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Herbicide Tolerance/Resistance in Plants

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1. Herbicide resistance--Bibliography. 2 Plant biotechnology--Bibliography. 3. Herbicide safeners--Bibliography. I. Dobert, Raymond. II. Title.
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Search Strategy

SET ITEMS DESCRIPTION

1 20266 BIOTECH* or BIOENGINEER* or RECOMBINANT or TRANSGEN*

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5 302 #3 and #4

6 301 #5 and (LA=ENGLISH)

7 189 #6 and (PY>=1991)

Herbicide Tolerance/Resistance in Plants

Go to:

1.
NAL Call No.: 442.8-Z34
An acetohydroxy acid synthase mutant reveals a single site involved in multiple herbicide resistance.
Hattori, J.; Brown, D.; Mourad, G.; Labbe, H.; Ouellet, T.; Sunohara, G.; Rutledge, R.; King, J.; Miki, B. *MGG,-Mol-gen-genet* v.246(4): p.419-425. (1995 Feb.)
Includes references.

Descriptors: brassica-napus; alleles-; structural-genes; mutants-; oxo-acid-lyases-; herbicide-resistance; chlorsulfuron-; imidazolinone-herbicides; pyrimidines-; herbicides-; gene-expression; transgenic-plants; amino-acid-sequences; binding-site; enzyme-activity; ahas3r-gene; triazolopyrimidine-herbicices; ac-263,499; xrd-489; ahas-gene; ahas1-gene; ahas3-gene

Abstract: Acetohydroxy acid synthase (AHAS) is an essential enzyme for many organisms as it catalyzes the first step in the biosynthesis of the branched-chain amino acids valine, isoleucine, and leucine. The enzyme is under allosteric control by these amino acids. It is also inhibited by several classes of herbicides, such as the sulfonylureas, imidazolinones and triazolopyrimidines, that are believed to bind to a relic quinone- binding site. In this study, a mutant allele of AHAS3 responsible for sulfonylurea resistance in a Brassica napus cell line was isolated. Sequence analyses predicted a single amino acid change (557 Trp replaced by Leu) within a conserved region of AHAS. Expression in transgenic plants conferred strong resistance to the three classes of herbicides, revealing a single site essential for the binding of all the herbicide classes. The mutation did not appear to affect feedback inhibition by the branched-chain amino acids in plants.

2.
NAL Call No.: QK710.P62
Activity of a maize ubiquitin promoter in transgenic rice.
Cornejo, M. J.; Luth, D.; Blankenship, K. M.; Anderson, O. D.; Blechl, A. E. *Plant-mol-biol* v.23(3): p.567-581. (1993 Nov.)
Includes references.

Descriptors: zea-mays; oryza-sativa; promoters-; ubiquitin-; exons-; introns-; recombinant-dna; reporter-genes; beta-glucuronidase-; luciferase-; acyltransferases-; genetic-transformation; transgenic-plants; gene-expression; callus-; protoplasts-; histoenzymology-; cell-division; enzyme- activity; herbicide-resistance; bilanafos-; heat-shock; phosphinothricin-acetyltransferase; uida-gene; bar-gene

Abstract: We have used the maize ubiquitin 1 promoter, first exon and first intron (UBI) for rice (Oryza sativa L. cv. Taipei 309) transformation experiments and studied its expression in transgenic calli and plants. UBI directed significantly higher levels of transient gene expression than other promoter/intron combinations used for rice transformation. We exploited these high levels of expression to identify stable transformants obtained from callus-derived protoplasts co-transfected with two chimeric genes. The genes consisted of UBI fused to the coding regions of the uidA and bar marker genes (UBI:GUS and UBI:BAR). UBI:GUS expression increased in response to thermal stress in both transfected protoplasts and transgenic rice calli. Histochemical localization of GUS activity revealed that UBI was most active in rapidly dividing cells. This promoter is expressed in many, but not all, rice tissues and undergoes important changes in activity during the development of transgenic rice plants.

3.
NAL Call No.: SB610.W39
Addressing real weed science needs with innovations.
Gressel, J. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.509-525. (1992 July-1992 Sept.)
Literature review.

Descriptors: weeds-; weed-control; agricultural-research; herbicides-; herbicide-resistance; pest-management; biological-control; biotechnology-; parasitic-weeds; agriculture-; literature-reviews; third-world-agriculture

4.
NAL Call No.: SB123.P55
Advances in achieving the needs for biotechnologically-derived herbicide resistant crops.
Gressel, J. *Plant-breed-rev. New York, N.Y. : John Wiley & Sons, Inc. 1993. v. 11 p. 155-198.*
Includes references.

Descriptors: crops-; plant-breeding; herbicide-resistance; genes-; genetic-engineering; biotechnology-; cultivars-; weed-control; genetic-resistance; literature-reviews

5.
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. *Plant-Cell-Rep* v.11(5/6): p.243-247. (1992)
Includes references.

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.

6.
NAL Call No.: 450-P692
Agrobacterium-mediated transformation of subterranean clover (Trifolium subterraneum L.).
Khan, M. R. I.; Tabe, L. M.; Heath, L. C.; Spencer, D.; Higgins, T. J. V. *Plant-physiol* v.105(1): p.81-88. (1994 May)
Includes references.

Descriptors: trifolium-subterraneum; agrobacterium-tumefaciens; genetic-transformation; gene-transfer; laboratory-methods; transgenic-plants; regenerative-ability; explants-; gene-expression

Abstract: We have developed a rapid and reproducible transformation system for subterranean clover (Trifolium subterraneum L.) using Agrobacterium tumefaciens-mediated gene delivery. Hypocotyl segments from seeds that had been allowed to imbibe were used as explants, and regeneration was achieved via organogenesis. Glucose and acetosyringone were required in the co-cultivation medium for efficient gene transfer. DNA constructs containing four genes encoding the enzymes phosphinothricin acetyl transferase, beta-glucuronidase (GUS), neomycin phosphotransferase, and an alpha-amylase inhibitor were used to transform subterranean clover. Transgenic shoots were selected on a medium containing 50 mg/L of phosphinothricin. Four commercial cultivars of subterranean clover (representing all three subspecies) have been successfully transformed. Southern analysis revealed the integration of T-DNA into the subterranean clover genome. The expression of the introduced genes has been confirmed by enzyme assays and northern blot analyses. Transformed plants grown in the glasshouse showed resistance to the herbicide Basta at applications equal to or higher than rates recommended for killing subterranean clover in field conditions. In plants grown from the selfed seeds of the primary transformants, the newly acquired gene encoding GUS segregated as a dominant Mendelian trait.

7.
NAL Call No.: 30-Ad9
Agronomic improvement in oilseed brassicas.
Downey, R. K.; Rimmer, S. R. *Adv-agron. San Diego, Calif. : Academic Press. 1993. v. 50 p. 1-66.*
Includes references.

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

8.
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. *Crop-sci* v.33(4): p.847-852. (1993 July-1993 Aug.)
Includes references.

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; thifensulfuron-

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.

9.
NAL Call No.: S77.I56
Applications of biotechnology to crop improvement.
Warnes, D. D.; Somers, D. A. *Innovations-Univ-Minn-West-Cent-Exp-Stn* v.2(1): p.5. (1992 Winter)

Descriptors: plant-breeding; genetic-engineering; genetic-resistance; herbicide-resistance; pest-resistance

10.
NAL Call No.: 79.8-W41
Applications of molecular biology in weed science.
Dyer, W. E. *Weed-Sci* v.39(3): p.482-488. (1991 July-1991 Sept.)
Paper presented at the "Symposium on New Techniques adn Advances in Weed Physiology and Molecular Biology," February 6, 1991, Louisville, Kentucky.

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; gene-cloning

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.

11.
NAL Call No.: SB113.2.S45
Asgrow's genetically engineered soybean has farmers excited.
Cutler, K. *Seed-Ind. Cedar Falls, IA : Freiberg Pub. Co. Oct 1991. v. 42 (9) p. 7, 17.*

Descriptors: glycine-max; herbicide-resistance; genetic-engineering; patents-; self-pollination; plant-variety-protection-act; asgrow-; agracetus-

12.
NAL Call No.: QP601.M49
The bar gene as selectable and screenable marker in plant engineering.
D'Halluin, K.; Block, M. d.; Denecke, J.; Janssens, J.; Leemans, J.; Reynaerts, A.; Botterman, J. *Methods-*

Enzymol (216): p.397-414. (1992)
In the series analytic: Recombinant DNA (part G) / edited by R. Wu.

Descriptors: plants-; bilanafos-; herbicide-resistance; reporter-genes; marker-genes; genetic-transformation; plant-breeding; molecular-biology; tissue- cultures

13.
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. *Bio/technology-Nat-Publ-Co* v.11(7): p.835-836. (1993 July)
Includes references.

Descriptors: oryza-sativa; rhizoctonia-solani; transgenic-plants; genetic-transformation; disease-resistance; glyphosate-; herbicide-resistance; disease- resistance; blight-; structural-genes; acyltransferases-; phosphinothricin-acetyltransferase

14.
NAL Call No.: QH442.G4522
Biotech fix for African crops held hostage to profit motive.
Conroy, D. *Biotech-Dly. Washington, D.C. : King Pub. Group. Feb 17, 1993. v. 2 (124) p. 3.*

Descriptors: herbicide-resistance; genetic-engineering; food-crops; food-supply; Africa-

15.
NAL Call No.: SB950.2.A1J58
Biotechnology and agricultural pesticide use: an interaction between genes and poisons.
Cox, C. *J-pestic-reform* v.13(3): p.4-11. (1993 Fall)
Includes references.

Descriptors: pesticides-; biotechnology-; agriculture-; genetic-engineering; crops-; herbicide-resistance; insecticide-resistance; pest-resistance

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

16.
NAL Call No.: QH442.B5
Biotechnology in the food industry.
Beck, C. I.; Ulrich, T. *Bio/Technol* v.11(8): p.895-902. (1993 Aug.)
Includes references.

Descriptors: food-crops; plant-breeding; genetic-engineering; biotechnology-; food-quality; food-processing-quality; genetic-resistance; herbicide- resistance; plant-development

17.
NAL Call No.: SB1.H6
Biotechnology of vegetable crops.
Grierson, D. *HortScience* v.26(8): p.1025-1028. (1991 Aug.)
Paper presented at the "Colloquium on Biotechnology: Implications for Improved Quality in Horticultural Products," held at the 86th American Society for Horticultural Science Annual Meeting, July 31, 1989, Tulsa, Oklahoma.

Descriptors: vegetables-; biotechnology-; gene-transfer; genetic-resistance; herbicide-resistance; disease-resistance; antisense-dna; genes-; genetic- engineering; plant-development; gene-expression

18.
NAL Call No.: A00035
Breakthrough should lead to higher wheat yields.
Biotechnol-News. Summit, N.J. : CTB International Pub. Co. June 4, 1992. v. 12 (14) p. 1-2.

Descriptors: triticum-aestivum; genetic-engineering; micromanipulation-; herbicide-resistance

19.
NAL Call No.: A00109
Bromoxynil-tolerant cotton set for large-scale testing.
Gene-Exch v.2(1): p.1, 8. (1991 Mar.)

Descriptors: bromoxynil-; herbicide-resistance; gossypol-; field-tests; USDA-; USA-; US-environmental-protection-agency

20.
NAL Call No.: SB599.C8
Can wild species become problem weeds because of herbicide resistance? Brachypodium distachyon: a case study.
Gressel, J. T. W. I. o. S. R. I.; Kleifeld, Y. *Crop-prot* v.13(8): p.563-566. (1994 Dec.)
Includes references.

Descriptors: brachypodium-; wild-plants; herbicide-resistance; triazine-herbicides; herbicide-resistant-weeds; weed-competition; mutations-; transgenic- plants; transgenic-crops

21.
NAL Call No.: QK710.P62
The carboxy-terminal extension of the D1-precursor protein is dispensable for a functional photosystem II complex in Chlamydomonas reinhardtii.
Schrader, S.; Johanningmeier, U. *Plant-Mol-Biol-Int-J-Mol-Biol-Biochem-Genet-Eng* v.19(2): p.251-256. (1992 May)
Includes references.

Descriptors: chlamydomonas-reinhardtii; structural-genes; plant-proteins; photosystem-ii; targeted-mutagenesis; induced-mutations; genetic- transformation; photosynthesis-; oxygen-; gas-production; genetic-code; herbicide-resistance; metribuzin-; nucleotide-sequences; amino-acid- sequences; psba-gene; d1-protein; stop-codons

Abstract: The D1-precursor protein of the photosystem II reaction centre contains a carboxy-terminal extension whose proteolytic removal is necessary for oxygen-evolving activity. To address the question of the role of the carboxy-terminal extension in the green alga Chlamydomonas reinhardtii, we truncated D1 by converting codon Ser345 of the psbA gene into a stop codon. Particle gun transformation of an in vitro modified psbA gene fragment also carrying mutations conferring herbicide resistance yielded a homoplasmic transformant containing the stop codon. Since oxygen evolution capacity is not affected in this mutant as compared with herbicide-resistant control cells, the carboxy-terminal extension is dispensable for a functional photosystem II complex under normal growth conditions.

