 mo after treatment the shoot biomass of plants in untreated plots was four times greater than in sprayed plots. Herbicides with alternative modes of action including fluroxypyr, bromoxynil/MCPA ester, dichlorprop/2,4-D ester, and 2,4-D ester provided good control of R kochia in the field. Quinclorac did not reduce kochia densities, but surviving plants were stunted. To delay or avoid development of ALS inhibitor-resistant kochia populations, these alternative herbicides applied alone or in tank mixtures could be incorporated into a herbicide rotation.

278 NAL Call. No.: SB610.W39
Response of common bean (Phaseolus vulgaris) cultivars to metobromuron. Park, S.J.; Hamill, A.S.
Champaign, Ill. : The Weed Science Society of America; 1993 Jan. Weed technology : a journal of the Weed Science Society of America v. 7 (1): p. 70-75; 1993 Jan. Includes references.

Language: English

Descriptors: Ontario; Cabt; Phaseolus vulgaris; Cultivars; Varietal susceptibility; Metobromuron; Herbicide resistance; Screening; Phytotoxicity; Crop damage; Seedling stage; Application rates

279 NAL Call. No.: 79.8 W41
Response of corn (Zea mays L.) inbreds and hybrids to sulfonylurea herbicides. Green, J.M.; Ulrich, J.F.
Champaign, Ill. : Weed Science Society of America; 1993 Jul. Weed science v. 41 (3): p. 508-516; 1993 Jul. Includes references.

Language: English

Descriptors: Zea mays; Inbred lines; Hybrids; Herbicide resistance; Sulfonylurea herbicides; Chlorimuron; Metsulfuron; Tribenuron; Sulfometuron; Phytotoxicity; Varietal susceptibility; Recessive genes; Plant breeding

Abstract: Extensive field and greenhouse studies were done to characterize varietal response of three recently commercialized sulfonylurea corn herbicides: nicosulfuron, primisulfuron, and thifensulfuron. Most of the 94 varieties tested were highly tolerant to these herbicides. The 37 inbreds represented all major inbred families now used in hybrid seed production as well as several sensitive experimentals. Twenty-one defined hybrids from these inbreds as well as 36 commercially coded hybrids were also tested. Sensitive inbreds produced tolerant hybrids when crossed with tolerant inbreds. Sensitive hybrids occurred when both parents were sensitive. Genetic analysis of sensitive by tolerant crosses showed that sensitivity is controlled by a single recessive gene. Nicosulfuron had the widest corn safety margin and fewest sensitive varieties. Dose response analysis showed varieties can vary more than 40 000-fold in sensitivity. Only

corn varieties with the AHAS-modified XA-17 gene showed any change in enzyme sensitivity. This gene overcame sensitivity to sulfonylureas, even when the organophosphate insecticide terbufos was present. Thus, breeders have three options to eliminate sulfonylurea sensitivity: backcross sensitive inbreds with tolerant, always use at least one tolerant hybrid parent, or use the XA-17 gene.

280 NAL Call. No.: SB610.W39
Response of quackgrass (Elytrigia repens) biotypes to primisulfuron. Gillespie, G.R.; Vitolo, D.B.
Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 411-416; 1993 Apr. Includes references.

Language: English

Descriptors: New York; Cabt; Ohio; Cabt; Pennsylvania; Cabt; Minnesota; Cabt; Massachusetts; Cabt; North Dakota; Cabt; Elymus repens; Biotypes; Weed biology; Herbicide resistant weeds; Provenance; Herbicide resistance; Sulfonylurea herbicides; Weed control; Chemical control; Application rates; Additives

281 NAL Call. No.: 500 T25A
Response of several cucumber cultivar seedlings to ethalfluralin and pendimethalin in vitro.
Kennedy, J.M.; Caponetti, J.D.; Jeffery, L.S.
Hixson, Tenn. : The Academy; 1991 Jul.
Journal of the Tennessee Academy of Science v. 66 (3): p. 111-114; 1991 Jul. Includes references.

Language: English

Descriptors: Cucumis sativus; Cultivars; Seedlings; Injuries; Herbicide resistance; Ethalfluralin; Pendimethalin

282 NAL Call. No.: ArUSB608.R5B42 1991
Rice response to rotational crop herbicides.
Beaty, Jackie Dwayne
1991; 1991.
x, 47 leaves ; 28 cm. May 1991. Includes bibliographical references (leaf 16).

Language: English

Descriptors: Rice; Herbicide resistance; Crop rotation

283 NAL Call. No.: SB951.P49
Role of glutathione and glutathione S-transferase in the selectivity of acetochlor in maize and wheat.
Jablonkai, I.; Hatzios, K.K.
Orlando, Fla. : Academic Press; 1991 Nov.
Pesticide biochemistry and physiology v. 41 (3): p. 221-231; 1991 Nov. Includes references.

Language: English

Descriptors: Zea mays; Triticum aestivum; Roots; Shoots; Plant composition; Chemical composition; Glutathione; Enzyme

activity; Glutathione transferase; Metabolic detoxification; Acetochlor; Selectivity; Hybrid varieties; Cultivars; Varietal susceptibility; Genotypes; Genetic variation; Seedlings; Phytotoxicity; Herbicide resistance; Pharmacokinetics

Abstract: The role of shoot and root glutathione (GSH) content and glutathione S-transferase (GST) activity in the response of the 'A632 X A635' and 'Anjou SC256' hybrids of maize (Zea mays L.) and of 'Jubilejnaja 50' wheat (Triticum aestivum L.) to the chloroacetanilide herbicide acetochlor was evaluated. The concentrations of root-applied acetochlor causing a 50% inhibition of plant shoot height were 20 micromoles for the tolerant 'A632 X A635' maize, 1 micromole for the sensitive 'Anjou SC256' maize, and 0.1 micromoles for the very sensitive 'Jubilejnaja 50' wheat. The nonprotein thiol (mainly GSH) level in the roots of the tolerant 'A632 X A635' maize hybrid was 2-fold greater than that found in the roots of the sensitive maize hybrid and of wheat. Pretreatment with 10 micromoles of acetochlor induced the root nonprotein thiol levels of all three genotypes. The highest induction of root thiol content compared to controls was observed at 48 hr after acetochlor treatment and was 2.23-fold in the tolerant maize and 1.72-fold for the sensitive wheat. GST activities of etiolated maize and wheat seedlings were evaluated using both CDNB (1-chloro-2,4-dinitrobenzene) and [14C]-acetochlor as substrates. GST(CDNB) activity was greater in the roots than in the shoots of both maize hybrids. The shoot activity of both maize genotypes was similar, but the tolerant 'A632 X A635' maize had slightly higher root GST(CDNB) activity. In the sensitive wheat, similar shoot and root activities were observed. GST(CDNB) activity in roots of the maize hybrids and of wheat was enhanced by 70-100% at 48 hr after pretreatment with 10 micromoles of acetochlor. Shoot GST(CDNB) activity of maize or wheat was not induced significantly by acetochlor pretreatment. Root and shoot GST(acetochlor) activities of the maize hybrids and wheat were much lower than GST(CDNB) activities. Root GST(acetochlor) activities of the two maize hybrids were greater and more inducible by acetochlor pretreatment than those of the sensitive wheat. These results demonstrate the important role of endogenous levels of GSH and of GST activity in chloroacetanilide herbicide detoxication and selectivity.

284 NAL Call. No.: 450 P692

S1 destabilization and higher sensitivity to light in metribuzin-resistant mutants.

Perewoska, I.; Etienne, A.L.; Miranda, T.; Kirilovsky, D.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1994 Jan. Plant physiology v. 104 (1): p. 235-245; 1994 Jan. Includes references.

Language: English

Descriptors: Cyanobacteria; Photosystem ii; Redox potential; Electron transfer; Quinones; Binding proteins; Herbicide resistance; Metribuzin; Mutants; Mutations; Photoinhibition; Light; Stress; Amino acid sequences; Structural genes

Abstract: Mutations in the secondary quinone electron acceptor pocket of the D1 protein conferring a modification on the donor side of photosystem II (PSII) have been characterized by gene cloning and sequencing in two metribuzin-resistant mutants of Synechocystis PCC 6714. The mutations induce different herbicide resistances: in M30, a

point mutation at the codon 248, isoleucine to threonine, results in resistance only to metribuzin; in a single mutation, Ala251Val, confers metribuzin, atrazine, and ioxynil resistance. As with other herbicide-resistant mutants, and present modifications in the electron transfer between the primary quinone electron acceptor and (QA) and QB. In addition, they have a modified oscillatory pattern of oxygen emission: after dark adaptation, the maximum oscillation is shifted by one flash. Both mutants have a higher concentration of the redox state in the dark-adapted state than the wild type. The mutations render the oxygen-evolving system more accessible to cell reductants. The mutation Ala251Val also confers to PSII an increased sensitivity to high light. We have already demonstrated that underlight stress a double mutant, AzV (Ala251Val, Phe211Ser), lost the ability to recover the PSII activity sooner than the wild type. Here, we confirm that the modification of the alanine-251 is responsible for this specific sensitivity to high light. We conclude that specific mutations of the QB pocket modify the behavior of the cells under light stress and have an effect on the structure of the D1 protein in the other side of the membrane.