22.
NAL Call No.: TP248.27.P55P53-1991
Cell selection.
Loh, W. H. T. *Plant biotechnology comprehensive biotechnology, second supplement / volume editors, Michael W Fowler and Graham S Warren; editor-in-chief, Murray Moo-Young. Oxford : Pergamon Press, 1992.. p. 33-*

44.
Literature review.

Descriptors: plants-; mutants-; induced-mutations; in-vitro-selection; herbicide-resistance; salt-tolerance; metal-tolerance; heavy-metals; disease- resistance; tissue-culture; cell-culture; literature-reviews

23.
NAL Call No.: QD1.A45
Challenges of pest control with enhanced toxicological and environmental safety. An overview.
Duke, S. O.; Menn, J. J.; Plimmer, J. R. *A-C-S-Symp-Ser-Am-Chem-Soc* (524): p.1-13. (1993)
In the series analytic: Pest control with enhanced environmental safety / edited by S.O. Duke, J.J. Menn, and J.R. Plimmer.

Descriptors: pest-control; plant-protection; legislation-; microbial-pesticides; pesticides-; genetic-engineering; environmental-protection

Abstract: Much of the increase in agricultural productivity over the past half century has been due to more efficacious and economical pest control through the use of synthetic chemical pesticides (SCPs). However, there is continued and growing social and legislative pressure to reduce the toxicological and environmental risks associated with control of agricultural pests with SCPs. Public and private sector research is being conducted to develop biorational pesticides and to replace or reduce the use of SCPs with natural product-based pesticides, biocontrol (including classical biocontrol), genetically-engineered pest resistance, and combinations of these replacement strategies. Nevertheless, these emerging pest control technologies will likely represent only a small percentage of the pest control market by the year 2000. Therefore, methods to reduce use rates of synthetic pesticides and to develop more environmentally and toxicologically benign pesticides are also important in risk abatement. Such strategies as biorational design, development of pesticide synergists, and development of crops resistant to more environmentally safe herbicides, insects, and plant pathogens can improve the environmental quality, food safety, and allay societal fears concerning crop protection technology.

24.
NAL Call No.: 442.8-Z8
Characterization of transgenic sulfonylurea-resistant flax (Linum usitatissimum).
McSheffrey, S. A.; McHughen, A.; Devine, M. D. *Theor-Appl-Genet* v.84(3/4): p.480-481. (1992)
Includes references.

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-; metsulfuron-methyl; acetolactate-synthase

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.

25.
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. *Sov-Biotechnol* (3): p.27-33. (1991)
Translated from: Biotekhnologiia, (3), 1991, p. 19-22, (TP248.2.B57).

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; n'-nitro-n-nitrosoguanidine-; 5-enol-pyruvylshiki-mate-3-phosphate-synthetase

26.
NAL Call No.: 64.8-C883
A comparison of two genes for sulfonylurea herbicide resistance in transgenic tobacco seedlings.
Brandle, J. E.; Morrison, M. J.; Hattori, J.; Miki, B. L. *Crop-sci* v.34(1): p.226-229. (1994 Jan.-1994 Feb.)
Includes references.

Descriptors: nicotiana-tabacum; transgenic-plants; seedlings-; herbicide-resistance; sulfonylurea-herbicides; genetic-resistance; genes-; chlorsulfuron-; genotypes-; comparisons-; dpx-r9694-

Abstract: Previous work in tobacco (Nicotiana tabacum L.) showed the csr1-1 gene for sulfonylurea resistance was inadequate for use in conjunction with a new, low residual sulfonylurea herbicide, DPX-R9674 (a mixture of (methyl 2[[[[N-4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylamino]-carbonyl]amino]sulfonyl] benzoate) and (methyl.

27.
NAL Call No.: QH442.6.T74
Competitiveness of transgenic oilseed rape.
Fredshavn, J. R.; Poulsen, G. S.; Huybrechts, I.; Rudelsheim, P. *Transgenic-res* v.4(2): p.142-148. (1995 Mar.)
Includes references.

Descriptors: brassica-napus; transgenic-plants; herbicide-resistance; glufosinate-; reporter-genes; male-sterility; structural-genes; ribonucleases-; enzyme-inhibitors; bacteria-; male-fertility; plant-competition; interspecific-competition; sinapis-alba; hordeum-vulgare; crop-density; monoculture-; crop-mixtures; intercropping-; competitive-ability; crop-yield; harvesting-date; barnase-gene; barster-gene; fertility-restoration

28.
NAL Call No.: SB610.W39
Concerns a weed scientist might have about herbicide-tolerant crops.
Radosevich, S. R.; Ghersa, C. M.; Comstock, G. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.635-639. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; weed-control; biotechnology-; ethics-

29.
NAL Call No.: SB610.W39
Concerns of seed company officials with herbicide-tolerant cultivars.
Duvick, D. N. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.640-646. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: seed-industry; transgenic-plants; herbicide-resistance; cultivars-; biotechnology-; profitability-; supply-balance; research-

30.
NAL Call No.: QH301.A76
Considerations for release of herbicide resistant crops.
Bainton, J. A. *Asp-appl-biol* (35): p.45-52. (1993)
In the series analytic: Volunteer crops as weeds / edited by R.J. Froud-Williams, C.M. Knott and P.J.W. Lutman.

Descriptors: crops-; herbicide-resistance; low-input-agriculture; crop-plants-as-weeds; volunteer-plants; herbicide-resistant-weeds; herbicides-

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

31.
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. *Biotechnol-Lett* v.13(11): p.793-798. (1991 Nov.)
Includes references.

Descriptors: nostoc-muscorum; strains-; gloeocapsa-; herbicides-; herbicide-resistance; phenotypes-; dna-; genetic-transformation; gene-transfer; mutations-; ammonia-; excretion-; photosystem-ii; nitrogen-fixation; biofertilizers-

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.

32.
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. *Pestic-Biochem-Physiol* v.40(1): p.80-85. (1991 May)
Includes references.

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.

33.
NAL Call No.: 442.8-Z8
The cost of herbicide resistance in white-chicory: ecological implications for its commercial release.
Lavigne, C.; Manac'h, H.; Guyard, C.; Gasquez, J. *Theor-appl-genet. Berlin; Springer-Verlag. Dec 1995. v. 91 (8) p. 1301-1308.*
Includes references.

Descriptors: cichorium-intybus; herbicide-resistance; chlorsulfuron-; in-vitro-selection; biotypes-; intraspecific-competition; competitive-ability; plant- development; growth-; dry-matter-accumulation; seed-set; pollen-; resistant-biotypes; susceptible-biotypes; pollen-production

Abstract: Applications for the commercial release of herbicide-resistant crops, most of them transgenic, are likely to become more frequent in the coming years. The ecological concerns raised by their large scale use call for risk-assessment studies. One of the major issues in such studies is the relative fitness of the resistant line compared to the susceptible when no herbicide is applied since this will largely determine the long-term fate of the resistance gene outside of the field. Here we report on a comparison of a sulfonylurea-resistant line of white-chicory regenerated from a non-mutagenized cell culture with a supposedly isogenic susceptible biotype. The plants were grown in experimental plots at a range of densities in a replacement series. The reproductive output of the plants decreased with increasing density but no significant difference was found between the two lines for any vegetative or reproductive trait at any density. This suggests that no cost is associated with the mutation causing the resistance and that the resistance gene would not be selected against if it escaped to populations of wild chicories.

34.
NAL Call No.: SB113.2.S45
Cotton meets the biotech challenge: genetic engineering races to the marketplace.
Cutler, K. *Seed-Ind. Cedar Falls, IA : Freiberg Pub. Co. Nov 1991. v. 42 (10) p. 4-5, 19.*

Descriptors: gossypium-; bromoxynil-; herbicide-resistance; genetic-engineering; field-tests; sulfonylurea-herbicides; USDA-; roundup-resistance; agracetus-

35.
NAL Call No.: 450-P692
Decrease in activity in glutathione reductase enhances paraquat sensitivity in transgenic Nicotiana tabacum.
Aono, M.; Saji, H.; Fujiyama, K.; Sugita, M.; Kondo, N.; Tanaka, K. *Plant-physiol* v.107(2): p.645-648. (1995 Feb.)
Includes references.

Descriptors: nicotiana-tabacum; plasmids-; gene-transfer; antisense-dna; genetic-regulation; transgenic-plants; glutathione-reductase-nadph; enzyme- activity; leaves-; paraquat-; susceptibility-; light-; chlorophyll-; electrolytes-; oxidation-; stress-response

Abstract: Transgenic tobacco (Nicotiana tabacum L. cv SR1) with decreased activity of glutathione reductase exhibited enhanced sensitivity to paraquat in the light as evaluated by chlorophyll destruction and electrolyte leakage from leaf discs. This result indicates the involvement of glutathione reductase in the tolerance of plants to photooxidative stress caused by the herbicide.

36.
NAL Call No.: QK710.P62
Definition and characterization of an artificial En/Spm-based transposon tagging system in transgenic tobacco.
Cardon, G. H.; Frey, M.; Saedler, H.; Gierl, A. *Plant-mol-biol* v.23(1): p.157-178. (1993 Oct.)
Includes references.

Descriptors: nicotiana-tabacum; zea-mays; transposable-elements; insertional-mutagenesis; transgenic-plants; genetic-transformation; genetic-change; deletions-; beta-glucuronidase-; dihydrofolate-reductase; reporter-genes; marker-genes; bilanafos-; herbicide-resistance; somatic-excision; germinal-excision; bar-gene; transposition-

Abstract: A transposon tagging system for heterologous hosts, based on the maize En/Spm transposable element, was developed in transgenic tobacco. In this system, the two En-encoded trans-acting factors necessary for excision are expressed by fusing their cDNAs to the CaMV 35S promoter. The dSpm receptor component is inserted in the 5'-untranslated leader of the bar gene. Germinal revertants can therefore be selected by seed germination on L-PPT-containing medium or by spraying seedlings with the herbicide Basta. Using this bar-based excision reporter construct, an average frequency of germinal excision of 10.1% was estimated for dSpm-S, an En/Spm native internal deletion derivative. Insertion of En- foreign sequences in a receptor, such as a DHFR selectable marker gene in dSpm-DHFR, does not abolish its capacity to transpose. However, dSpm-DHFR has a lower frequency of somatic and germinal excision than dSpm-S. Revertants carrying a transposed dSpm-DHFR element can be selected with methotrexate. Germinal excision is frequently associated with reinsertion but, as in maize, dSpm has a tendency to integrate at chromosomal locations linked to the donor site. Concerning the timing of excision, independent germinal transpositions are often found within a single seed capsule. All activity parameters analysed suggest that transposon tagging with this system in heterologous hosts should be feasible.

37.
NAL Call No.: SB951.P47
Detoxification and activation of agrochemicals in plants.
Cole, D. J. *Pestic-sci* v.42(3): p.209-222. (1994 Nov.)
Paper presented at the symposium, "Current Themes In Pharmaceuticals and Agrochemicals : Principles and Differences", December 7, 1993, London, England.

Descriptors: herbicides-; crops-; weeds-; metabolic-detoxification; mode-of-action; glutathione-transferase; enzyme-activity; herbicide-resistant-weeds; transgenic-plants; genetic-engineering; biotechnology-; herbicide-resistant-crops

Abstract: Plants are able to metabolize agrochemicals and other foreign compounds by a variety of mechanisms and with extraordinary species diversity. Minor structural alterations of these compounds can bring about dramatic and unpredictable changes in the routes of their metabolism. The enzymes responsible for this exist in multiple forms which renders prediction of herbicide metabolism and, therefore, of selectivity, difficult. In some notable instances, pesticides are activated by plant metabolism. In the main, however, mechanisms such as hydroxylation dealkylation and glutathione conjugation bring about detoxification and form the basis of herbicide selectivity. The properties of oxygenating and conjugating enzymes in plants are highlighted, with emphasis on the evident narrow substrate specificities, species differences and physiological roles. The molecular cloning of the genes specifying these enzymes will permit a much better definition of these mechanisms and will illuminate the natural roles of the enzymes involved. The prospects for utilizing recombinant enzymes as tools for the rational design of new selective herbicides are discussed. Herbicide safeners can protect certain crops from herbicide injury by promoting herbicide metabolism. The precise mechanisms of safener action and the reasons for their specificity are attracting much interest but are at present obscure. Natural variation in detoxification abilities of weed populations has allowed the field selection of some biotypes resistant to repeatedly used herbicides. By analogy, the introduction of microbial detoxification genes into major crops through genetic transformation has created new herbicide- resistant crops which will enhance the flexibility.

38.
NAL Call No.: TP248.27.P55P52
Developing herbicide resistance in crops by gene transfer technology.
Stalker, D. M. *Plant-Biotechnol. New York, N.Y. : Chapman and Hall. 1991. v. 1 p. 82-104.*
In the series analytic: Plant genetic engineering / edited by D. Grierson.

Descriptors: crops-; gene-transfer; herbicide-resistance; genetic-transformation; vectors-; plasmids-; transgenics-; agrobacterium-tumefaciens; agrobacterium-rhizogenes; direct-dna-uptake; literature-reviews

39.
NAL Call No.: SB610.W39
Developing herbicide-tolerant crop cultivars: introduction.
Harrison, H. F. Jr. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.613-614. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; cultivars-; genotypes-; genetic-engineering; biotechnology-; genetically-engineered-organisms

40.
NAL Call No.: SB319.2.F6F56
Development and breeding of herbicide tolerant lettuce.
Nagata, R. T.; Dusky, J. A.; Torres, A. C.; Cantliffe, D. J.; Ferl, R. J.; Bewick, T. A. *Proc-annu-meet-Fla-State-Hort-Soc. [S.l.] : The Society,. May 1993. v. 105 p. 358-361.*
Meeting held November 3-5, 1992, Tampa, Florida.

Descriptors: lactuca-sativa; herbicide-resistance; lines-; glyphosate-; genetic-resistance; imazethapyr-; genes-; lactuca-serriola; plant-breeding; backcrossing-; segregation-; dominance-; inheritance-; genetic-transformation; homozygosity-; agrobacterium-tumefaciens; weed-control; chemical-control

41.
NAL Call No.: 64.8-C883
Development, identification, and characterization of a glyphosate-tolerant soybean line.
Padgette, S. R.; Kolacz, K. H.; Delannay, X.; Re, D. B.; LaVallee, B. J.; Tinius, C. N.; Rhodes, W. K.; Otero, Y. I.; Barry, G. F.; Eichholtz, D. A. *Crop-sci* v.35(5): p.1451-1461. (1995 Sept.-1995 Oct.)
Includes references.

Descriptors: glycine-max; lines-; genetic-resistance; herbicide-resistance; glyphosate-; transgenic-plants; genetic-transformation; agrobacterium- tumefaciens; plasmid-vectors; gene-expression; inheritance-; genes-; dominance-; stability-; transgenes-

Abstract: Glyphosate (N-phosphonomethyl-glycine) is the active ingredient in the nonselective herbicide Roundup. The sensitivity of crop plants to glyphosate has limited its in-season use as a postemergence herbicide. The extension of the use of Roundup herbicide to allow in-season application in major crops such as soybeans [Glycine max (L.) Merr.] would provide new weed control options for farmers. A glyphosate- tolerant soybean line, 40-3-2, was obtained through expression of the bacterial 5-enolpyruvylshikimate-3-phosphate synthase (EPSP synthase, EPSPS) enzyme from Agrobacterium sp. strain CP4. Line 40-3-2 is highly tolerant to glyphosate, showing no visual injury after application of up to 1.68 kg acid equivalent (a.e.) ha-1 of glyphosate under field conditions. Molecular characterization studies determined that the single genetic insert in line 40-3-2 contains only a portion of the cauliflower mosaic virus 35S promoter (P-E35S), the Petunia hybrida EPSPS chloroplast transit peptide (CTP), the CP4 EPSPS gene, and a portion of the 3' nontranslated region of the nopaline synthase gene (NOS 3') terminator. Inheritance studies have shown that the transgene behaves as a single dominant gene and is stable over several generations.

42.
NAL Call No.: 442.8-Z34
Development of a transformation system for the thermophilic fungus Talaromyces sp. CL240 based on the use of phleomycin resistance as a dominant selectable marker.
Jain, S.; Durand, H.; Tiraby, G. *M-G-G-Mol-Gen-Genet* v.234(3): p.489-493. (1992 Sept.)
Includes references.

Descriptors: talaromyces-; genetic-transformation; reporter-genes; genetic-markers; glufosinate-; herbicide-resistance; vectors-; plasmids-; actinomycetales-; promoters-; trichoderma-longibrachiatum; ble-gene; streptoalloteichus-hindustanus

Abstract: A transformation system for the thermophilic cellulolytic fungus Talaromyces sp. CL240 has been developed, using the phleomycin resistance gene from Streptoalloteichus hindustanus (Sh ble) as a dominant selectable marker. The plasmids (pAN8-1 and pUT720) carrying the Sh ble gene under the control of the Aspergillus nidulans glyceraldehyde-3-phosphate dehydrogenase (gpd) promoter, allowed selection of phleomycin-resistant transformants. A new promoter sequence cloned from chromosomal DNA of Trichoderma reesei (pUT737) was also able to drive efficient expression of the Sh ble gene in Talaromyces sp. CL240, resulting in the selection of transformants that were highly resistant to phleomycin.

43.
NAL Call No.: 442.8-Z34
Directed excision of a transgene from the plant genome.
Russell, S. H.; Hoopes, J. L.; Odell, J. T. *M-G-G-Mol-Gen-Genet* v.234(1): p.49-59. (1992 July)
Includes references.

Descriptors: nicotiana-tabacum; arabidopsis-thaliana; agrobacterium-tumefaciens; bacteriophages-; genetic-transformation; transgenics-; recombination- ; deletions-; reporter-genes; beta-glucuronidase-; oxo-acid-lyases-; herbicide-resistance; sulfonylurea-herbicides; genes-; loxp-cre-excision; gene-deletion; cre-gene; bacteriophage-p1; site-specific-recombination; acetolactate-synthase

Abstract: The effectiveness of loxP-Cre directed excision of a transgene was examined using phenotypic and molecular analyses. Two methods of combining the elements of this system, re-transformation and cross pollination, were found to produce different degrees of excision in the resulting plants. Two linked traits, beta-glucuronidase (GUS) and a gene encoding sulfonylurea-resistant acetolactate synthase (ALS(r)), were integrated into the genome of tobacco and Arabidopsis. The ALS(r) gene, bounded by loxP sites, was used as the selectable marker for transformation. The directed loss of the ALS(r) gene through Cre-mediated excision was demonstrated by the loss of resistance to sulfonylurea herbicides and by Southern blot analysis. The beta-glucuronidase gene remained active. The excision efficiency varied in F1 progeny of different lox and Cre parents and was correlated with the Cre parent. Many of the lox X Cre F1 progeny were chimeric and some F2 progeny retained resistance to sulfonylureas. Re-transformation of lox/ALS/lox/GUS tobacco plants with cre led to much higher efficiency of excision. Lines of tobacco transformants carrying the GUS gene but producing only sulfonylurea-sensitive progeny were obtained using both approaches for introducing cre. Similarly, Arabidopsis lines with GUS activity but no sulfonylurea resistance were generated using cross pollinations.

44.
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. *Nature* v.363(6430): p.620-623. (1993 June)
Includes references.

Descriptors: brassica-napus-var; -oleifera; transgenics-; genetic-engineering; ecology-; invasiveness-

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.

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

45.
NAL Call No.: 442.8-Z8
Effect of oilseed rape genotype on the spontaneous hybridization rate with a weedy species: an assessment of transgene dispersal.
Baranger, A.; Chevre, A. M.; Eber, F.; Renard, M. *Theor-appl-genet. Berlin; Springer-Verlag. Nov 1995. v. 91 (6/7) p. 956-963.*
Includes references.

Descriptors: brassica-napus; raphanus-raphanistrum; transgenic-plants; marker-genes; glufosinate-; herbicide-resistance; outcrossing-; hybrids-; intergeneric-hybridization; flow-cytometry; chromosome-number; seed-size; triploidy-; diploidy-; line-differences; genotypes-; seed-set; male- fertility; bar-gene

Abstract: Spontaneous outcrossing of different male-sterile rapeseed lines and transgenic hybrids with a population of a weedy species, Raphanus raphanistrum L., has led to the harvest of numerous seeds showing a size dimorphism. Flow cytometry analysis correlated with chromosome counts showed that all of the large seeds belonged to rapeseed, whereas the small seeds were a mixture of mostly interspecific triploid hybrids, with some trigenomic amphidiploids, diploid and haploid rapeseed plants. Significant differences were revealed between the rapeseed lines and transgenic hybrids in their ability to form interspecific hybrids with Raphanus raphanistrum under natural conditions. Resistance to the herbicide Basta was properly expressed in the triploid and amphidiploid hybrids. Low male fertility of the interspecific triploid hybrids was not correlated with seed set in the subsequent generation.

46.
NAL Call No.: QK725.P54
Efficient Agrobacterium-mediated transformation of Arabidopsis thaliana using the bar gene as selectable marker.
Akama, K.; Puchta, H.; Hohn, B. *Plant-cell-rep* v.14(7): p.450-454. (1995)
Includes references.

Descriptors: arabidopsis-thaliana; genetic-transformation; agrobacterium-tumefaciens; gene-transfer; marker-genes; reporter-genes; hypocotyls-; roots-; explants-; chimeras-; bilanafos-; herbicide-resistance; genetic-code; glufosinate-; transferases-; culture-media; in-vitro-culture

Abstract: We have established an efficient Agrobacterium-mediated transformation procedure for Arabidopsis thaliana genotype C24 using the chimeric bialaphos resistance gene (bar) coding for phosphinothricin acetyltransferase (PAT). Hypocotyl explants from young seedlings cocultivated with agrobacteria carrying a bar gene were selected on shoot-inducing media containing different concentrations of phosphinothricin (PPT) which is an active component of bialaphos. We found that 20 mg/l of PPT completely inhibited the control explants from growing whereas the explants transformed with the bar gene gave rise to multiple shoots resistant to PPT after 3 weeks under the same selection conditions. The transformation system could also be applied to root explants. Resulting plantlets could produce viable seeds in vitro within 3 months after preparation of the explants. The stable inheritance of the resistance trait, the integration and expression of the bar gene in the progeny were confirmed by genetic tests, Southern analysis and PAT enzyme assay, respectively. In addition, the mature plants in soil showed tolerance to the herbicide Basta.

47.
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. *Theor-Appl-Genet* v.83(5): p.645-649. (1992)
Includes references.

Descriptors: gossypium-hirsutum; nicotiana-tabacum; agrobacterium-tumefaciens; alcaligenes-; genetic-transformation; transgenics-; gene-transfer; genes-; oxidoreductases-; 2,4-d-; herbicide-resistance; inheritance-; enzyme-activity; 2,4-d-monooxygenase; tfda-gene; alcaligenes-eutrophus

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.

48.
NAL Call No.: QD1.A45
Engineering crop resistance to the naturally occurring glutamine synthetase inhibitor phophinothricin.
Mullner, H.; Eckes, P.; Donn, G. *A-C-S-Symp-Ser-Am-Chem-Soc* (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.

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.

49.
NAL Call No.: SB951.P49
Engineering cyanobacterial models resistant to bleaching herbicides.
Windhovel, U.; Geiges, B.; Sandmann, G.; Boger, P. *Pestic-biochem-physiol* v.49(1): p.63-71. (1994 May)
Includes references.

Descriptors: synechococcus-; strains-; herbicide-resistance; genes-; enzymes-; erwinia-uredovora; genetic-transformation; gene-expression; herbicides-; cross-resistance; carotenoids-; biosynthesis-; biochemical-pathways; phytoene-desaturase

Abstract: Enzymes catalyzing the dehydrogenation steps of the carotenoid biosynthetic pathway are target sites for bleaching herbicides. We introduced the gene crtI, coding for phytoene desaturase of the nonphotosynthetic bacterium Erwinia uredovora into the cyanobacterium Synechococcus PCC 7942, using it as a convenient experimental model for higher-plant transformation. The heterologous expression of the foreign gene in the transformants was demonstrated by Western blot analysis. The respective gene product CRTI, the enzyme phytoene desaturase, catalyzes the conversion of phytoene to lycopene via phytofluene, zeta-carotene, and neurosporene. It is highly resistant against various herbicides that affect either phytoene or zeta-carotene desaturase activity. Molar I50 values of carotenoid synthesis caused by various bleaching herbicides and determined at the intact cell revealed that the transformant strains exhibited strong cross-resistance toward the

herbicides assayed. Resistance factors were more than 3 orders of magnitude greater than those of the control strain.

50.
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.*
Literature review.

Descriptors: crops-; nicotiana-tabacum; genetic-engineering; transgenics-; genetic-transformation; herbicide-resistance; herbicides-; 2,4-d-; enzymes-; microbial-degradation; oxygenases-; genes-; alcaligenes-; literature-reviews; alcaligenes-eutrophus; 2,4-d-monooxygenase; tfda-gene

51.
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. *Theor-Appl-Genet* v.85(5): p.568-576. (1993 Jan.)
Includes references.

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; complementary-dna; methyl-viologen

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.

52.
NAL Call No.: SB610.W39
Environmental concerns with the development of herbicide-tolerant plants.
Goldburg, R. J. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.647-652. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

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-

53.
NAL Call No.: SB610.W39
EPA's response to resistance management and herbicide--tolerant crop issues.
Horne, D. M. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.657-661. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; herbicide-resistance; public-agencies; biotechnology-; regulation-; legislation-; USA-; US-environmental-protection-agency

54.
NAL Call No.: SB123.P535
Evaluating the effectiveness of isolation distances for field plots of oilseed rape (Brassica napus) using a herbicide-resistance transgene as a selectable marker.
Scheffler, J. A.; Parkinson, R.; Dale, P. J. *Plant-breed* v.114(4): p.317-321. (1995 Aug.)
Includes references.