285 NAL Call. No.: SB610.W39
Seed biology of sulfonylurea-resistant and -susceptible biotypes of prickly lettuce (Lactuca serriola).
Alcocer-Ruthling, M.; Thill, D.C.; Shafii, B.
Champaign, Ill. : The Weed Science Society of America; 1992 Oct. Weed technology : a journal of the Weed Science Society of America v. 6 (4): p. 858-864; 1992 Oct. Includes references.

Language: English

Descriptors: Idaho; Cabt; Lactuca serriola; Biotypes; Sulfonylurea herbicides; Herbicide resistance; Susceptibility; Competitive ability; Seed longevity; Seed germination; Fecundity

286 NAL Call. No.: QK725.P54
Selection of atrazine tolerant soybean calli and expression of that tolerance in regenerated plants.
Wrather, J.A.; Freytag, A.H.
Berlin, W. Ger. : Springer International; 1991.
Plant cell reports v. 10 (1): p. 44-47; 1991. Includes references.

Language: English

Descriptors: Glycine max; Plant breeding; In vitro selection; Atrazine; Herbicide resistance; Callus; Regenerative ability; Phytotoxicity; Selection

Abstract: Lines of soybean [Glycine max (L.)] tolerant of atrazine were developed by an in vitro and in vivo atrazine challenge. Cotyledonary node plus epicotyl explants from mature germinated seed of soybean introduction PI 438489B were cultured on RV-5 medium containing 48 mg active ingredient (a.i.)/l atrazine for one month. Most of the explants (66%) on medium containing atrazine, and 10% on medium without atrazine died. Explants surviving exposure to atrazine callused and organogenically regenerated shoots developed. Soil around R0 plants regenerated from atrazine tolerant shoots and

nonatrazine challenged shoots (controls) were subsequently tested in vivo for atrazine tolerance. All controls died. Seeds were collected from atrazine tolerant R0 plants. Two weeks after planting, emerged R1 seedlings were tested in vivo for atrazine tolerance as the R0 plants were. This procedure was repeated on the R2 plants. All nonatrazine selected control plants died when exposed to this herbicide. Atrazine tolerant R2 plants were maintained in atrazine amended soil and appeared as healthy and vigorous as the control growing in atrazine free soil.

287 NAL Call. No.: QK710.P63
Selective agents and marker genes for use in transformation of monocotyledonous plants.
Wilmink, A.; Dons, J.J.M.
Athens, Ga. : International Society for Plant Molecular Biology, University of Georgia; 1993 Jun.
Plant molecular biology reporter - ISPMB v. 11 (2): p. 165-185; 1993 Jun. Literature review. Includes references.

Language: English

Descriptors: Monocotyledons; Genetic transformation; Selection; Marker genes; Antibiotics; Resistance; Herbicide resistance; Gene expression; Vectors; Literature reviews

288 NAL Call. No.: 79.8 W41
Semidominant nature of monogenic sulfonylurea herbicide resistance in sugarbeet (Beta vulgaris).
Hart, S.E.; Saunders, J.W.; Penner, D.
Champaign, Ill. : Weed Science Society of America; 1993 Jul.
Weed science v. 41 (3): p. 317-324; 1993 Jul. Includes references.

Language: English

Descriptors: Beta vulgaris; Herbicide resistance; Inheritance; Sulfonylurea herbicides; Chlorimuron; Semidominance; Semidominant genes; Lines; Homozygosity; Heterozygosity; Enzyme activity; Enzyme inhibitors

Abstract: Greenhouse and laboratory studies were conducted to determine the degree of dominance of the monogenic sulfonylurea herbicide resistance trait in diploid sugarbeet by comparing the response of homozygous and heterozygous resistant sugarbeet to primisulfuron, thifensulfuron, and chlorimuron on the whole plant and acetolactate synthase (ALS) enzyme level. Progeny tests suggested that the monogenic sulfonylurea herbicide resistance was semidominant. Subsequently, heterozygous resistant (R-1) and homozygous resistant (R-2) sugarbeet lines were sprayed with increasing rates of primisulfuron, thifensulfuron, and chlorimuron, and herbicide rates required for 50% growth reduction (GR50) were determined. GR50 values were also determined for homozygous susceptible sugarbeet lines (S-1 and S-2). The GR50 values indicated that the R-2 sugarbeet was 377, 269, and 144 times more resistant to primisulfuron, thifensulfuron, and chlorimuron, respectively, than susceptible S-2 sugarbeet. In contrast, R-1 sugarbeet was only 107, 76, and 57 times more resistant to primisulfuron, thifensulfuron, and chlorimuron, respectively, than S-1 sugarbeet, indicating at least a twofold difference in the magnitude of resistance between homozygous resistant and heterozygous resistant sugarbeet

lines. ALS enzyme activity analysis were consistentwith whole plant results. Thus, based on these two, maximum crop resistance can be obtained by developing homozygous resistant cultivars.

289 NAL Call. No.: 450 M99
Sensitivity of field strains of Gibberella fujikuroi (Fusarium section Liseola) to benomyl and hygromycin B.
Yan, K.; Dickman, M.B.; Xu, J.R.; Leslie, J.F.
Bronx, N.Y. : The New York Botanical Garden; 1993 Mar.
Mycologia v. 85 (2): p. 206-213; 1993 Mar. Includes references.

Language: English

Descriptors: Gibberella fujikuroi; Plant pathogenic fungi; Benomyl; Hygromycin b; Resistance; Herbicide resistance; Strain differences; Genetic regulation

290 NAL Call. No.: 450 P692
A serine-to-threonine substitution in the triazine herbicide-binding protein in potato cells results in atrazine resistance without impairing productivity. Smeda, R.J.; Hasegawa, P.M.; Goldsbrough, P.B.; Singh, N.K.; Weller, S.C. Rockville, MD : American Society of Plant Physiologists, 1926-; 1993 Nov.
Plant physiology v. 103 (3): p. 911-917; 1993 Nov. Includes references.

Language: English

Descriptors: Solanum tuberosum; Cells; Selection criteria; Herbicide resistance; Atrazine; Genes; Mutations; Thylakoids; Membranes; Proteins; Quinones; Photosystem ii; Photosynthesis; Electron transfer

Abstract: A mutation of the psbA gene was identified in photoautotrophic potato (Solanum tuberosum L. cv Superior X U.S. Department of Agriculture line 66-142) cells selected for resistance to 6-chloro-N-ethyl-N'-(1-methylethyl)-1,3, 5-triazine-2,4-diamine (atrazine). Photoaffinity labeling with 6-azido-N-ethyl-N'-(1-methylethyl)-1,3, 5-triazine-2,4-diamine detected a thylakoid membrane protein with a Mr of 32,000 in susceptible, but not in resistant, cells. This protein was identified as the secondary quinone acceptor of photosystem II (QB) protein. Atrazine resistance in selected cells was attributable to a mutation from AGT (serine) to ACT (threonine) in codon 264 of the psbA gene that encodes the QB protein. Although the mutant cells exhibited extreme levels of resistance to atrazine, no concomitant reductions in photosynthetic electron transport or cell growth rates compared to the unselected cells were detected. This is in contrast with the losses in productivity observed in atrazine-resistant mutants that contain a glycine-264 alteration.

291 NAL Call. No.: SB951.P49
A similar metabolism of chlorotoluron in cell suspension cultures from near-isogenic susceptible and tolerant lines of wheat.
Cabanne, F.; Snape, J.W.
Orlando, Fla. : Academic Press; 1993 Sep.
Pesticide biochemistry and physiology v. 47 (1): p. 51-59;

1993 Sep. Includes references.

Language: English

Descriptors: Triticum aestivum; Lines; Varietal susceptibility; Herbicide resistance; Metabolism; Chlorotoluron; Metabolites; Mode of action; Cell culture; In vitro

Abstract: The metabolism of the herbicide chlorotoluron was followed in cell suspension cultures of wheat. The cultures originated from plants of the susceptible variety Corin, the tolerant variety Clement, and six near-isogenic lines, 9S, 10S, 16S, 17T, 18T, and 24T [susceptible (S) and tolerant (T), respectively]. The six lines had the genetic background of the susceptible variety Chinese Spring, but the three lines 17T, 18T, and 24T contained a gene for tolerance (Sul) transferred from the variety Cappelle-Desprez. The cultures from Corin and Clement produced identical patterns of metabolites which were also identical to those found in plants. The rate of metabolism of the herbicide was slightly higher in the cell culture of Clement (T) than in Corin (S), as reported for the corresponding plants. Patterns of metabolites were similar in the cell cultures from the six isogenic lines. The rate of metabolism was the same in 9S, 10S, 16S, 18T, and 24T, and lower in 17T, so that a differential rate of metabolism was not found between T and S cell cultures. The occurrence of a differential rate of metabolism as the primary mechanism of varietal selectivity of wheat to chlorotoluron is discussed.

292 NAL Call. No.: QH301.N32
Site directed mutagenesis of a chloroplast encoded protein.
Przibilla, E.; Yamamoto, R.
New York, N.Y. : Plenum Press; 1992.
NATO ASI series : Series A : Life sciences v. 226: p. 561-565. ill; 1992. In the series analytic: Regulation of chloroplast biogenesis / edited by J.H. Argyroudi-Akoyunoglou. Proceedings of a NATO Advanced Research Workshop, July 28-August 3, 1991, Crete, Greece. Includes references.

Language: English

Descriptors: Chlamydomonas reinhardtii; Genetic engineering; Mutants; Thylakoids; Herbicide resistance; Phenolic compounds

293 NAL Call. No.: S494.5.B563B56
Somaclonal selection for tolerance to streptomycin and herbicides through rice cell culture.
Kinoshita, T.; Mori, K.; Mikami, T.
Berlin, W. Ger. : Springer-Verlag; 1991.
Biotechnology in agriculture and forestry (14): p. 383-404; 1991. In the series analtyic: Rice / edited by Y.P.S. Bajaj. Includes references.

Language: English

Descriptors: Oryza sativa; Cell culture; Somaclonal variation; In vitro selection; Herbicide resistance; Streptomycin; Resistance; Salt tolerance

294 NAL Call. No.: SB610.W39
Soybean (Glycine max) cultivar tolerance to chlorimuron and

imazaquin with varying hydroponic solution pH.
Newsom, L.J.; Shaw, D.R.
Champaign, Ill. : The Society; 1992 Apr.
Weed technology : a journal of the Weed Science Society of America v. 6 (2): p. 382-388; 1992 Apr. Includes references.

Language: English

Descriptors: Glycine max; Cultivars; Varietal susceptibility; Herbicide resistance; Chlorimuron; Imazaquin; Crop damage; Phytotoxicity; Ph; Nutrient solutions; Hydroponics

295 NAL Call. No.: SB610.W39
Soybean (Glycine max) response to chlorimuron and imazaquin as influenced by soil moisture.
Newsom, L.J.; Shaw, D.R.
Champaign, Ill. : The Society; 1992 Apr.
Weed technology : a journal of the Weed Science Society of America v. 6 (2): p. 389-395; 1992 Apr. Includes references.

Language: English

Descriptors: Mississippi; Glycine max; Cultivars; Varietal susceptibility; Herbicide resistance; Chlorimuron; Imazaquin; Phytotoxicity; Environmental factors; Soil water content; Crop yield; Yield losses; Crop damage

296 NAL Call. No.: S79 .E3
Soybean response to quinclorac and triclopyr.
Barrentine, W.L.; Street, J.E.
State College, Miss. : Mississippi State University, Agricultural and Forestry Experiment Station, 1970-; 1993 Mar.
Bulletin (995): 12 p.; 1993 Mar. Includes references.

Language: English

Descriptors: Mississippi; Cabt; Glycine max; Quinclorac; Triclopyr; Herbicide resistance; Oryza sativa; Drift; Crop yield; Field tests; Application rates; Injuries

297 NAL Call. No.: QK725.P54
Stably transformed herbicide resistant callus of sugarcane via microprojectile bombardment of cell suspension cultures and electroporation of protoplasts. Chowdhury, M.K.U.; Vasil, I.K.
Berlin, W. Ger. : Springer International; 1992.
Plant cell reports v. 11 (10): p. 494-498; 1992. Includes references.

Language: English

Descriptors: Saccharum; Genetic transformation; Gene transfer; Cell suspensions; Callus; Protoplasts; Electroporation; Plasmids; Herbicide resistance

Abstract: Stably transformed callus of a hybrid sugarcane cultivar (Saccharum species hybrid, CP72-1210) was achieved following high velocity microprojectile bombardment of suspension culture cells, and electroporation of protoplasts. A three-day old cell suspension culture (SC88) was bombarded with gold particles coated with pBARGUS plasmid DNA containing the B-glucuronidase (GUS) reporter gene and the bar selectable gene that confers resistance to the herbicide basta. The

pBARGUS plasmid was also electroporated into the protoplasts of another cell line (SCPP). Colonies resistant to basta were recovered from both sources. Stable integration of the bar gene in the resistant cell lines was confirmed by Southern analysis. In addition, phosphinothricin acetyltransferase (PAT) activity was also demonstrated in the transformed cell lines.

298 NAL Call. No.: 100 F663
Strategies in breeding herbicide resistant lettuce.
Nagata, R.T.; Dusky, J.A.; Torres, A.C.; Cantliffe, D.J.; Feri, R.J.; Bewick, T.A.
Belle Glade, Fla. : The Center; 1993 Feb.
Belle Glade EREC research report EV - Florida University Agricultural Research and Education Center (1993-2): p. 97-104; 1993 Feb. Paper presented at the Lettuce Research Workshop, February 4, 1993, Belle Glade, Florida. Includes references.

Language: English

Descriptors: Florida; Lactuca sativa; Herbicide resistance; Plant breeding; Weed control; Glyphosate; Sulfonylurea herbicides; Gene splicing; Backcrossing

299 NAL Call. No.: 500 N21P
Structure and topological symmetry of the glyphosate target 5-enol-pyruvylshikimate-3-phosphate synthase: A distinctive protein fold. Stallings, W.C.; Abdel-Meguid, S.S.; Lim, L.W.; Shieh, H.S.; Dayringer, H.E.; Leimgruber, N.K.; Stegeman, R.A.; Anderson, K.S.; Sikorski, J.A.; Padgette, S.R.; Kishore, G.M.
Washington, D.C. : The Academy; 1991 Jun01.
Proceedings of the National Academy of Sciences of the United States of America v. 88 (11): p. 5046-5050; 1991 Jun01. Includes references.

Language: English

Descriptors: Glyphosate; Herbicide resistance; Plant physiology; Lyases; Amino acids; Aromatic acids; Biosynthesis; Escherichia coli; X radiation

Abstract: 5-enol-Pyruvylshikimate -3-phosphate synthase (EPSP synthase; phosphoenolpyruvate:3-phosphoshikimate 1-carboxyvinyltransferase, EC 2.5.1.19) is an enzyme on the pathway toward the synthesis of aromatic amino acids in plants, fungi, and bacteria and is the target of the broad-spectrum herbicide glyphosate. The three-dimensional structure of the enzyme from Escherichia coli has been determined by crystallographic techniques. The polypeptide backbone chain was traced by examination of an electron density map calculated at 3-A resolution. The two-domain structure has a distinctive fold and appears to be formed by 6-fold replication of a protein folding unit comprising two parallel helices and a four-stranded sheet. Each domain is formed from three of these units, which are related by an approximate threefold symmetry axis; in each domain three of the helices are completely buried by a surface formed from the three beta-sheets and solvent-accessible faces of the other three helices. The domains are related by an approximate dyad, but in the present crystals the molecule does not display pseudo-symmetry related to the symmetry of point group 32 because its

approximate threefold axes are almost normal. A possible relation between the three-dimensional structure of the protein and the linear sequence of its gene will be described. The topological threefold symmetry and orientation of each of the two observed globular domains may direct the binding of substrates and inhibitors by a helix macrodipole effect and implies that the active site is located near the interdomain crossover segments. The structure also suggests a rationale for the glyphosate tolerance conferred by sequence alterations.

300 NAL Call. No.: 381 J824
Structure of an mdr-like gene from Arabidopsis thaliana: evolutionary implications.
Dudler, R.; Hertig, C.
Baltimore, Md. : American Society for Biochemistry and Molecular Biology; 1992 Mar25.
The Journal of biological chemistry v. 267 (9): p. 5882-5888; 1992 Mar25. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Glycoproteins; Structural genes; Cloning; Nucleotide sequences; Amino acid sequences; Introns; Exons; Evolution; Herbicide resistance

Abstract: Multidrug resistance of mammalian tumor cells is caused by the enhanced expression of P-glycoproteins. These proteins are encoded by mdr genes and mediate the energy-dependent efflux of a variety of lipophilic drugs from cells. To test whether in plants mdr-like genes might be involved in certain cases of cross-resistance to different herbicides, we have cloned and characterized a gene from Arabidopsis thaliana, atpgp1, encoding a putative P-glycoprotein homologue. Like the mammalian P-glycoproteins, with which it shares extensive sequence homology and a similar organization in structural domains, this protein is internally duplicated. Seven of the nine introns in the atpgp1 gene match introns in the mammalian mdr genes to within a few nucleotides, and the positions of these suggest that P-glycoprotein genes evolved by duplication and subsequent fusion of an intron-containing primordial gene prior to the evolutionary separation of plants and mammals. The atpgp1 gene gives rise to transcripts present in all plant parts but particularly abundant in inflorescence axes.