Descriptors: brassica-napus; transgenic-plants; herbicide-resistance; glufosinate-; structural-genes; acyltransferases-; hybridization-; cross-pollination; pollen-; dispersal-; spatial-distribution; fields-; experimental-plots; hybrids-; pollinators-; non-transgenic-plants; bar-gene; phosphinothricin-acetyltransferase

55.
NAL Call No.: 100-L939
Evaluation of roundup ready transgenic soybean in Louisiana.
Griffin, J. L.; Reynolds, D. B.; Jordan, D. L.; Prochaska, L. M.; Rogers, R. L. *La-agric* v.37(3): p.23. (1994 Summer)

Descriptors: glycine-max; transgenics-; glyphosate-; agrobacterium-tumefaciens; weed-control; herbicide-resistance; Louisiana-

56.
NAL Call No.: QK710.P62
Expression of a bacterial gene in transgenic plants confers resistance to the herbicide phenmedipham.
Streber, W. R.; Kutschka, U.; Thomas, F.; Pohlenz, H. D. *Plant-mol-biol* v.25(6): p.977-987. (1994 Sept.)
In the special issue: Molecular breeding.

Descriptors: nicotiana-tabacum; arthrobacter-; gene-transfer; esterases-; herbicide-resistance; phenmedipham-; transgenic-plants; recombinant-dna; arthrobacter-oxidans; phenmedipham-hydrolase; phenmedipham-carbamate-hydrolase

Abstract: Tobacco plants were genetically engineered to express a detoxifying pathway for the herbicide phenmedipham. A gene from Arthrobacter oxidans strain P52 that encodes an enzyme catalysing the hydrolytic cleavage of the carbamate compound phenmedipham has recently been cloned and sequenced. The coding sequence was fused with a cauliflower mosaic virus 35S promoter and introduced into tobacco plants by Agrobacterium-mediated gene transfer. Transgenic plants expressing high levels of phenmedipham hydrolase exhibited resistance when sprayed with the herbicide at up to ten times the usual field application rate.

57.
NAL Call No.: 450-P692
Expression of a maize ubiquitin gene promoter-bar chimeric gene in transgenic rice plants.
Toki, S.; Takamatsu, S.; Nojiri, C.; Ooba, S.; Anzai, H.; Iwata, M.; Christensen, A. H.; Quail, P. H.; Uchimiya, H. *Plant-physiol* v.100(3): p.1503-1507. (1992 Nov.)
Includes references.

Descriptors: oryza-sativa; promoters-; introns-; exons-; structural-genes; ubiquitin-; recombinant-dna; reporter-genes; marker-genes; acyltransferases-; genetic-transformation; direct-dna-uptake; electroporation-; transgenic-plants; bilanafos-; herbicide-resistance; streptomyces-; gene-expression; callus-; regenerative-ability; ubi1-gene; bar-gene; phosphinothricin-acetyltransferase; streptomyces-hygroscopicus

Abstract: We have constructed a chimeric gene consisting of the promoter, first exon, and first intron of a maize ubiquitin gene (Ubi-1) and the coding sequence of the bar gene from Streptomyces hygroscopicus. This

construct was transferred into rice (Oryza sativa L.) protoplasts via electroporation, and 10 plants were regenerated from calli that had been selected for resistance to exogenously supplied bialaphos. Transgenic plants grown in a greenhouse were resistant to both bialaphos and phosphinothricine at a dosage lethal to untransformed control plants. Evidence of stable integration of the transferred gene into the genome of the regenerated primary transformant plants was obtained from Southern blot analysis. In addition, northern blot analysis indicated expression and proper splicing of the maize ubiquitin gene first intron from the primary chimeric transcript in these transgenic rice plants, and western blot analysis and enzymic assays verified expression of the active bar gene product. Apparent mendelian segregation for bialaphos resistance in T1 progeny of primary transformants was confirmed.

58.
NAL Call No.: QK710.P68
Expression of an Erwinia phytoene desaturase gene not only confers multiple resistance to herbicides interfering with carotenoid biosynthesis but also alters xanthophyll metabolism in transgenic plants.
Misawa, N.; Masamoto, K.; Hori, T.; Ohtani, T.; Boger, P.; Sandmann, G. *Plant-j* v.6(4): p.481-489. (1994 Oct.)
Includes references.

Descriptors: nicotiana-tabacum; erwinia-uredovora; oxygenases-; structural-genes; gene-transfer; herbicide-resistance; norflurazon-; carotenoids-; xanthophyll-; biosynthesis-; transgenic-plants; xanthophylls-; crtl-gene

59.
NAL Call No.: 450-P692
Expression of engineered nuclear male sterility in Brassica napus. Genetics, morphology, cytology, and sensitivity to temperature.
Denis, M.; Delourme, R.; Gourret, J. P.; Mariani, C.; Renard, M. *Plant-physiol* v.101(4): p.1295-1304. (1993 Apr.)
Includes references.

Descriptors: brassica-napus; male-sterility; recombinant-dna; ribonucleases-; structural-genes; anthers-; linkage-; marker-genes; reporter-genes; bilanafos-; glufosinate-; herbicide-resistance; genetic-transformation; transgenic-plants; segregation-; stamens-; pollen-; gametogenesis-; temperature-; tapetum-; barnase-; microsporogenesis-

Abstract: A dominant genetic male sterility trait obtained through transformation in rapeseed (Brassica napus) was studied in the progenies of 11 transformed plants. The gene conferring the male sterility consists of a ribonuclease gene under the control of a tapetum-specific promoter. Two ribonuclease genes, RNase T1 and barnase, were used. The chimaeric ribonuclease gene was linked to the bialophos-resistance gene, which confers resistance to the herbicide phosphinotricine (PPT). The resistance to the herbicide was used as a dominant marker for the male sterility trait. The study presented here concerns three aspects of this engineered male sterility: genetics correlated with the segregation of the T-DNA in the progenies; expression of the male sterility in relation to the morphology and cytology of the androecium; and stability of the engineered male sterility under different culture conditions. Correct segregation, 50% male-sterile, PPT-resistant plants, and 50% male-fertile, susceptible plants were observed in the progeny of seven transformants. The most prominent morphological change in the male-sterile flowers was a noticeable reduction in the length of the stamen filament. The first disturbances of microsporogenesis were observed from the free microspore stage and were followed by a simultaneous degeneration of microspore and tapetal cell content. At anthesis, the sterile anthers contained only empty exines. In some cases, reversion to fertility of male-sterile plants has been observed. Both ribonuclease genes are susceptible to instability. Instability of the RNase T1-male sterility trait increased at temperatures higher than 25 degrees C. Our results do not allow us to confirm this observation for the barnase male-sterile plants. However, the male-sterile.

60.
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. *Plant-physiol* v.104(1): p.119-125. (1994 Jan.)
Includes references.

Descriptors: synechococcus-; erwinia-uredovora; genetic-transformation; structural-genes; oxygenases-; recombinant-dna; promoters-; gene-expression; herbicide-resistance; norflurazon-; carotenoids-; biosynthesis-; phytoene-; crti-gene; psba-gene

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.

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

61.
NAL Call No.: QK725.P54
Expression of phosphinothricin acetyltransferase from the root specific par promoter in transgenic tobacco plants is sufficient for herbicide tolerance.
Hoeven, C. v. d.; Dietz, A.; Landsmann, J. *Plant-cell-rep* v.14(2/3): p.165-170. (1994)
Includes references.

Descriptors: nicotiana-tabacum; gene-transfer; genes-; transgenic-plants; gene-expression; roots-; glufosinate-; transferases-; enzyme-activity; herbicide- resistance; phytotoxicity-; restriction-mapping; pat-genes; parasponia-andersonii

Abstract: The pat gene, coding for phosphinothricin acetyltransferase (PAT) from Streptomyces viridochromogenes, was cloned behind the par promoter of the hemoglobin gene from Parasponia andersonii. Introduction into tobacco (Nicotiana tabacum) resulted in predominantly root specific PAT expression. Application of 5 l/ha BASTA (herbicidal component: phosphinothricin) did not effect growth morphology and vigor of the plants. After application of 20 l/ha BASTA the plants showed herbicide damage. Nevertheless, they all recovered by forming new undamaged leaves and resumed full growth despite virtually non-detectable expression of the PAT enzyme in the leaves.

62.
NAL Call No.: QK725.P54
Expression of the hydromycin B phosphotransferase gene confers tolerance to the herbicide glyphosate.
Penaloza Vazquez, A.; Oropeza, A.; Mena, G. L.; Bailey, A. M. *Plant-cell-rep* v.14(8): p.482-487. (1995)
Includes references.

Descriptors: nicotiana-tabacum; escherichia-coli; genetic-transformation; gene-transfer; genetic-code; hygromycin-b; phosphotransferases-; gene- expression; glyphosate-; herbicide-resistance; transgenic-plants; in-vitro-culture; callus-; cell-growth; culture-media; enzyme-activity; substrates- ; kanamycin-

Abstract: Escherichia coli cells and tobacco (cv. Xanthi) plants transformed with the hygromycin B phosphotransferase gene were able to grow in culture medium containing glyphosate at 2.0 mM. The growth of tobacco calli in media containing increasing glyphosate concentrations was measured. The ID50 for glyphosate

was 1.70 +/- 0.03 mM for hygromycin-B resistant plants, and 0.45 +/- 0.02 mM for control plants. Regenerated plants and progeny selected for resistance to hygromycin B were tested for glyphosate tolerance by spraying them with Faena herbicide (formulated glyphosate with surfactant) at a dose equal to 0.24 kg/ha. This was two times the dose required to kill 100 percent of the control plants. Phosphotransferase activity was measured in the extracts of the transformed leaves by the incorporation of 32p from [gamma- 32P]ATP and it was observed that hygromycin B phosphotransferase was able to recognize the molecule of glyphosate as substrate.

63.
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. *Genetics* v.131(4): p.803-809. (1992 Aug.)
Includes references.

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-; deficient-mutants

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.

64.
NAL Call No.: QH442.B5
Fertile, transgenic oat plants.
Somers, D. A.; Rines, H. W.; Gu, W.; Kaeppler, H. F.; Bushnell, W. R. *Bio/Technol* v.10(12): p.1589-1594. (1992 Dec.)
Includes references.

Descriptors: avena-sativa; transgenics-; genetic-transformation; callus-; direct-dna-uptake; reporter-genes; beta-glucuronidase-; phosphotransferases-; glufosinate-; herbicide-resistance; regenerative-ability; fertility-; inheritance-; histoenzymology-; microprojectile-bombardment; uida-gene; bar-gene

65.
NAL Call No.: 100-L93-3
Field evaluation of genetically engineered glufosinate-resistant rice lines.
Linscombe, S. D.; Christou, P.; Braverman, M. P.; Jodari, F. *Annu-res-rep-La-State-Univ-Baton-Rouge,-La*, (85th): p.96-100. (1993)

Descriptors: oryza-sativa; crop-plants-as-weeds; oryza-sativa; genetic-resistance; glufosinate-; herbicide-resistance; cultivars-; Louisiana-

66.
NAL Call No.: 100-L939

Field evaluation of genetically engineered glufosinate resistant rice lines.
Braverman, M. P.; Linscombe, S. D. *La-agric* v.37(3): p.29. (1994 Summer)

Descriptors: oryza-sativa; glufosinate-; herbicide-resistance; transgenics-; field-experimentation; Louisiana-

67.
NAL Call No.: 470-SCI24
First gene-splice wheat.
Sci-News-Washington v.141(23): p.379. (1992 June)

Descriptors: triticum-aestivum; genetic-engineering; herbicide-resistance

68.
NAL Call No.: QH442.B5
From pots to plots: genetically modified plants on trial.
Goy, P. A.; Duesing, J. H. *Bio/technology-Nat-Publ-Co* v.13(5): p.454-458. (1995 May)
Includes references.

Descriptors: crops-; genetic-engineering; transgenic-plants; field-experimentation; herbicide-resistance; disease-resistance; agronomic-characteristics

69.
NAL Call No.: QK710.P68
Functional expression of Saccharomyces cerevisiae CYP51A1 encoding lanosterol-14-demethylase in tobacco results in bypass of endogenous sterol biosynthetic pathway and resistance to an obtusifoliol-14-demethylase herbicide inhibitor.
Grausem, B.; Chauber, N.; Gigot, C.; Loper, J. C.; Benveniste, P. *Plant-j* v.7(5): p.761-770. (1995 May)
Includes references.

Descriptors: nicotiana-tabacum; genetic-transformation; agrobacterium-tumefaciens; saccharomyces-cerevisiae; gene-transfer; gene-expression; genetic- code; lanosterol-; methylation-; enzymes-; enzyme-activity; biosynthesis-; biochemical-pathways; sterols-; biochemical-pathways; sterols-; herbicide-resistance; enzyme-inhibitors; transgenic-plants; callus-; plant-composition

Abstract: Nicotiana tabacum protoplasts have been transformed by Agrobacterium tumefaciens containing a T-DNA in which the gene CYP51A1 encoding lanosterol-14-demethylase (LAN14DM) from Saccharomyces cerevisiae is under the control of a cauliflower mosaic virus (CaMV) 35S promoter. Two transformants strongly expressed the LAN14DM as shown by Northern and Western experiments. These transgenic calli were killed by LAB 170250F (LAB) (a phytotoxic fungicide inhibiting both plant obtusifoliol-14-demethylase (OBT14DM and LAN14DM) but were resistant to gamma-ketotriazole (gamma-kt), a herbicide which has been shown to inhibit OBT14DM but not LAN14DM at a concentration that was lethal to control calli. However, these transgenic calli were killed by mixtures of gamma-kt plus fungicide inhibitors of LAN14DM such as ketoconazole, itraconazole or flusilazole which alone were not effective. Further analysis of the transgenic calli grown in the presence of gamma-kt showed that their delta 5-sterol content was close to that of untreated control calli obtained from protoplasts transformed with control plasmid; this is in agreement with evidence that the LAN14DM expressed from the transgene could bypass the blocked OBT14DM by using the plant substrate obtusifoliol. In contrast, control calli when treated with gamma-kt, displayed a sterol content strongly enriched in 14 alpha-methyl sterols and depressed in physiological delta 5-sterols. When the transgenic calli were cultured in mixtures of gamma-kt and LAN14DM inhibitors sterol compositions enriched in 14 alpha-methyl sterols were obtained, reflecting a strong inhibition of both 'endogenous' OBT14DM and 'exogenous' LAN14DM. Taken together these results show that in tobacco calli transformed. creates a bypass of the sterol biosynthetic pathway at the 14-demethylase level when this latter is blocked by an OBT14DM herbicide inhibitor.