301 NAL Call. No.: QK710.P62
Structure of the amplified 5-enolpyruvylshikimate-3-phosphate synthase gene in glyphosate-resistant carrot cells.
Suh, H.; Hepburn, A.G.; Kriz, A.L.; Widholm, J.M.
Dordrecht : Kluwer Academic Publishers; 1993 May.
Plant molecular biology v. 22 (2): p. 195-205; 1993 May. Includes references.

Language: English

Descriptors: Daucus carota; Structural genes; Amplification; Alkyl (aryl) transferases; Glyphosate; Herbicide resistance; Cell lines; Nucleotide sequences; Restriction mapping; Repetitive DNA

Abstract: The structure of amplified 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) DNA of

carrot suspension-cultured cell lines selected for glyphosate resistance was analysed to determine the mechanism of gene amplification in this plant system. Southern hybridization of the amplified DNA digested with several restriction enzymes probed with a petunia EPSPS cDNA clone showed that there were differences in fragment sizes in the amplified DNA from one highly resistant cell line in comparison with the parental line. Cloning of the EPSPS gene and 5' flanking sequences was carried out and two different DNA structures were revealed. A 13 kb clone contained only one copy of the EPSPS gene while a 16 kb clone contained an inverted duplication of the gene. Southern blot analysis with a carrot DNA probe showed that only the uninverted repeated DNA structure was present in all of the cell lines during the selection process and the inverted repeat (IR) was present only in highly amplified DNA. The two structures were present in about equal amounts in the highly amplified line, TC 35G, where the EPSPS gene was amplified about 25-fold. The presence of the inverted repeat (IR) was further verified by re-sistance to S1 nuclease hydrolysis after denaturation and rapid renaturation, showing foldback DNA with the IR length being 9.5 kb. The junction was also sequenced. Mapping of the clones showed that the size of the amplified carrot EPSPS gene itself is about 3.5 kb. This is the first report of an IR in amplified DNA of a target enzyme gene in selected plant cells.

302 NAL Call. No.: SB951.P47
Structure-activity relationships of triazinone herbicides on resistant weeds and resistant Chlamydomonas reinhardtii.
Oettmeier, W.; Hilp, U.; Draber, W.; Fedtke, C.; Schmidt, R.R.
Essex : Elsevier Applied Science Publishers; 1991.
Pesticide science v. 33 (4): p. 399-409; 1991. Includes references.

Language: English

Descriptors: Amaranthus retroflexus; Chenopodium album; Chlamydomonas reinhardtii; Mutants; Herbicide resistance; Herbicide resistant weeds; Atrazine; Metribuzin; Structure activity relationships; Photosystem ii; Inhibition; Wild strains

Abstract: Weeds resistant to the s-triazine herbicide atrazine also show resistance to the triazinone herbicide metribuzin. However, with highly lipophilic triazinones, thylakoids isolated from atrazine-resistant Amaranthus retroflexus (mutation at position Ser264 of the photosystem II D-1 reaction centre protein) in general show a higher pI(50) value in photosystem II electron transport than those from the wild type (i.e. negative cross-resistance; 'supersensitivity'). A quantitative structure-activity relationship (QSAR) can be established, wherein the lipophilicity of the compound plays a major role. In in-vivo experiments, it was found that the triazinone DRW2698 killed resistant Amaranthus retroflexus and Chenopodium album whereas the wild type was almost unaffected. Triazinones were further investigated in five different mutants of Chlamydomonas reinhardtii (mutations in the D-1 protein at positions Ser264, Ala251, Leu275, Phe255 and Val219). Inhibitory activity of all triazinones was generally enhanced in the Phe255 mutant but decreased in the Val219 mutant. In the other mutants, biological activity was decreased when position 3 of the triazinone was substituted by CH3, OCH3, SCH3, NHCH3 or N(CH3)2. However, negative cross-resistance was again observed

when this position was occupied by free thiol. It is therefore suggested that these two groups of triazinones orient themselves differently within the herbicide binding niche of the photosystem II D-1 protein.

303 NAL Call. No.: 450 P692
A sulfonylurea herbicide resistance gene from Arab idopsis thaliana as a new selectable marker for producti on of fertile transgenic rice plants. Li, Z.; Hayashimoto, A.; Murai, N.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1992 Oct. Plant physiology v. 100 (2): p. 662-668; 1992 Oct. Includes references.

Language: English

Descriptors: Arabidopsis thaliana; Oryza sativa; Marker genes; Oxo-acid-lyases; Mutations; Mutants; Genetic transformation; Transgenic plants; In vitro selection; Herbicide resistance; Chlorsulfuron; Direct DNAuptake; Protoplasts

Abstract: A mutant acetolactate synthase (ALS) gene, csr1-1, isolated from sulfonylurea herbicide-resistant Arabidopsis thaliana, was placed under control of a cauliflower mosaic virus 35S promoter (35S). Rice protoplasts were transformed with the 35S/ALS chimeric gene and regenerated into fertile transgenic rice (Oryza sativa) plants. The 35S/ALS gene was expressed effectively as demonstrated by northern blot hybridization analysis, and conferred to transformed calli at least 200-fold greater chlorsulfuron resistance than nontransformed control calli. Effective selection of 35S/ALS-transformed protoplasts was achieved at extremely low chlorsulfuron concentrations of 10 nm. The results demonstrated that the 35S/ALS gene is an alternative selectable marker for rice protoplast transformation and fertile transgenic rice production. The results also suggest that the mutant form of Arabidopsis ALS enzyme operates normally in rice cells. Thus, the mechanism of protein transport to chloroplast and ALS inhibition by chlorsulfuron is apparently conserved among plant species as diverse as Arabidopsis (dicotyledon) and rice (monocotyledon).

304 NAL Call. No.: SB951.P49
Sulfonylurea herbicide resistance in common chickweed, perennial ryegrass, and Russian thistle.
Saari, L.L.; Cotterman, J.C.; Smith, W.F.; Primiani, M.M.
Orlando, Fla. : Academic Press; 1992 Feb.
Pesticide biochemistry and physiology v. 42 (2): p. 110-118; 1992 Feb. Includes references.

Language: English

Descriptors: Stellaria media; Lolium perenne; Salsola iberica; Herbicide resistance; Chlorsulfuron; Sulfometuron; Triasulfuron; Imazapyr; Biotypes; Herbicide resistant weeds; Dry matter accumulation; Resistance mechanisms; Enzyme activity; Ligases; Metabolic detoxification; Pharmacokinetics

Abstract: Sulfonylurea herbicide resistance was demonstrated in two broadleaf species, common chickweed (Stellaria media [L]. Vill.) and Russian thistle (Salsola iberica Sennen & Pau), and in one grass species, perennial ryegrass (Lolium perenne L.), in greenhouse tests by determining the sulfonylurea and imidazolinone herbicide rates required to

reduce the dry weight accumulation of resistant and susceptible weed biotypes. The herbicide resistance in each of the three weed biotypes was due to an acetolactate synthase (ALS) enzyme that was less sensitive to inhibition by ALS-inhibiting herbicides, including five sulfonylurea, one imidazolinone, and one dichlorosulfonanilide herbicides. The Km (pyruvate) and specific activity values associated with ALS isolated from the resistant biotypes were similar in magnitude to those obtained with ALS isolated from susceptible biotypes. Both susceptible and resistant biotypes of each weed species metabolized radiolabeled sulfonylurea herbicides at similar rates, indicating that herbicide metabolism was not contributing to the differential plant response of the biotypes to ALS-inhibiting herbicides.

305 NAL Call. No.: SB1.H6
Sweet corn to cultivars respond differentially to the herbicide nicosulfuron. Stall, W.M.; Bewick, T.A.
Alexandria, Va. : American Society for Horticultural Science; 1992 Feb. HortScience v. 27 (2): p. 131-133; 1992 Feb. Includes references.

Language: English

Descriptors: Zea mays; Cultivars; Sweetcorn; Sulfonylurea herbicides; Application rates; Herbicide resistance; Varietal susceptibility; Genes; Phytotoxicity; Herbicide mixtures; Terbufos; Chlorpyrifos

Abstract: Twelve sweet corn (Zea mays L. var. rugosa Bonaf.) cultivars were tested for response to nicosulfuron at rates of 0, 18, 36, and 72 g a.i./ha. Weight of marketable ears indicated that five cultivars were intolerant to the herbicide. Three of the cultivars that were intolerant contained the shrunken-2 endosperm mutant (sh2) and two contained the sugary enhancer endosperm mutant (se). Cultivars that were most tolerant of nicosulfuron contained the sh2 gene. Incorporation of terbufos insecticide before planting led to decreased marketable yield when nicosulfuron was applied at 36 g.ha-1 in all cultivars tested. Chlorpyrifos insecticide incorporated before planting did not affect tolerance to nicosulfuron. Neither soil-applied insecticide affected yield when nicosulfuron was not applied.

306 NAL Call. No.: SB610.W39
Sweet corn (Zea mays) hybrid tolerance to nicosulfuron. Morton, C.A.; Harvey, R.G.
Champaign, Ill. : The Society; 1992 Jan.
Weed technology : a journal of the Weed Science Society of America v. 6 (1): p. 91-96; 1992 Jan. Includes references.

Language: English

Descriptors: Wisconsin; Zea mays; Hybrids; Screening; Herbicide resistance; Sulfonylurea herbicides; Phytotoxicity; Growth rate; Crop damage; Varietal susceptibility

307 NAL Call. No.: HD1.A3
Systems approaches to quantify crop-weed interactions and their application in weed management.
Kropff, M.J.; Lotz, L.A.P.
Essex : Elsevier Applied Science Publishers; 1992.

Agricultural systems v. 40 (1/3): p. 265-282; 1992. In the special issue: Systems approaches for agricultural development / edited by P.S. Teng and F. Penning de Vries. Proceedings of an international symposium held December 2-9, 1991, Bangkok, Thailand. Includes references.

Language: English

Descriptors: Plant interaction; Pest management; Crop management; Integrated control; Yield losses; Plant density; Systems approach; Simulation models; Growth models; Herbicide resistance; Weed control; Weed competition; Leaf area

308 NAL Call. No.: SB610.W39
Technology transfer for herbicide-tolerant weeds and herbicide-tolerant crops. Knake, E.L.
Champaign, Ill. : The Society; 1992 Jul.
Weed technology : a journal of the Weed Science Society of America v. 6 (3): p. 662-664; 1992 Jul. Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky. Includes references.

Language: English

Descriptors: Transgenic plants; Crops; Herbicide resistance; Weeds; Biotechnology; Weed control; Technology transfer

309 NAL Call. No.: 79.8 W41
Terbacil and bromacil cross-resistance in powell amaranth (Amaranthus powellii).
Boydston, R.A.; Al-Khatib, K.
Champaign, Ill. : Weed Science Society of America; 1992.
Weed science v. 40 (4): p. 513-516; 1992. Includes references.

Language: English

Descriptors: Idaho; Amaranthus powellii; Biotypes; Herbicide resistance; Triazine herbicides; Cross resistance; Bromacil; Terbacil; Binding site; Thylakoids

Abstract: A triazine-resistant Powell amaranth biotype collected in Idaho was approximately six times more resistant to terbacil and sixteen times more resistant to bromacil than a normal susceptible biotype when planted into terbacil- or bromacil-treated soil. The concentration of terbacil required to reduce photosystem II activity by 50% (I50) in isolated thylakoids was 0.24 and 13.33 micromolar for the susceptible and resistant biotypes, respectively. Likewise, the I50 values for bromacil were 0.33 and 18.4 micromolar for the susceptible and resistant biotypes, respectively. More 14C-terbacil was bound to isolated thylakoids of the susceptible than the resistant biotype with binding constants (Kb) of 0.26 and 12.9 micromolar, respectively, indicating that resistance was at the chloroplast level.

310 NAL Call. No.: S587.T47
Tolerance of almond to herbicides.
Saavedra, M.; Natera, C.
London : Association of Applied Biologists : c1980-; 1993 Apr.
Tests of agrochemicals and cultivars (14): p. 82-83; 1993 Apr.

Supplement to Annals of applied biology, volume 122. Includes references.

Language: English

Descriptors: Prunus dulcis; Herbicides; Tolerance; Phytotoxicity; Mediterranean climate

311 NAL Call. No.: SB1.H6
Tolerance of apple and peach trees to triclopyr.
Derr, J.F.
Alexandria, Va. : The American Society for Horticultural Science; 1993 Oct. HortScience : a publication of the American Society for Horticultural Science v. 28 (10): p. 1021-1023; 1993 Oct. Includes references.

Language: English

Descriptors: Virginia; Cabt; Malus pumila; Prunus persica; Orchards; Fruit trees; Weed control; Chemical control; Triclopyr; Phytotoxicity; Crop damage; Herbicide resistance; Application rates; Glyphosate; 2,4-d

Abstract: The tolerance of newly planted apple (Malus domestica Borkh.) and peach [Prunuspersica (L.) Batsch] trees to the postemergence herbicide triclopyr was evaluated in field trials. Apple and peach trees were not injured by triclopyr applied at rates ranging from 0.28 to 1.12 kg acid equivalent (a.e.)/ha as a directed spray to soil. No injury was observed following direct application of 10 ml of a triclopyr solution at 2 g a.e/liter to the lower bark of either tree species. Applications of that solution to an individual branch injured or killed the treated apple or peach branch but did not affect the rest of the tree. No reduction in tree growth or injury was noted 1 year after triclopyr application. Applications of 10 ml of a glyphosate solution at 15 g a.i./liter to an apple branch caused severe injury and a growth reduction by 1 year after application, and killed all treated peach trees when applied to one branch. No triclopyr or 2,4-D treatment had affected apple or peach trunk diameter, number of branches, or tree size 1 year after application.

312 NAL Call. No.: 79.9 W52R
Tolerance of Kentucky bluegrass seedlings to three wild oat herbicides in greenhouse experiments.
Swensen, J.B.; Dial, M.J.; Murray, G.A.; Thill, D.C.
S.l. : The Society; 1993.
Research progress report - Western Society of Weed Science. p. III/46-III/48; 1993. Meeting held March 9-11, 1993, Tucson, Arizona.

Language: English

Descriptors: Poa pratensis; Herbicides; Tolerance

313 NAL Call. No.: 100 L93 (3)
Tolerance of rice varieties and experimental lines to rice herbicides. Sanders, D.E.; Linscombe, S.D.; Jodari, F.; Fabacher, A.P. Crowley, La. : The Station, 1986-; 1992.
Annual research report / (84th): p. 89-95; 1992.

Language: English

Descriptors: Oryza sativa; Varieties; Herbicide resistance; Application rates; Crop yield

314 NAL Call. No.: SB610.W39
Tolerance of three annual forage legumes to selected postemergence herbicides. Evers, G.W.; Grichar, W.J.; Pohler, C.L.; Schubert, A.M.
Champaign, Ill. : The Weed Science Society of America; 1993 Jul. Weed technology : a journal of the Weed Science Society of America v. 7 (3): p. 735-739; 1993 Jul. Includes references.

Language: English

Descriptors: Texas; Cabt; Trifolium alexandrinum; Trifolium subterraneum; Trifolium hirtum; Fodder legumes; Weed control; Chemical control; Tolerance; Bentazone; 2,4-d; Propyzamide; Phytotoxicity; Crop damage; Abiotic injuries; Herbicide resistance; Species differences

315 NAL Call. No.: 79.8 W412
Tolerance of triazine-resistant and susceptible biotypes of three weeds to heat stress: a fluorescence study.
Fuks, B.; Eycken, F. van; Lannoye, R.
Oxford : Blackwell Scientific Publications; 1992 Feb. Weed research v. 32 (1): p. 9-17; 1992 Feb. Includes references.

Language: English

Descriptors: Solanum nigrum; Poa annua; Chenopodium album; Herbicide resistant weeds; Susceptibility; Biotypes; Heat stress; Heat tolerance; Chlorophyll; Fluorescence; Plant physiology

316 NAL Call. No.: 450 P692
Tolerance to imidazolinone herbicides in wheat.
Newhouse, K.E.; Smith, W.A.; Starrett, M.A.; Schaefer, T.J.; Singh, B.K. Rockville, MD : American Society of Plant Physiologists, 1926-; 1992 Oct. Plant physiology v. 100 (2): p. 882-886; 1992 Oct. Includes references.

Language: English

Descriptors: Triticum aestivum; Imazethapyr; Herbicide resistance; Induced mutations; Mutants; Genes; Inheritance; Segregation; Oxo-acid-lyases; Enzyme activity; Allelism

Abstract: An imidazolinone-tolerant wheat (Triticum aestivum L. em Thell) mutant in the winter wheat cultivar Fidel has been identified and characterized. The mutant was isolated from a population derived through seed mutagenesis of the variety with an aqueous solution containing sodium azide. Imidazolinone-tolerant wheat seedlings were selected from the generation of the population in the presence of imazethapyr herbicide and identified as herbicide-insensitive individuals. The trait is inherited as a single semidominant gene and confers high levels of tolerance to imazethapyr. Acetohydroxyacid synthase activity in extracts from imidazolinone-tolerant plants was less inhibited by imazethapyr than the enzyme from the wild type. The herbicide-

tolerant plants have a completely normal phenotype and display no negative effects on growth and yield in either the absence or presence of imazethapyr.

317 NAL Call. No.: 23 AU792
Tolerances of canola, field pea, lupin and faba bean cultivars to herbicides. Lemerle, D.; Hinkley, R.B.
East Melbourne : Commonwealth Scientific and Industrial Research Organization; 1991.
Australian journal of experimental agriculture v. 31 (3): p. 379-386; 1991. Includes references.