70.
NAL Call No.: QK710.P68

Functional expression of the Erwinia uredovora carotenoid biosynthesis gene crtI 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. *Plant-j* v.4(5): p.833-840. (1993 Nov.)
Includes references.

Descriptors: nicotiana-tabacum; transgenics-; biosynthesis-; carotenoids-; herbicide-resistance; norflurazon-

71.
NAL Call No.: SB610.W39
Future impact of crops with modified herbicide resistance.
Wyse, D. L. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.665-668. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; biotechnology-; weed-control; development-plans

72.
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. *Nucleic-Acids-Res* v.20(15): p.3977-3982. (1992 Aug.)
Includes references.

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-dna-uptake; 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.

73.
NAL Call No.: SB218.J67
Gene transfer for herbicide resistance.
Steen, P.; Pedersen, H. C. *J-sugar-beet-res* v.30(4): p.267-274. (1993 Oct.-1993 Dec.)
Includes references.

Descriptors: beta-vulgaris; transgenic-plants; lines-; gene-transfer; herbicide-resistance; glyphosate-; genetic-transformation; glyphosate-; genetic- transformation; position-effect; agrobacterium-tumefaciens; plasmid-vectors; Denmark-; Belgium-; France-; England-; USA-; positype-

74.
NAL Call No.: 450-P692
Generation of large numbers of independently transformed fertile barley plants.
Wan, Y.; Lemaux, P. G. *Plant-physiol* v.104(1): p.37-48. (1994 Jan.)
Includes references.

Descriptors: hordeum-vulgare; genetic-transformation; transgenic-plants; direct-dna-uptake; reporter-genes; beta-glucuronidase-; acyltransferases-; barley-yellow-dwarf-luteovirus; coat-proteins; plant-embryos; callus-; regenerative-ability; organogenesis-; fertility-; phosphinothricin-acetyltransferase; biolistic-transformation; vida-gene; bar-gene

Abstract: A rapid, efficient, and reproducible system to generate large numbers of independently transformed, self-fertile, transgenic barley (Hordeum vulgare L.) plants is described. Immature zygotic embryos, young callus, and microspore-derived embryos were bombarded with a plasmid containing bar and uidA either alone or in combination with another plasmid containing a barley yellow dwarf virus coat protein (BYDVcp) gene. A total of 91 independent bialaphos-resistant callus lines expressed functional phosphinothricin acetyltransferase, the product of bar. Integration of bar was confirmed by DNA hybridization in the 67 lines analyzed. Cotransformation frequencies of 84 and 85% were determined for the two linked genes (bar and uidA) and for two unlinked genes (bar and the BYDVcp gene), respectively. More than 500 green, fertile, transgenic plants were regenerated from 36 transformed callus lines on bialaphos-containing medium; albino plants only were regenerated from 41 lines. T(0) plants in 25 lines (three plants per line) were analyzed by DNA hybridization, and all contained bar. Most contained the same integration patterns for the introduced genes (bar, uidA, and the BYDVcp gene) as their parental callus lines. Transmission of the genes to T(1) progeny was confirmed in the five families analyzed by DNA hybridization. A germination test of immature T(1) embryos on bialaphos-containing medium was useful for selecting individuals that were actively expressing bar, although this was not a good indicator of the. were in soil approximately 7 months after bombardment of the immature embryo.

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

75.
NAL Call No.: TA166.T72
Genes of jeans: biotechnological advances in cotton.
John, M. E.; Stewart, J. M. *Trends-Biotechnol* v.10(5): p.165-170. (1992 May)
Includes references.

Descriptors: gossypium-; biotechnology-; genetic-engineering; selection-criteria; agronomic-characteristics; crop-management; improvement-; fiber- quality; modification-; genes-; genetic-transformation; hybrid-cotton

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.

76.
NAL Call No.: QH442.J69
Genetic manipulation of crop plants.
Lindsey, K. *J-Biotechnol* v.26(1): p.1-28. (1992 Oct.)
In the special issue: Plant cell culture / edited by A.H. Scragg.

Descriptors: crops-; genetic-engineering; genetic-transformation; genetic-resistance; plant-development; herbicide-resistance; literature-reviews; pest- resistance

77.
NAL Call No.: 472-N42
Genetic weeding and feeding for tobacco plants.
Bradley, D. *New-Sci* v.133(1802): p.11. (1992 Jan.)

Descriptors: nicotiana-tabacum; myrothecium-verrucaria; genetic-engineering; herbicide-resistance

78.
NAL Call No.: 61.8-SE52
Genetically altered seed & how it will be distributed.
Grooms, L. *Seed-World* v.130(12): p.8-9, 11-13. (1992 Nov.)

Descriptors: seeds-; genetic-engineering; distribution-; herbicide-resistance; pest-resistance; roundup-

79.
NAL Call No.: S494.5.B563A382
Genetically-engineered herbicide-resistant crops--a moral imperative for world food production.
Gressel, J. *Agro-Ind-Hi-Tech* v.3(6): p.3-7. (1992 Nov.-1992 Dec.)
Includes references.

Descriptors: crops-; herbicide-resistance; genetic-engineering; weed-control; herbicides-

80.
NAL Call No.: S494.5.B563B554
Genetically engineered plants for herbicide resistance.
Mullineaux, P. M. *Biotechnol-Agric. Wallingford, Oxford, UK : CAB International. 1992. v. 7 p. 75-107.*
In the series analytic: Plant genetic manipulation for crop protection / edited by A.M.R. Gatehouse, V.A. Hilder and Boulter, D.

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-; herbicides-; glutathione-transferase; herbicide-safeners; chimerism-; plant-protection; amino-acid-sequences; gene-expression; mutations-; chimeric-genes; herbicide-detoxifying-genes

81.
NAL Call No.: 442.8-G28
Germinal transpositions of the maize element Dissociation from T-DNA loci in tomato.
Carroll, B. J.; Klimyuk, V. I.; Thomas, C. M.; Bishop, G. J.; Harrison, K.; Scofield, S. R.; Jones, J. D. G.
Genetics v.139(1): p.407-420. (1995 Jan.)
Includes references.

Descriptors: zea-mays; lycopersicon-esculentum; agrobacterium-tumefaciens; transposable-elements; loci-; dna-; genetic-transformation; genetic- change; germ-line; reporter-genes; beta-glucuronidase-; marker-genes; kanamycin-; drug-resistance; spectinomycin-; herbicide-resistance; glufosinate-; transferred-dna; spec-gene; bar-gene; iaah-gene; npt-gene

Abstract: We have analyzed the pattern of germinal transpositions of artificial Dissociation (Ds) transposons in tomato. T-DNA constructs carrying Ds were transformed into tomato, and the elements were trans-activated by crossing to lines transformed with a stabilized Activator (sAc) that expressed the transposase gene. The sAc T-DNA carried a GUS gene to monitor its segregation. The Ds elements were inserted in a marker gene so that excision from the T-DNA could be monitored. The Ds elements also carried a genetic marker that was intended to be used for reinsertion selection of the elements after excision. Unfortunately, this gene was irreversibly inactivated on crossing to sAc. Germinal excision frequencies of Ds averaged 15-40%, but there was large variation between and within plants. Southern hybridization analysis of stable transposed Ds elements indicated

that although unique transpositions predominate, early transposition events can lead to large clonal sectors in the germline of developing plants and to sibling offspring carrying the same transposition event. Multiple germinal transpositions from three different loci were examined for uniqueness, and 15 different transpositions were identified from each of three T-DNA loci that carried a single independent Ds. These were mapped relative to the donor T-DNA loci, and for each locus 70-80% of the transposed elements were closely linked to the donor site.

82.
NAL Call No.: 450-C16
Growth of transgenic and standard canola (Brassica napus L.) varieties in response to soil salinity.
Redmann, R. E.; Wi, M. Q.; Belyk, M. *Can-j-plant-sci* v.74(4): p.797-799. (1994 Oct.)
Includes references.

Descriptors: brassica-napus; seedling-emergence; seedling-growth; soil-salinity; transgenic-plants; leaf-area; shoots-; roots-; biomass-production; evapotranspiration-; genetic-variation; herbicide-resistance; glufosinate-

83.
NAL Call No.: SD13.C35
Growth, photosynthesis, and herbicide tolerance of genetically modified hybrid poplar.
Donahue, R. A.; Davis, T. D.; Michler, C. H.; Riemenschneider, D. E.; Carter, D. R.; Marquardt, P. E.; Sankhla, N.; Sankhla, D.; Haissig, B. E.; Isebrands, J. G. *Can-j-for-res. Ottawa, National Research Council of Canada. Dec 1994. v. 24 (12) p. 2377-2383.*
Includes references.

Descriptors: populus-alba; populus-grandidentata; hybrids-; clones-; genetic-transformation; tolerance-; herbicide-resistance; glyphosate-; growth-rate; photosynthesis-; gene-expression; agrobacterium-; ligases-

Abstract: Hybrid poplar clone NC-5339 (Populus alba X Populus grandidentata cv. Crandon) was genetically modified for glyphosate (N- (phosphonomethyl)glycine) tolerance by Agrobacterium-mediated transformation with genetic constructs (pPMG 85/587 and pCGN 1107) that included the mutant aroA gene for 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase (EC 2.5.1.19) and the neomycin phosphotransferase selectable marker gene. pCGN 1107 also harbored the coding sequence for a chloroplast transit peptide and the CaMV 35S promoter fused to the mutant aroA gene. Transformants were selected for kanamycin tolerance, and integration of the aroA gene was verified by Southern blot analysis. Cuttings of NC-5339 and the derived transformants were rooted and grown in glasshouses at separate locations, with maximum photosynthetic photon flux density of 1600 and 750 micromoles.m-2.s-1. Productivity was assessed by growth studies and photosynthesis measurements at both locations. Glyphosate tolerance was tested by (i) measurement of chlorophyll concentration in herbicide-treated leaf discs and (ii) whole-plant spray tests. Plants transformed with construct pCGN 1107 were the most herbicide tolerant. Perhaps high-level expression of the aroA gene by the CaMV 35S promoter, transport of mutant EPSP synthase into the chloroplasts, or both facilitated glyphosate tolerance. Plants grown at higher photosynthetic photon flux densities (1600 vs. 750 micromoles.m-2.s-1) had significantly higher maximum net photosynthesis (19.8 vs. 16.2 micromoles.m-2.s-1) and more biomass accumulation (47.6 vs. 33.7 g). However, there were no significant differences between NC-5339 and transformants within location for. affect plant productivity at either location.

84.
NAL Call No.: 450-C16
Growth, yield and quality of canola expressing resistance to acetolactate synthase inhibiting herbicides.
Blackshaw, R. E.; Kanashiro, D.; Moloney, M. M.; Crosby, W. L. *Can-j-plant-sci* v.74(4): p.745-751. (1994 Oct.)
Includes references.

Descriptors: brassica-napus; crop-production; growth-; crop-yield; crop-quality; herbicide-resistance; weed-control; chlorsulfuron-; genetic-regulation; plant-breeding; cultivars-; gene-transfer; genes-; arabidopsis-

thaliana; transgenic-plants; seed-weight; herbicides-; imazamethabenz-; metsulfuron-; imazethapyr-; application-rates; Alberta-; flumetsulam-; crs1-1-genes

85.
NAL Call No.: 284.28-W15
Hardy crops yield herbicide controversy.
Nazario, S. L. *Wall-St-J-East-Ed* p.B1, B4. (1991 Aug.)

Descriptors: herbicide-resistance; genetic-engineering; bromoxynil-; environmental-impact; USA-; US-environmental-protection-agency; environmental-defense-fund; national-wildlife-federation; calgene-; dekalb-genetics; du-pont; monsanto-; sandoz-; upjohn-

86.
NAL Call No.: S494.5.B563A382
Herbicide resistance.
Howard, J.; Baszczynski, C. *Agrofoodindustry-Hi-Tech* v.3(5): p.3-6. (1992 Sept.-1992 Oct.)
Includes references.

Descriptors: crops-; herbicide-resistance; biotechnology-; uses-; applications-

87.
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. *M-G-G-Mol-Gen-Genet* v.233(3): p.427-435. (1992 June)
Includes references.

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; cinosulfuron-; primisulfuron-; point-mutation; sura-gene; surb-gene; acetolactate-synthase

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.

88.
NAL Call No.: 60.18-UN33
Herbicide-resistant creeping bentgrass.
Lee, L.; Hartman, C.; Laramore, C.; Tumer, N.; Day, P. *USGA-Green-Sect-rec* v.33(2): p.16-18. (1995 Mar.-1995

Apr.)