Language: English

Descriptors: New South Wales; Brassica campestris; Brassica napus; Lupinus albus; Lupinus angustifolius; Pisum sativum; Vicia faba; Cultivars; Herbicide resistance; Herbicides; Injuries; Phytotoxicity; Site factors; Weed control; Yield losses; Yield response functions

318 NAL Call. No.: 450 P692
Transformation and regeneration of two cultivars of pea (Pisum sativum L.). Schroeder, H.E.; Schotz, A.H.; Wardley-Richardson, T.; Spencer, D.; Higgins, T.J.V.
Rockville, MD : American Society of Plant Physiologists, 1926- ; 1993 Mar. Plant physiology v. 101 (3): p. 751-757; 1993 Mar. Includes references.

Language: English

Descriptors: Pisum sativum; Agrobacterium tumefaciens; Genetic transformation; Transgenic plants; Gene transfer; Reporter genes; Phosphotransferases; Acyltransferases; Recombinant DNA; Regenerative ability; Tissue culture; Herbicide resistance; Glufosinate; Genetic markers; Explants; Plant embryos

Abstract: A reproducible transformation system was developed for pea (Pisum sativum L.) using as explants sections from the embryonic axis of immature seeds. A construct containing two chimeric genes, nopaline synthase-phosphinothricin acetyl transferase (bar) and cauliflower mosaic virus 35S-neomycin phosphotransferase (nptII), was introduced into two pea cultivars using Agrobacterium tumefaciens-mediated transformation procedures. Regeneration was via organogenesis, and transformed plants were selected on medium containing 15 mg/L of phosphinothricin. Transgenic peas were raised in the glasshouse to produce flowers and viable seeds. The bar and nptII genes were expressed in both the primary transgenic pea plants and in the next generation progeny, in which they showed a typical 3:1 Mendelian inheritance pattern. Transformation of regenerated plants was confirmed by assays for neomycin phosphotransferase and phosphinothricin acetyl transferase activity and by northern blot analyses. Transformed plants were resistant to the herbicide Basta when sprayed at rates used in field practice.

319 NAL Call. No.: S494.5.B563B56
Transformation in Linum usitatissimum L. (flax).
Jordan, M.C.; McHughen, A.
Berlin, W. Ger. : Springer-Verlag; 1993.
Biotechnology in agriculture and forestry v. 22: p. 244-252;

1993. In the series analytic: Plant protoplasts and genetic engineering III / edited by Y.P.S. Bajaj. Includes references.

Language: English

Descriptors: Linum usitatissimum; Genetic transformation; Agrobacterium tumefaciens; Transgenic plants; Herbicide resistance; Glyphosate; Glufosinate; Gene transfer; Sulfonylurea herbicides; Regenerative ability

320 NAL Call. No.: QH442.B5
Transformation of sugarbeet (Beta vulgaris L.) and evaluation of herbicide resistance in transgenic plants.
D'Halluin, K.; Bossut, M.; Bonne, E.; Mazur, B.; Leemans, J.; Botterman, J. New York, N.Y. : Nature Publishing Company; 1992 Mar.
Bio/technology v. 10 (3): p. 309-314; 1992 Mar. Includes references.

Language: English

Descriptors: Beta vulgaris var. saccharifera; Agrobacterium tumefaciens; Genetic transformation; Transgenics; Gene transfer; Genes; Bilanafos; Ligases; Glufosinate; Sulfonylurea herbicides; Herbicide resistance; Acyltransferases

321 NAL Call. No.: QK725.P54
Transgenic herbicide-resistant Atropa belladonna using an Ri binary vector and inheritance of the transgenic trait.
Saito, K.; Tamazaki, M.; Anzai, H.; Yoneyama, K.; Murakoshi, I. Berlin, W. Ger. : Springer International; 1992.
Plant cell reports v. 11 (5/6): p. 219-224; 1992. Includes references.

Language: English

Descriptors: Atropa belladonna; Transgenics; Gene transfer; Genetic transformation; Herbicide resistance; Bilanafos; Glufosinate; Inheritance; Agrobacterium rhizogenes; Enzyme activity; Cauliflower mosaic caulimovirus; Transferases

Abstract: Transgenic Atropa belladonna conferred with a herbicide-resistant trait was obtained by transformation with an Ri plasmid binary vector and plant regeneration from hairy roots. We made a chimeric construct, pARK5, containing the bar gene encoding phosphinothricin acetyltransferase flanked with the promoter for cauliflower mosaic virus 35S RNA and the 3' end of the nos gene. Leaf discs of A. belladonna were infected with Agrobacterium rhizogenes harboring an Ri plasmid, pRi15834, and pARK5. Transformed hairy roots resistant to bialaphos (5 mg/l) were selected and plantlets were regenerated. The integration of T-DNAs from pRi15834 and pARK5 were confirmed by DNA-blot hybridization. Expression of the bar gene in transformed R0 tissues and in backcrossed F1 progeny with a non-transformant and self-fertilized progeny was indicated by enzymatic activity of the acetyltransferase. The transgenic plants showed resistance towards bialaphos and phosphinothricin. Tropane alkaloids of normal amounts were produced in the transformed regenerants. These results present a successful application of transformation with an Ri plasmid binary vector for conferring an agronomically useful trait to medicinal plants.

322 NAL Call. No.: 450 P693
Transgenic plants containing the phosphinothricin-N-acetyltransferase gene metabolize the herbicide L-phosphinothricin (glufosinate) differently from untransformed plants.
Droge, W.; Broer, I.; Puhler, A.
Berlin : Springer-Verlag; 1992.
Planta v. 187 (1): p. 142-151; 1992. Includes references.

Language: English

Descriptors: Nicotiana tabacum; Daucus carota; Agrobacterium tumefaciens; Transgenics; Glufosinate; Metabolism; Transferases; Enzyme activity; Genetic code; Nucleotide sequences

Abstract: L-Phosphinothricin (L-Pt)-resistant plants were constructed by introducing a modified phosphinothricin-N-acetyl-transferase gene (pat) via Agrobacterium-mediated gene transfer into tobacco (Nicotiana tabacum L), and via direct gene transfer into carrot (Daucus carota L). The metabolism of L-Pt was studied in these transgenic, Pt-resistant plants, as well as in the untransformed species. The degradation of L-Pt, 14C-labeled specifically at different C-atoms, was analysed by measuring the release of 14CO2 and by separating the labeled degradation products on thin-layer-chromatography plates. In untransformed tobacco and carrot plants, L-Pt was deaminated to form its corresponding oxo acid 4-methylphosphinico-2-oxo-butanoic acid (PPO), which subsequently was decarboxylated to form 3-methylphosphinico-propanoic acid (MPP). This compound was stable in plants. A third metabolite remained unidentified. The L-Pt was rapidly N-acetylated in herbicide-resistant tobacco and carrot plants, indicating that the degradation pathway of L-Pt into PPO and MPP was blocked. The N-acetylated product, L-N-acetyl-Pt remained stable with regard to degradation, but was found to exist in a second modified form. In addition, there was a pH-dependent, reversible change in the mobility of L-N-acetyl-Pt thin-layer during chromatography.

323 NAL Call. No.: QH442.B5
Transgenic plants of tall fescue (Festuca arundinacea Schreb.) obtained by direct gene transfer to protoplasts.
Wang, Z.Y.; Takamizo, T.; Iglesias, V.A.; Osusky, M.; Nagel, J.; Potrykus, I.; Spangenberg, G.
New York, N.Y. : Nature Publishing Company; 1992 Jun.
Bio/technology v. 10 (6): p. 691-696; 1992 Jun. Includes references.

Language: English

Descriptors: Festuca arundinacea; Genetic transformation; Transgenics; Protoplasts; Gene transfer; Direct DNAuptake; Reporter genes; Phosphotransferases; Acyltransferases; Cell suspensions; In vitro selection; Hygromycin b; Glufosinate; Drug resistance; Herbicide resistance; Callus; Embryogenesis; Regenerative ability

324 NAL Call. No.: 500 N21P
Transgenic sorghum plants via microprojectile bombardment.
Casas, A.M.; Kononowicz, A.K.; Zehr, U.B.; Tomes, D.T.;

Axtell, J.D.; Butler, L.G.; Bressan, R.A.; Hasegawa, P.M.
Washington, D.C. : National Academy of Sciences,; 1993 Dec01.
Proceedings of the National Academy of Sciences of the United States of America v. 90 (23): p. 11212-11216; 1993 Dec01.
Includes references.

Language: English

Descriptors: Sorghum bicolor; Transgenics; Cultivars; Gene transfer; Genetic transformation; Genotypes; Herbicide resistance; Tissue culture; Transferases; Beta-glucuronidase; Enzyme activity

Abstract: Transgenic sorghum plants have been obtained after microprojectile bombardment of immature zygotic embryos of a drought-resistant sorghum cultivar, P898012. DNA delivery parameters were optimized based on transient expression of R and C1 maize anthocyanin regulatory elements in scutellar cells. The protocol for obtaining transgenic plants consists of the delivery of the bar gene to immature zygotic embryos and the imposition of bialaphos selection pressure at various stages during culture, from induction of somatic embryogenesis to rooting of regenerated plantlets. One in about every 350 embryos produced embryogenic tissues that survived bialaphos treatment; six transformed callus lines were obtained from three of the eight sorghum cultivars used in this research. Transgenic (T0) plants were obtained from cultivar P898012 (two independent transformation events). The presence of the bar and uidA genes in the T0 plants was confirmed by Southern blot analysis of genomic DNA. Phosphinothricin acetyltransferase activity was detected in extracts of the T0 plants. These plants were resistant to local application of the herbicide Ignite/Basta, and the resistance was inherited in T1 plants as a single dominant locus.

325 NAL Call. No.: 79.8 W41
Translocation of glyphosate, quizalofop, and sucrose in quackgrass (Elytrigia repens) biotypes.
Tardif, F.J.; Leroux, G.D.
Champaign, Ill. : Weed Science Society of America; 1993 Jul.
Weed science v. 41 (3): p. 341-346; 1993 Jul. Includes references.

Language: English

Descriptors: Elymus repens; Biotypes; Herbicide resistance; Herbicide resistant weeds; Glyphosate; Quizalofop; Translocation; Rhizomes; Sucrose; Uptake; Stable isotopes; Spatial distribution; Systemic action; Perennial weeds; Weed control; Chemical control

Abstract: The translocation pattern and distribution in rhizomes of 14C-glyphosate, 14C-quizalofop, and 14C-sucrose was examined in five quackgrass biotypes. Translocation of radioactivity in the different plant parts varied among biotypes. Translocation in the whole plant after treatment with the three 14C-chemicals varied among biotypes but was not correlated with their tolerance to herbicides. Detailed analysis of distribution of radioactivity in the primary rhizome showed that more 14C was found in the apical sections after treatment with 14C-sucrose. A similar pattern was observed after 14C-glyphosate application with all biotypes except one. Very low radioactivity was found in rhizomes after 14C-quizalofop application, but a preferential accumulation in

apical sections of the primary rhizome was detected in two biotypes. The tolerance of one biotype to glyphosate was explained by the absence of radioactivity accumulation in the apical sections of the rhizome.

326 NAL Call. No.: SB610.W39
Triazine-resistant common lambsquarters (Chenopodium album L.) control in field corn (Zea mays L.).
Myers, M.G.; Harvey, R.G.
Champaign, Ill. : The Weed Science Society of America; 1993 Oct. Weed technology : a journal of the Weed Science Society of America v. 7 (4): p. 884-889; 1993 Oct. Includes references.

Language: English

Descriptors: Wisconsin; Cabt; Zea mays; Weed control; Herbicide resistant weeds; Chenopodium album; Triazine herbicides; Chemical control; Application date; Timing; Acetochlor; Alachlor; Atrazine; Bentazone; Bromoxynil; Cyanazine; Dicamba; Metolachlor; Pendimethalin; Pyridate; Sulfonylurea herbicides; Tridiphane; 2,4-d; Amines; Application rates; Efficacy

327 NAL Call. No.: SB610.W39
Triazine-resistant smooth pigweed (Amaranthus hybridus) control in field corn (Zea mays L.).
Birschbach, E.D.; Myers, M.G.; Harvey, R.G.
Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 431-436; 1993 Apr. Includes references.

Language: English

Descriptors: Wisconsin; Cabt; Zea mays; Weed control; Chemical control; Amaranthus hybridus; Herbicide resistance; Herbicide resistant weeds; Atrazine; Metribuzin; Herbicide mixtures; Dicamba; Alachlor; Acetochlor; Pyridate; Bentazone; Cyanazine; 2,4-d; Linuron; Simazine; Sulfonylurea herbicides; Pendimethalin; Tridiphane; Application rates; Application date; Timing

328 NAL Call. No.: 450 C16
Tribute summer rape.
Rakow, G.; Downey, R.K.
Ottawa : Agricultural Institute of Canada; 1993 Jan. Canadian journal of plant science; Revue canadienne de phytotechnie v. 73 (1): p. 189-191; 1993 Jan. Includes references.

Language: English

Descriptors: Saskatchewan; Brassica napus; Breeding methods; Crop yield; Cultivars; Herbicide resistance

329 NAL Call. No.: 450 P693
Tubulin-isotype analysis of two grass species-resistant to dinitroaniline herbicides.
Waldin, T.R.; Ellis, J.R.; Hussey, P.J.
Berlin : Springer-Verlag; 1992.

Planta v. 188 (2): p. 258-264; 1992. Includes references.

Language: English

Descriptors: Eleusine indica; Setaria viridis; Trifluralin; Herbicide resistance; Cross resistance; Dinitroaniline herbicides; Diagnostic techniques; Tubulin; Chemical composition; Protein content; Protein composition

Abstract: Trifluralin-resistant biotypes of Eleusine indica (L.) Gaertn. (goosegrass) and Setaria viridis (L.) Beauv. (green foxtail) exhibit cross-resistance to other dinitroaniline herbicides. Since microtubules are considered the primary target site for dinitroaniline herbicides we investigated whether the differential sensitivity of resistant and susceptible biotypes of these species results from modified tubulin polypeptides. One-dimensional and two-dimensional polyacrylamide gel electrophoresis combined with immunoblotting using well-characterised anti-tubulin monoclonal antibodies were used to display the family of tubulin isotypes in each species. Seedlings of E. indica exhibited four beta-tubulin isotypes and one alpha-tubulin isotype, whereas those of S. viridis exhibited two beta-tubulin and two alpha-tubulin isotypes. Comparison of the susceptible and resistant biotypes within each species revealed no differences in electrophoretic properties of the multiple tubulin isotypes. These results provide no evidence that resistance to dinitroaniline herbicides is associated with a modified tubulin polypeptide in these biotypes of E. indica or S. viridis.

330 NAL Call. No.: 470 C16C
Ultrastructure of Chlamydomonas reinhardtii following exposure to paraquat: comparison of wild type and a paraquat-resistant mutant.
Bray, D.F.; Bagu, J.R.; Nakamura, K.
Ottawa, Ont. : National Research Council of Canada; 1993 Jan.
Canadian journal of botany; Journal canadien de botanique v. 71 (1): p. 174-182; 1993 Jan. Includes references.

Language: English

Descriptors: Chlamydomonas reinhardtii; Paraquat; Phytotoxicity; Herbicide resistance; Mutants; Genes; Inheritance; Ultrastructure; Mitochondria; Thylakoids; Chloroplasts; Nuclei; Methionine; Resistance

331 NAL Call. No.: 79.8 W412
Uptake and efflux of chlorimuron ethyl by excised soybean (Glycine max (L.) Merr.) root tissue.
Nandihalli, U.B.; Bhowmik, P.C.
Oxford : Blackwell Scientific Publications; 1991 Oct.
Weed research v. 31 (5): p. 295-300; 1991 Oct. Includes references.

Language: English

Descriptors: Glycine max; Roots; Uptake; Chlorimuron; Radioactive tracers; Herbicide resistance; Susceptibility

332 NAL Call. No.: SB610.W39
Uptake, translocation, and metabolism of chlorimuron in

soybean (Glycine max) and morningglory (Ipomoea spp.).
Moseley, C.; Hatzios, K.K.; Hagood, E.S.
Champaign, Ill. : The Weed Science Society of America; 1993 Apr. Weed technology : a journal of the Weed Science Society of America v. 7 (2): p. 343-348; 1993 Apr. Includes references.

Language: English

Descriptors: Glycine max; Cultivars; Varietal susceptibility; Ipomoea lacunosa; Pharbitis hederacea; Chlorimuron; Uptake; Translocation; Metabolism; Herbicide resistance; Growth rate; Absorption; Phytotoxicity; Crop damage; Weed control; Chemical control

333 NAL Call. No.: 79.8 W412
Uptake, translocation and phytotoxicity of root-absorbed haloxyfop in soybean, Festuca rubra L. and Festuca arundinacea Schreb.
Aguero-Alvarado, R.; Appleby, A.P.
Oxford : Blackwell Scientific Publications; 1991 Oct.
Weed research v. 31 (5): p. 257-263; 1991 Oct. Includes references.

Language: English

Descriptors: Festuca rubra; Festuca arundinacea; Glycine max; Haloxyfop; Phytotoxicity; Roots; Uptake; Absorption; Translocation; Herbicide resistance; Susceptibility; Growth rate; Radioactive tracers

334 NAL Call. No.: A00109
USDA scientist develops herbicide-tolerant potatoes.
Washington, DC : National Biotechnology Policy Center of the National Wildlife Federation; 1991 Jun.
The gene exchange v. 2 (2): p. 7; 1991 Jun.