Descriptors: agrostis-stolonifera-var; -palustris; herbicide-resistance; lawns-and-turf; transgenic-plants; golf-courses

89.
NAL Call No.: QK710.C87
Herbicide-resistant crops.
Bright, S. W. J. *Curr-topics-plant-physiol. Rockville, Md. : American Society of Plant Physiologists, 1989-. 1992. v. 7 p. 184-194.*
In the series analytic: Biosynthesis and molecular regulation of amino acids in plants / edited by B.K. Singh, H.E. Flores and J.C. Shannon. 7th Annual Penn State Symposium in Plant Physiology held May 28-30, 1992, University Park, PA.

Descriptors: plant-physiology; amino-acids; biosynthesis-; regulation-; herbicides-; enzyme-inhibitors; herbicide-resistance; kinetics-; literature-reviews

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

90.
NAL Call No.: 381-J825N
Herbicide-resistant crops focus of biotechnology debate.
Baum, R. *Chem-Eng-News* v.71(10): p.38-41. (1993 Mar.)

Descriptors: brassica-napus; herbicide-resistance; transgenics-; crops-; roundup-; monsanto-

91.
NAL Call No.: 381-J825N
Herbicide-resistant crops focus of biotechnology debate.
Baum, R. M. *Chem-Eng-News* v.71(10): p.38-41. (1993 Mar.)

Descriptors: herbicide-resistance; crops-; genetic-engineering; USDA-; public-opinion; USA-

92.
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. *Bio/Technol* v.10(6): p.662-674. (1992 June)
Includes references.

Descriptors: triticum-aestivum; genetic-transformation; direct-dna-uptake; transgenics-; gene-transfer; structural-genes; acyltransferases-; plasmids-; herbicide-resistance; glufosinate-; callus-; regenerative-ability; embryogenesis-; reporter-genes; basta-; bar-gene; phosphinothricin-acetyltransferase

93.
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. *Plant-Mol-Biol-Int-J-Mol-Biol-Biochem-Genet-Eng* v.20(4): p.619-629. (1992 Nov.)
Includes references.

Descriptors: oryza-sativa; genetic-transformation; protoplasts-; direct-dna-uptake; polyethylene-glycol; gene-transfer; transgenics-; phosphotransferases-; drug-resistance; hygromycin-b; acyltransferases-; herbicide-resistance; glufosinate-; regenerative-ability; enzyme-activity; pat-gene; phosphinothricin-acetyltransferase; hph-gene; hygromycin-phosphotransferase; bar-gene

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.

94.
NAL Call No.: 450-P692
Herbicide-resistant tobacco plants expressing the fused enzyme between rat cytochrome P4501A1 (CYP1A1) and yeast NADPH- cytochrome P450 oxidoreductase.
Shiota, N.; Nagasawa, A.; Sakaki, T.; Yabusaki, Y.; Ohkawa, H. *Plant-physiol* v.106(1): p.17-23. (1994 Sept.) Includes references.

Descriptors: nicotiana-tabacum; genetic-transformation; cauliflower-mosaic-caulimovirus; gene-transfer; transgenic-plants; gene-expression; herbicide- resistance; cytochrome-p-450; oxidoreductases-; enzyme-activity; genome-analysis; dna-; messenger-rna; protein-synthesis; chlorotoluron-

Abstract: Transgenic tobacco (Nicotiana tabacum cv Xanthi) plants expressing a genetically engineered fused enzyme between rat cytochrome P4501A1 (CYP1A1) and yeast NADPH-cytochrome P450 oxidoreductase were produced. The expression plasmid pGFC2 for the fused enzyme was constructed by insertion of the corresponding cDNA into the expression vector pNG01 under the control of the cauliflower mosaic virus 35S promoter and nopaline synthase gene terminator. The fused enzyme cDNA was integrated into tobacco genomes by Agrobacterium infection techniques. In transgenic tobacco plants, the fused enzyme protein was localized primarily in the microsomal fraction. The microsomal monooxygenase activities were approximately 10 times higher toward both 7-ethoxycoumarin and benzo[a]pyrene than in the control plant. The transgenic plants also showed resistance to the herbicide chlortoluron.

95.
NAL Call No.: SB951.P47
Herbicide-resistant transgenic tobacco plants expressing CYP1A1/P450 reductase fused enzyme.
Shiota, N.; Ohkawa, H.; Sakaki, T.; Nagasawa, A.; Yabusaki, Y. *Pestic-sci* v.44(1): p.83-84. (1995 May) Extended Summaries 8th International Congress of Pesticide Chemistry (IUPAC).

Descriptors: transgenic-plants; nicotiana-tabacum; herbicide-resistance; chlorotoluron-; metabolism-; gene-expression; oxidoreductases-; biochemical- pathways

96.
NAL Call No.: QH442.B5
Herbicide resistant turfgrass (Agrostis palustris Huds.) by biolistic transformation.
Hartman, C. L.; Lee, L.; Day, P. R.; Tumer, N. E. *Bio/technology-Nat-Publ-Co* v.12(9): p.919-923. (1994 Sept.) Includes references.

Descriptors: agrostis-stolonifera-var; -palustris; genetic-transformation; structural-genes; bilanafos-; herbicide-resistance; transgenic-plants; gene- expression; messenger-rna; bar-gene

97.
NAL Call No.: S494.5.B563N33

Herbicide tolerance in crops. 1.
Fehr, W. R. *NABC-rep* (3): p.179-198. (1991)
In the series analytic: Agricultural biotechnology at the crossroads: biological, social and institutional concerns.

Descriptors: herbicides-; tolerance-; biotechnology-

98.
NAL Call No.: aZ5071.N3
Herbicide tolerance/resistance in plants: April 1991-March 1994.
Dobert, R. *Quick-bibliogr-ser. Beltsville, Md., National Agricultural Library. Sept 1994. (94-60) 122 p.*
Updates QB 91-104.

Descriptors: herbicide-resistance; tolerance-; plants-; bibliographies-

99.
NAL Call No.: SB950.2.I3I4
Herbicide tolerant crops.
Graham, J. *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. [Urbana, Ill.] : Cooperative Extension Service, Univ of Illinois at Urbana-Champaign, [1991].. p. 167-169.*
"Proceedings of the 1991 Illinois Agricultural Pesticides Conference," January 8-10, 1991, Urbana, Illinois.

Descriptors: crops-; herbicide-resistance; genetic-engineering

100.
NAL Call No.: A00109
Herbicide-tolerant crops dominate testing in the industrialized world.
Gene-Exch v.4(1): p.3. (1993 May)

Descriptors: herbicide-resistance; field-tests

101.
NAL Call No.: 500-N21P
High-frequency germinal transposition of Ds(ALS) in Arabidopsis.
Honma, M. A.; Baker, B. J.; Waddell, C. S. *Proc-Natl-Acad-Sci-U-S-A* v.90(13): p.6242-6246. (1993 July)
Includes references.

Descriptors: arabidopsis-thaliana; gene-mapping; gene-transfer; genetic-code; genetic-markers; mutagenesis-; transgenics-; transposable-elements; zea- mays

Abstract: We have established an efficient transposon-tagging system in Arabidopsis thaliana using the Activator/Dissociation (Ac/Ds) elements from maize. This system consists of two components, a stable trans-activator, Ac(st), that supplies transposase, and a cis-responsive Ds element. Ds and Ac(st) were constructed with different selectable and screenable markers to facilitate monitoring of Ds excisions and insertions as well as segregation of Ds and Ac(st). Fusions of the 35S, rbcS, or CHS promoters to Ac transposase were used to trans-activate Ds(ALS), a Ds element carrying an herbicide-resistance gene. The ALS gene encoding acetolactase synthase, which confers resistance to chlorsulfuron, functioned as a versatile marker for selection of plants grown in tissue culture as well as in soil. Thirty-five Ac(st) lines were crossed to two Ds(ALS) lines, and the resulting progeny were assayed for germinal transposition of Ds(ALS). Trans-activation of Ds(ALS) by Ac(st) resulted in germinal excision frequencies of up to 64% when using 35S promoter-Ac transposase fusions, up to 67% when using rbcS-transposase fusions, and up to 1% when using CHS-transposase fusions. Amongst progeny bearing terminal excisions, Southern analysis revealed that 45% from 35S-Ac(st) crosses and 29% from rbcS-Ac(st) crosses carried reintegrated Ds(ALS) elements. The Ac/Ds system we have developed should prove to be an effective tool for stable gene tagging in Arabidopsis.

102.
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. *M-G-G-Mol-Gen-Genet* v.235(2/3): p.189-196. (1992 Nov.)
Includes references.

Descriptors: medicago-sativa; genetic-transformation; transgenics-; structural-genes; acyltransferases-; glufosinate-; herbicide-resistance; gene- expression; cell-suspensions; genetic-regulation; heat-; callus-; regenerative-ability; enzyme-activity; gene-inactivation; pat-gene; phosphinothricin-n-acetyltransferase-

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.

103.
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. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.626-634. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; glyphosate-; weed-control; chemical-control; gene-transfer; biotechnology-; research-; literature-reviews

104.
NAL Call No.: QK725.P532
Identification of the Arabidopsis CHL3 gene as the nitrate reductase structural gene NIA2.
Wilkinson, J. Q.; Crawford, N. M. *Plant-Cell* v.3(5): p.461-471. (1991 May)
Includes references.

Descriptors: arabidopsis-thaliana; induced-mutations; mutants-; deletions-; nitrate-reductase; genes-; chlorates-; herbicide-resistance; phenotypic- selection; nucleotide-sequences; complementation-; transgenics-; genetic-transformation; alleles-; allelism-; deletion-mutations; potassium-chlorate; null-mutants; molecular-sequence-data

Abstract: Chlorate, the chlorine analog of nitrate, is a herbicide that has been used to select mutants impaired in the process of nitrate assimilation. In Arabidopsis thaliana, mutations at any one of eight distinct loci confer resistance to chlorate. The molecular identities of the genes at these loci are not known; however, one of these

loci--chl3--maps very near the nitrate reductase structural gene NIA2. Through the isolation, characterization, and genetic analysis of new chlorate-resistant mutants generated by gamma irradiation, we have been able to demonstrate that the CHL3 gene and the NIA2 gene are identical. Three new chlorate-resistant mutants were identified that had deletions of the entire NIA2 gene. These nia2 null mutants were viable and still retained 10% of wild-type nitrate reductase activity in the leaves of the plants. All three deletion mutations were found to be new alleles of chl3. Introduction of the NlA2 gene back into these chl3 mutants by Agrobacterium- mediated transformation partially complemented their mutant phenotype. From these data, we conclude that Arabidopsis has at least two functional nitrate reductase genes and that the NIA2 gene product accounts for the majority of the leaf nitrate reductase activity and chlorate sensitivity of Arabidopsis plants.

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

105.
NAL Call No.: QH442.6.T74
The impact of selection parameters on the phenotype and genotype of transgenic rice callus and plants.
Christou, P.; Ford, T. L. *Transgenic-res* v.4(1): p.44-51. (1995 Jan.)
Includes references.

Descriptors: oryza-sativa; transgenic-plants; reporter-genes; hygromycin-b; drug-resistance; beta-glucuronidase-; in-vitro-selection; phenotypes-; genotypes-; callus-; explants-; genetic-transformation; bilanafos-; herbicide-resistance; regeneration-; chimeras-; chimerism-; gus-gene; bar-gene; hmr-gene; particle-bombardment; uida-gene

106.
NAL Call No.: S494.5.B563B56
In vitro selection for herbicide tolerance in maize.
Somers, D. A.; Anderson, P. C. *Biotechnol-agricult-for* (25): p.293-313. (1994)
In the series analytic: Maize / edited by Y.P.S. Bajaj.

Descriptors: zea-mays; in-vitro-selection; herbicide-resistance; callus-; tissue-culture; mutants-; mutations-; literature-reviews

107.
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. *Proc-Natl-Acad-Sci-U-S-A* v.90(4): p.1629-1633. (1993 Feb.)
Includes references.

Descriptors: nicotiana-tabacum; transgenics-; chloroplasts-; gene-expression; genetic-code; oxidation-; photoinhibition-; stress-; superoxide-dismutase; herbicide-resistance; methyl-viologen

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.

108.
NAL Call No.: TA166.T72
Indiscriminate use of selectable markers--sowing wild oats.
Gressel, J. *Trends-Biotechnol* v.10(11): p.382. (1992 Nov.)
Includes references.

Descriptors: avena-fatua; genetic-markers; marker-genes; herbicide-resistance; glufosinate-; gene-transfer; avena-sativa; transgenics-; biotechnology-

109.
NAL Call No.: SB610.W39
An industry perspective on herbicide-tolerant crops.
Giaquinta, R. T. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.653-656. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; biotechnology-; industry-; weed-control

110.
NAL Call No.: 442.8-Z8
Inheritance of rapeseed (Brassica napus)-specific RAPD markers and a transgene in the cross B. juncea X (B. juncea X B. napus).
Frello, S.; Hansen, K. R.; Jensen, J.; Jorgensen, R. B. *Theor-appl-genet. Berlin; Springer-Verlag. July 1995. v. 91 (2) p. 236-241.*
Includes references.

Descriptors: brassica-juncea; brassica-napus; interspecific-hybridization; inheritance-; genetic-markers; transgenic-plants

Abstract: We have examined the inheritance of 20 rapeseed (Brassica napus)-specific RAPD (randomly amplified polymorphic DNA) markers from transgenic, herbicide-tolerant rapeseed in 54 plants of the BC, generation from the cross B. juncea X (B. juncea X B. napus). Hybridization between B. juncea and B. napus, with B. juncea as the female parent, was successful both in controlled crosses and spontaneously in the field. The controlled backcrossing of selected hybrids to B. juncea, again with B. juncea as the female parent, also resulted in many seeds. The BC1 plants contained from 0 to 20 of the rapeseed RAPD markers, and the frequency of inheritance of individual RAPD markers ranged from 19% to 93%. The transgene was found in 52% of the plants analyzed. Five synteny groups of RAPD markers were identified. In the hybrids pollen fertility was 0-28%. The hybrids with the highest pollen fertility were selected as male parents for backcrossing, and pollen fertility in the BC1 plants was improved (24-90%) compared to that of the hybrids.

111.
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. *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. Braunschweig, Germany : Biologische Bundesanstalt fur Land- und Forstwirtschaft, [1992].. p. 230-238.*
Includes references.

Descriptors: plants-; transgenics-; genetic-engineering; herbicide-resistance

112.
NAL Call No.: QH442.B5
Instability of transgene expression in field grown tobacco carrying the csr1-1 gene for sulfonylurea herbicide resistance.
Brandle, J. E.; McHugh, S. G.; James, L.; Labbe, H.; Miki, B. L. *Bio/technology-Nat-Publ-Co* v.13(9): p.994-998. (1995 Sept.)
Includes references.

Descriptors: nicotiana-tabacum; arabidopsis-thaliana; transgenic-plants; structural-genes; oxo-acid-lyases-; gene-transfer; gene-expression; herbicide- resistance; chlorsulfuron-; enzyme-activity; acetohydroxyacid-synthase

113.
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. *Genome* v.36(6): p.1099-1106. (1993 Dec.)
Includes references.

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; brassica-oleracea-var; -acephala; brassica-adpressa; bar-gene; phosphinothricin-acetyltransferase

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. 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. chromosomes of AC genomes of rapeseed and the genomes of the related species.

114.
NAL Call No.: 442.8-Z34
Intragenic recombination in the CSR1 locus of Arabidopsis.
Mourad, G.; Haughn, G.; King, J. *MGG,-Mol-gen-genet* v.243(2): p.178-184. (1994 Apr.)
Includes references.

Descriptors: arabidopsis-thaliana; intragenic-recombination; loci-; oxo-acid-lyases-; structural-genes; alleles-; herbicide-resistance; mutations-; in-vitro- selection; acetolactate-synthase; csr1-1-allele; csr1-2-allele; csr1-gene; multiherbicide-resistance; point-mutations

Abstract: Four classes of herbicides are known to inhibit plant acetolactate synthase (ALS). In Arabidopsis, ALS is encoded by a single gene, CSR1. The dominant csr1-1 allele encodes an ALS resistant to chlorsulfuron and triazolopyrimidine sulfonamide while the dominant csr1-2 allele encodes an ALS resistant to imazapyr and pyrimidyl-oxy-benzoate. The molecular distance between the point mutations in csr1-1 and csr1-2 is 1369 bp. Here we used multiherbicide resistance as a stringent selection to measure the intragenic recombination

frequency between these two point mutations. We found this frequency to be 0.008 +/- 0.0028. The recombinant multiherbicide-resistant allele, csr1-4, provides an ideal marker for plant genetic transformation.

115.
NAL Call No.: Videocassette-no.1003
Introduction to genetics and biotechnology. DNA technology. NAL genetics lecture.
Bottino, P. J. & National Agricultural Library (U.S.). [Beltsville, Md.?] : National Agricultural Library, [1991] 2 videocassettes (190 min.) : sd., col..
VHS. Restriction enzymes -- Plasmids -- Gene cloning -- Genetic manipulation -- Sequency -- Blotting -- PCR -- Chromosome walking -- Isolation of specific genes.

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.

116.
NAL Call No.: A00109
The latest on transgenic herbicide-tolerant crops.
Gene-Exch v.2(2): p.10. (1991 June)

Descriptors: herbicide-resistance; transgenics-; crops-; USDA-; field-tests; USA-; 153-applications; federal-plant-pest-act

117.
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. *J-Agric-Sci* v.118(pt.1): p.9-15. (1992 Feb.)
Includes references.

Descriptors: triticum-; polyploidy-; gene-transfer; genotypes-; herbicide-resistance; susceptibility-; difenzoquat-

118.
NAL Call No.: SD112.F67
Making a herbicide selective by genetic engineering of Pinus radiata.
Walter, C.; Smith, D. R.; Grace, L. J. *FRI-bull* (192): p.167-169. (1995 Mar.)
Paper presented at the Second International Conference on Forest Vegetation Management, March 20-24, 1995, Rotorua, New Zealand.

Descriptors: pinus-radiata; transgenic-plants; herbicide-resistance; chlorsulfuron-; glufosinate-; gene-transfer; genetic-transformation; reporter-genes; genetic-vectors; marker-genes; gene-expression; gus-gene; npt-ii-gene

119.
NAL Call No.: 450-P692
The metabolites of the herbicide L-phosphinothricin (Glufosinate). Identification, stability, and mobility in transgenic, herbicide-resistant, and untransformed plants.
Droge Laser, W.; Siemeling, U.; Puhler, A.; Broer, I. *Plant-physiol* v.105(1): p.159-166. (1994 May)
Includes references.

Descriptors: nicotiana-tabacum; medicago-sativa; daucus-carota; glufosinate-; metabolism-; metabolites-; chemical-composition; transgenic-plants; herbicide-resistance; molecular-conformation; biochemical-pathways; chemical-reactions; molecular-structure

Abstract: The metabolism of the herbicide L-phosphinothricin (L-Pt) was analyzed in tobacco (Nicotiana tabacum), alfalfa (Medicago sativa), and carrot (Daucus carota). In transgenic, Pt-resistant plants expressing the Pt-N-acetyltransferase gene (pat), L-Pt was acetylated, resulting in two forms of N-acetyl-Pt (ac-Pt). In transgenic plants expressing only low pat-encoded acetylating activity as well as in genetically unmodified plants, three metabolic compounds 4-methylphosphinico-2-oxo-butanoic acid, 3-methylphosphinicopropanoic acid (MPP), and 4- methylphosphinico-2-hydroxy-butanoic acid (MHB) were identified. Hence, the transgene-encoded acetylation of L-Pt competes with a plant- specific degradation. The compounds MPP, MHB, and ac-Pt were found to be the final, stable products of the plant's metabolic pathways. The mobility of these stable compounds in the plant was investigated: L-Pt as well as the derived metabolites were found to be preferentially transported to the upper regions of the plant.

120.
NAL Call No.: 472-N42
Modified wheat paves the way to bumper harvest.
Coghlan, A. *New-Sci* v.134(1827): p.19. (1992 July)

Descriptors: triticum-aestivum; genetic-engineering; herbicide-resistance; Florida-; basta-

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

121.
NAL Call No.: 442.8-Z8
Molecular and genetic characterization of elite transgenic rice plants produced by electric-discharge particle acceleration.
Cooley, J.; Ford, T.; Christou, P. *Theor-appl-genet* v.90(1): p.97-104. (1995 Jan.)
Includes references.

Descriptors: oryza-sativa; transgenic-plants; genetic-transformation; elites-; gene-transfer; reporter-genes; beta-glucuronidase-; phosphotransferases-; hygromycin-b; drug-resistance; acyltransferases-; glufosinate-; herbicide-resistance; recombination-; inheritance-; phosphinothricin-acetyltransferase; hygromycin-phosphotransferase; particle-bombardment; biolistic-transformation; hmr-gene; gus-gene; bar-gene

Abstract: The recovery of transgenic rice plants expressing a number of exogenous genes was reported previously. Using immature embryo explants as the target tissue, plasmids containing both selectable and screenable marker genes were introduced into elite rice varieties via electric- discharge particle acceleration. Co-integration, copy number, expression, and inheritance of these genes were analyzed. A 100% co-integration frequency was confirmed by Southern-blot analyses of R0 plants. The majority of transgenic plants contained between one and ten copies of exogenous DNA and molecular and genetic analyses of progeny indicated that all copies in almost all R0 plants were inherited as a single dominant hemizygous locus. Co-expression of unselected genes ranged from 30-66% for gus/hmr constructs, depending on the promotor used, and up to 90% for bar/hmr constructs. The integrative structures of two unlinked transgenic loci of a rare R0 plant were analyzed in detail by Southern-blot analysis of its progeny.

122.
NAL Call No.: 450-P692
Molecular basis of imidazolinone herbicide resistance in Arabidopsis thaliana var Columbia.
Sathasivan, K.; Haughn, G. W.; Murai, N. *Plant-Physiol* v.97(3): p.1044-1050. (1991 Nov.)
Includes references.

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.

123.
NAL Call No.: 79.8-W41
Molecular characterization of the tubulin-related gene families in herbicide resistant and susceptible goosegrass (Eleusine indica).
Mysore, K. S.; Baird, W. M. V. *Weed-sci* v.43(1): p.28-33. (1995 Jan.-1995 Mar.)
Includes references.

Descriptors: eleusine-indica; herbicide-resistant-weeds; herbicide-resistance; dinitroaniline-herbicides; biotypes-; genetic-analysis; restriction-fragment- length-polymorphism; tubulin-; microtubules-; genes-; phenotypes-; susceptibility-; alpha-tubulin-; beta-tubulin-; gamma-tubulin-

Abstract: Goosegrass, wide spread throughout the tropics and subtropics, is one of the most noxious weeds known. Recently, biotypes of goosegrass have been found resistant to the dinitroaniline herbicides. An alteration in the structure/composition of a tubulin protein has been postulated as an explanation for the hyperstable microtubules and the resistant phenotype. Our study was initiated to investigate the structure of the alpha (alpha)-, beta (beta)- and gamma (gamma)-tubulin related gene sequences in resistant, intermediately resistant, and susceptible biotypes. Heterologous tubulin gene clones were used as probes of restriction endonuclease-digested genomic DNA from each biotype, to determine gene size and copy number and to screen for restriction fragment length polymorphisms. The tubulin genes are organized into gene families. There are three to five alpha-tubulin genes, four to seven beta-tubulin genes, and four to eight gamma-tubulin genes. There was no evidence of multiple copies or tandem repeats of any individual gene sequence. Although RFLPs were observed, no significant difference in the banding pattern between the resistant and the susceptible biotypes was found for either alpha-, beta-, or gamma-tubulin gene families. Therefore, it is unlikely that the difference between the herbicide-response phenotypes can be attributed to large deletions or insertions in a tubulin gene.

124.
NAL Call No.: QL391.N4J62
Molecular transfer of nematode resistance genes.
Williamson, V. M.; Ho, J. Y.; Ma, H. M. *J-Nematol* v.24(2): p.234-241. (1992 June)
Includes references.

Descriptors: lycopersicon-esculentum; meloidogyne-; pest-resistance; transgenics-; agrobacterium-tumefaciens; dna-; genes-; cloning-

Abstract: Recombinant DNA techniques have been used to introduce agronomically valuable traits, including resistance to viruses, herbicides, and insects, into crop plants. Introduction of these genes into plants frequently involves Agrobacterium-mediated gene transfer. The potential exists for applying this technology to nematode control by introducing genes conferring resistance to nematodes. Transferred genes could include those encoding products detrimental to nematode development or reproduction as well as cloned host resistance genes. Host genes that confer resistance to cyst or root-knot nematode species have been identified in many plants. The best characterized is Mi, a gene that confers resistance to root-knot nematodes in tomato. A map-based cloning

approach is being used to isolate the gene. For development of a detailed map of the region of the genome surrounding Mi, DNA markers genetically linked to Mi have been identified and analyzed in tomato lines that have undergone a recombination event near Mi. The molecular map will be used to identify DNA corresponding to Mi. We estimate that a clone of Mi will be obtained in 2-5 years. An exciting prospect is that introduction of this gene will confer resistance in plant species without currently available sources of resistance.

125.
NAL Call No.: A00051
Monsanto begins research field trial of genetically engineered tomato plants.
New-Biotech-Bus-Can v.3(5): p.6. (1991 Jan.)
This publication is not owned by NAL.

Descriptors: lycopersicon-esculentum; genetic-engineering; herbicide-resistance; field-tests; USDA-; California-; roundup-tolerance

126.
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. *M-G-G-Mol-Gen-Genet* v.232(2): p.167-173. (1992 Mar.)
Includes references.

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; ac243,977-; imr1-allele

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.

127.
NAL Call No.: 442.8-G28
Nonrandom distribution of chloroplast recombination events in Chlamydomonas reinhardtii: evidence for a hotspot and an adjacent cold region.
Newman, S. M.; Harris, E. H.; Johnson, A. M.; Boynton, J. E.; Gillham, N. W. *Genetics* v.132(2): p.413-419. (1992 Oct.)
Includes references.