Language: English

Descriptors: U.S.A.; Field tests; Biotechnology; Usda; Plants

335 NAL Call. No.: QK710.P62
Use of bar as a selectable marker gene and for the production of herbicide-resistant rice plants from protoplasts.
Rathore, K.S.; Chowdhury, V.K.; Hodges, T.K.
Dordrecht : Kluwer Academic Publishers; 1993 Mar.
Plant molecular biology : an international journal on molecular biology, biochemistry and genetic engineering v. 21 (5): p. 871-884; 1993 Mar. Includes references.

Language: English

Descriptors: Oryza sativa; Streptomyces; Genetic transformation; Transgenic plants; Protoplasts; Direct DNAuptake; Gene transfer; Structural genes; Acyltransferases; Glufosinate; Herbicide resistance; In vitro selection; Marker genes; Reporter genes; Beta-glucuronidase

Abstract: We have used the bar gene in combination with the herbicide Basta to select transformed rice (Oryza sativa L. cv. Radon) protoplasts for the production of herbicide-resistant rice plants. Protoplasts, obtained from regenerable

suspension cultures established from immature embryo callus, were transformed using PEG-mediated DNA uptake. Transformed calli could be selected 2-4 weeks after placing the protoplast-derived calli on medium containing the selective agent, phosphinothricin (PPT), the active component of Basta. Calli resistant to PPT were capable of regenerating plants. Phosphinothricin acetyltransferase (PAT) assays confirmed the expression of the bar gene in plants obtained from PPT-resistant calli. The only exceptions were two plants obtained from the same callus that had multiple copies of the bar gene integrated into their genomes. The transgenic status of the plants was varified by Southern blot analysis. In our system, where the transformation was done via the protoplast method, there were very few escapes. The efficiency of co-transformation with a reporter gene gusA, was 30%. The T0 plants of Radon were self-fertile. Both the bar and gusA genes were transmitted to progeny as confirmed by Southern analysis. Both genes were expressed in T1 and T2 progenies. Enzyme analyses on T1 progeny plants also showed a gene dose response reflecting their homozygous and heterozygous status. The leaves of T0 plants and that of the progeny having the bar gene were resistant to application of Basta. Thus, the bar gene has proven to be a useful selectable and screenable marker for the transformation of rice plants and for the production of herbicide-resistant plants.

336 NAL Call. No.: QK710.A9
The use of the Emu promoter with antibiotic and herbicide resistance genes for the selection of transgenic wheat callus and rice plants. Chamberlain, D.A.; Brettell, R.I.S.; Last, D.I.; Witrzens, B.; McElroy, D.; Dolferus, R.; Dennis, E.S.
Melbourne, Commonwealth Scientific and Industrial Research Organization; 1994. Australian journal of plant physiology v. 21 (1): p. 95-112; 1994. Includes references.

Language: English

Descriptors: Triticum aestivum; Oryza sativa; Gene transfer; Transgenic plants; Callus; Gene expression; Selection; Marker genes; Leaves; Enzyme activity; Promoters

337 NAL Call. No.: SB951.P47
Using chlorophyll fluorescence induction for a quantitative detoxification assay with metribuzin and chlorotoluron in excised wheat (triticum aestivum and Triticum durum) leaves.
Ducruet, J.M.; Sixto, H.; Garcia-Baudin, J.M.
Sussex : John Wiley and Sons Limited; 1993.
Pesticide science v. 38 (4): p. 295-301; 1993. Includes references.

Language: English

Descriptors: Metribuzin; Chlorotoluron; Triticum aestivum; Triticum durum; Cultivars; Susceptibility; Herbicide resistance; Root treatment; Leaves; Translocation; Metabolic detoxification; Kinetics; Fluorescence; Induction; Dark; Incubation; Duration; Temperature; Photosystem ii; Inhibition; Quantitative techniques

Abstract: Chlorophyll fluorescence induction was used as a probe to detect herbicide detoxification in tolerant or susceptible wheat cultivars. Experimental conditions have been carefully examined for establishing detoxification kinetics of

chlorotoluron and metribuzin, two photosystem-II-inhibiting herbicides. After a root treatment, leaves were cut, placed in glass tubes and maintained in the dark. The fluorescence induction rise was examined repeatedly and detoxification kinetics were established from these data for the same position on the individual leaves. The herbicide-dependent fluorescence rise decreased within hours in chlorotoluron-tolerant but not in susceptible Triticum aestivum cultivars. In contrast, no significant reversion could be detected after metribuzin application in both tolerant and susceptible cultivars of Triticum durum. Near the fluorescence-determined half-inhibition of photosystem II, linear detoxification kinetics were obtained in individual leaves, thus providing an accurate measurement of relative detoxification rates.

338 NAL Call. No.: SB610.W39
Varietal tolerance of rice (Oryza sativa) to bromoxynil and triclopyr at different growth stages.
Pantone, D.J.; Baker, J.B.
Champaign, Ill. : The Weed Science Society of America; 1992 Oct. Weed technology : a journal of the Weed Science Society of America v. 6 (4): p. 968-974; 1992 Oct. Includes references.

Language: English

Descriptors: Louisiana; Cabt; Oryza sativa; Cultivars; Herbicide resistance; Varietal tolerance; Bromoxynil; Triclopyr; Application rates; Crop growth stage; Crop damage; Crop yield

339 NAL Call. No.: QH301.A76
Vegetation management during establishment of farm woodlands.
Williamson, D.R.; MacDonald, H.G.; Nowakowski, M.R.
Wellesbourne, Warwick : The Association of Applied Biologists; 1992. Aspects of applied biology (29): p. 203-210; 1992. In the series analytic: Vegetation management in forestry, amenity and conservation areas. Paper presented at the conference of the Association, April 7-9, 1992, University of York, England. Includes references.

Language: English

Descriptors: England; Farm woodlands; Trees; Weed control; Establishment; Ground cover plants; Herbicide residues; Herbicide resistance; Screening; Survival; Vegetation management

340 NAL Call. No.: SB610.W39
Weed control in oat (Avena sativa)-alfalfa (Medicago sativa) and effect on next year corn (Zea mays) yield.
Moomaw, R.S.
Champaign, Ill. : The Weed Science Society of America; 1992 Oct. Weed technology : a journal of the Weed Science Society of America v. 6 (4): p. 871-877; 1992 Oct. Includes references.

Language: English

Descriptors: Nebraska; Cabt; Avena sativa; Medicago sativa; Zea mays; Herbicide resistance; Rotations; No-tillage; Weed control; Herbicides; Crop density; Crop yield; Drought

341 NAL Call. No.: SB610.W39
Weed thresholds: the space component and considerations for herbicide resistance.
Maxwell, B.D.
Champaign, Ill. : The Society; 1992 Jan.
Weed technology : a journal of the Weed Science Society of America v. 6 (1): p. 205-212; 1992 Jan. Paper presented at the "Symposium on Ecological Perspectives on Utility of Thresholds for Weed Management," February 5, 1991. Includes references.

Language: English

Descriptors: Weeds; Economic thresholds; Weed control; Herbicide resistance; Herbicide resistant weeds; Population dynamics; Seeds; Dispersal; Weed biology; Crop yield; Yield losses; Mathematical models; Triticum aestivum; Setaria viridis; Simulation models

342 NAL Call. No.: SB1.H6
Wildflower tolerance to metolachlor and metolachlor combined with other broadleaf herbicides.
Derr, J.F.
Alexandria, Va. : The American Society for Horticultural Science; 1993 Oct. HortScience : a publication of the American Society for Horticultural Science v. 28 (10): p. 1023-1026; 1993 Oct. Includes references.

Language: English

Descriptors: Coreopsis; Leucanthemum vulgare; Echinacea purpurea; Gaillardia; Stand establishment; Weed control; Chemical control; Herbicide resistance; Site preparation; Metolachlor; Herbicide mixtures; Isoxaben; Oxadiazon; Simazine; Phytotoxicity; Abiotic injuries; Efficacy; Eclipta alba; Cyperus esculentus

Abstract: The tolerance of transplanted lanceleaf coreopsis (Coreopsis lanceolata L.), ox-eye daisy (Chrysanthemum leucantheum L.), purple coneflower [Echinaea purpurea (L.) Moench.], and blanket flower (Gaiuardia aristata Pursh) to metolachlor was determined in field trials.Metolachlor at 4.5 kg.ha-1 (maximum use rate) and 9.0 kg.ha-1 (twice the maximum use rate) did not reduce stand or flowering of any wildflower species after one or two applications, although plants developed transient visible injury. Combining metolachlor with the broadleaf herbicides simazine or isoxaben resulted in unacceptable injury and stand reduction, especially in ox-eye daisy. Metolachlor plus oxadiazon was less injurious to the wildflowers than metolachlor plus either simazine or isoxaben. Treatments containing metolachlor controlled yellow nutsedge (Cyperus escukntus L.) by at least 89% in both experiments. Treatments containing isoxaben controlled eclipta (Ecupta alba L.) 100% in both studies.

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