Descriptors: chlamydomonas-reinhardtii; chlamydomonas-; recombination-; chloroplast-genetics; repetitive-dna; molecular-mapping; genetic-markers; restriction-fragment-length-polymorphism; position-effect; chloroplasts-; genomes-; restriction-mapping; structural-genes; chlamydomonas-smithii; intermolecular-recombination; psba-gene

Abstract: Intermolecular recombination of Chlamydomonas chloroplast genes has been analyzed in sexual crosses and following biolistic transformation. The pattern and position of specific exchange events within 15 kb of the 22-kb inverted repeat have been mapped with respect to known restriction fragment length polymorphism markers that distinguish the chloroplast genomes of the interfertile species Chlamydomonas reinhardtii and Chlamydomonas smithii. Recombinant progeny were selected from two- and three-factor crosses involving point

mutations conferring herbicide (dr) and antibiotic resistance (er and spr) in the psbA, 23S and 16S ribosomal RNA genes, respectively. Exchange events were not randomly distributed over the 15-kb region, but were found to occur preferentially in a 0.7-kb sequence spanning the 3' end of the psbA gene and were much less common in an adjacent region of ca. 2.0 kb. These findings are corroborated by data showing that the dr mutation is unlinked genetically (3% recombination/kb) to the er and spr rRNA mutations, which are themselves linked and show ca. 1% recombination/kb. This discrepancy is significant since the dr-er and er-spr intervals are about the same length (ca. 7 kb). During chloroplast transformation, the 0.7-kb recombination hotspot also functions as a preferential site for exchange events leading to the integration of donor psbA gene sequences. The 0.7-kb hotspot region contains four classes of 18-37-bp direct repeats also found in other intergenic regions, but no open reading frame. Using deletion constructs in a chloroplast transformation assay, the hotspot was localized to a 500-bp region that lacks most of these repeats, which suggests that the repeats themselves are not responsible for the increased recombination frequency. Within this region, a 400-bp sequence is highly conserved between the chloroplast genomes of C. reinhardtii and C. smithii and includes several structural motifs characteristic of recombination hotspots in other systems.

128.
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. *Theor-appl-genet* v.87(4): p.477-478. (1993 Dec.)
Includes references.

Descriptors: 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; France-; weed-types; adventitious-types; cytoplasmic-types

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.

129.
NAL Call No.: 100-L939
Overtop applications of Buctril controls broadleaf weeds in transgenic cotton.
Crawford, S. H. *La-Agric-La-Agric-Exp-Stn* v.36(1): p.23. (1993 Winter)

Descriptors: gossypium-hirsutum; weed-control; bromoxynil-; transgenics-; herbicide-resistance; field-tests; Louisiana-

130.
NAL Call No.: 450-P699
Paraquat tolerance of transgenic Nicotiana tabacum with enhanced activities of glutathione reductase and superoxide dismutase.
Aono, M.; Saji, H.; Sakamoto, A.; Tanaka, K.; Kondo, N.; Tanaka, K. *Plant-and-cell-physiol* v.36(8): p.1687-

1691. (1995 Dec.)
Includes references.

Descriptors: nicotiana-tabacum; transgenic-plants; herbicide-resistance; genetic-regulation; paraquat-; phytotoxicity-; stress-response; cytosol-; glutathione-reductase-nadph; enzyme-activity; superoxide-dismutase

Abstract: Transgenic tobacco with enhanced cytosolic activities of glutathione reductase and superoxide dismutase were generated by cross- fertilization. Leaves of the hybrids exhibited further increased tolerance to a superoxide radical-generating herbicide paraquat than those of their parents. This result indicates the efficiency of manipulating more than one gene in improving resistance of plants to photooxidative stress.

131.
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. *Plant-Cell-Rep* v.11(12): p.627-631. (1992)
Includes references.

Descriptors: nicotiana-plumbaginifolia; leaves-; agrobacterium-tumefaciens; genetic-transformation; gene-transfer; marker-genes; selective-breeding; dalapon-; herbicide-resistance; phytotoxicity-; enzymes-; degradation-; plasmids-; pseudomonas-putida; dehalogenase-

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.

132.
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. *Hortic-rev. New York, NY : John Wiley & Sons, Inc. Press. 1993. v. 15 p. 367-408.*
Includes references.

Descriptors: herbicide-resistance; crops-; biotechnology-; detoxification-; selection-; screening-; hybridization-; gene-transfer; environmental- protection; economic-impact; reviews-; site-of-action-resistance

133.
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. *NATO-ASI-Ser-Ser-A-Life-Sci. New York, N.Y. : Plenum Press. 1991. v. 210 p. 247-263.*
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.

Descriptors: populus-alba; populus-grandidentata; crosses-; cultivars-; genetic-transformation; glyphosate-; herbicide-resistance; agrobacterium- tumefaciens; literature-reviews

134.
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. *Theor-Appl-Genet* v.86(2/3): p.150-158. (1993 Apr.)
Includes references.

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; asymmetric-protoplast-fusion

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.

135.
NAL Call No.: S494.5.B563B554
Promoting crop protection by genetic engineering and conventional plant breeding: problems and prospects.
Woolhouse, H. W. *Biotechnol-Agric. Wallingford, Oxford, UK : CAB International. 1992. v. 7 p. 249-256.*
In the series analytic: Plant genetic manipulation for crop protection / edited by A.M.R. Gatehouse, V.A. Hilder and Boulter, D.

Descriptors: crops-; genetic-engineering; genetic-improvement; plant-breeding; defense-mechanisms; insect-control; varietal-resistance; plant-viruses; herbicide-resistance; mixed-cropping; gene-mapping; breeding-programs

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

136.
NAL Call No.: 442.8-IN82
Properties and uses of photoautotrophic plant cell cultures.
Widholm, J. M. *Int-Rev-Cytol. San Diego, Calif. : Academic Press. 1992. v. 132 p. 109-175.*
Includes references.

Descriptors: plants-; cell-cultures; growth-; photosynthesis-; cell-differentiation; metabolism-; molecular-biology; genetic-engineering; herbicide- resistance

137.
NAL Call No.: SB951.P49
Purification and properties of propanil hydrolase in Pseudomonas picketti.
Hirase, K.; Matsunaka, S. *Pestic-Biochem-Physiol* v.39(3): p.302-308. (1991 Mar.)
Includes references.

Descriptors: oryza-sativa; herbicide-resistance; propanil-; hydrolases-; properties-; purification-; pseudomonas-; soil-bacteria; soil-energy-relations

Abstract: Rice is resistant to propanil by virtue of an aryl acylamidase I enzyme which carries out detoxification of the herbicide. In order to obtain other crop plants resistant to propanil a bacterial source of a similar enzyme was researched. Then the enzyme may be isolated, cloned, and used genetically to transform plants, thus conferring herbicide resistance. For the primary stage, the purification and properties of a propanil hydrolase, isolated from a soil bacteria, Pseudomonas pickettii, was carried out. This enzyme was purified to homogeneity by ammonium sulfate fractionation, hydrophobic interaction chromatography, ion-exchange chromatography, gel filtration, and polyacrylamide gel electrophoresis. The relative molecular weight was estimated to be 102,000 by HPLC equipped with gel filtration column. The purified enzyme showed a single band on sodium dodecyl sulfate-polyacrylamide gel electrophoresis and its molecular weight was estimated to be 49,000. These results indicate that the propanil hydrolase from P. pickettii is a homodimer with subunit molecular weight of 49,000. The purified enzyme was stable for 42 days at 4 degrees C. Amino acid composition of this enzyme was also determined.

138.
NAL Call No.: QH442.B5
Rapid production of fertile transgenic plants of rye (Secale cereale L.).
Castillo, A. M.; Vasil, V.; Vasil, I. K. *Bio/technology-Nat-Publ-Co* v.12(13): p.1366-1371. (1994 Dec.)
Includes references.

Descriptors: secale-cereale; genetic-transformation; transgenic-plants; gene-transfer; reporter-genes; beta-glucuronidase-; transferases-; glufosinate-; herbicide-resistance; direct-dna-uptake; callus-; embryogenesis-; regeneration-; inheritance-; segregation-; phosphinothricin-acetyltransferase; uida-gene; bar-gene; biolistic-transformation

139.
NAL Call No.: 450-P692
Rapid production of multiple independent lines of fertile transgenic wheat (Triticum aestivum).
Weeks, J. T.; Anderson, O. D.; Blechl, A. E. *Plant-physiol* v.102(4): p.1077-1084. (1993 Aug.)
Includes references.

Descriptors: triticum-aestivum; genetic-transformation; callus-; lines-; transgenic-plants; gene-transfer; reporter-genes; beta-glucuronidase-; acyltransferases-; recombinant-dna; ubiquitin-; promoters-; in-vitro-selection; bilanafos-; herbicide-resistance; direct-dna-uptake; regenerative- ability; embryogenesis-; biolistic-transformation; bar-gene; vida-gene; phosphinothricin-acetyltransferase

Abstract: Improvement of wheat (Triticum aestivum) by biotechnological approaches is currently limited by a lack of efficient and reliable transformation methodology. In this report, we detail a protocol for transformation of a highly embryogenic wheat cultivar, Bobwhite. Calli derived from immature embryos, 0.5 to 1 mm long, were bombarded with microprojectiles coated with DNA containing as marker genes the bar gene, encoding phosphinothricin-resistance, and the gene encoding beta-glucuronidase (GUS), each under control of a maize ubiquitin promoter. The bombardment was performed 5 d after embryo excision, just after initiation of callus proliferation. The ability of plantlets to root in the presence of 1 or 3 mg/L of bialaphos was the most reliable selection criteria used to identify transformed plants. Stable transformation was confirmed by marker gene expression assays and the presence of the bar sequences in high molecular weight chromosomal DNA of the resultant plants. Nine independent lines of fertile transgenic wheat plants have been obtained thus far, at a

frequency of 1 to 2 per 1000 embryos bombarded. On average, 168 d elapsed between embryo excision for bombardment and anthesis of the T0 plants. The transmission of both the resistance phenotype and bar DNA to the T1 generation verified that germline transformation had occurred.

140.
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. *Bio/technology-Nat-Publ-Co* v.11(13): p.1553-1558. (1993 Dec.)
Includes references.

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; phosphinothricin-acetyltransferase; particle-bombardment; bar-gene; biolistic-transformation

141.
NAL Call No.: QK725.I43
A rapid visual method to identify transformed plants.
Wright, M. S.; Launis, K.; Bowman, C.; Hill, M.; DiMaio, J.; Kramer, C.; Shillito, R. D. *In-vitro-cell-dev-biol,-Plant* v.32(1): p.11-13. (1996 Jan.-1996 Mar.)
Includes references.

Descriptors: zea-mays; triticum-aestivum; transgenic-plants; genetic-transformation; detection-; gene-transfer; reporter-genes; marker-genes; acyltransferases-; glufosinate-; herbicide-resistance; dyes-; indicators-; ph-; bar-; gene-; phosphinothricin-acetyltransferase; chlorophenol-red

142.
NAL Call No.: SB610.W39
Rationale for developing herbicide-resistant crops.
Burnside, O. C. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.621-625. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; genotypes-; biotechnology-; weed-control; risk-; risks-and-benefits

143.
NAL Call No.: QK710.P68
Recovery of transgenic peanut (Arachis hypogaea L.) plants from elite cultivars utilizing ACCELL technology.
Brar, G. S.; Cohen, B. A.; Vick, C. L.; Johnson, G. W. *Plant-j* v.5(5): p.745-753. (1994 May)
Includes references.

Descriptors: arachis-hypogaea; genetic-transformation; biochemical-techniques; transgenic-plants; elites-; cultivars-; reporter-genes; beta- glucuronidase-; acyltransferases-; glufosinate-; herbicide-resistance; viral-proteins; tomato-spotted-wilt-virus; biolistic-transformation; gus-gene; bar-gene; phosphinothricin-acetyltransferase

144.
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. *Plant-Cell-Rep* v.11(11): p.586-591. (1992)
Includes references.

Descriptors: oryza-sativa; cell-suspensions; genetic-transformation; dna-; gene-transfer; plasmids-; herbicide-resistance; glufosinate-; gene-expression; selection-; gene-mapping; nucleotide-sequences; molecular-sequence-data

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.

145.
NAL Call No.: 442.8-Z8
Regeneration of transgenic, microspore-derived, fertile barley.
Jahne, A.; Becker, D.; Brettschneider, R.; Lorz, H. *Theor-appl-genet* v.89(4): p.525-533. (1994 Oct.)
Includes references.

Descriptors: hordeum-vulgare; genetic-transformation; transgenic-plants; pollen-; gene-transfer; reporter-genes; beta-glucuronidase-; glufosinate-; herbicide-resistance; regeneration-; regenerative-ability; in-vitro-selection; biolistic-transformation; bar-gene; 4ida-gene; particle-bombardment

Abstract: We have developed a system for the biolistic transformation of barley using freshly-isolated microspores as the target tissue. Independent transformation events led, on average, to the recovery of one plant per 1 X 10(7) bombarded microspores. Putative transformants have been regenerated using phosphinothricin as a selective agent. Ro plants have been transferred to soil approximately 2 months after bombardment. Integration of the marker genes bar and uidA has been confirmed by Southern analysis. The marker genes are inherited in all progeny plants confirming the expected homozygous nature of the R0 plants.

146.
NAL Call No.: QK725.P54
Regeneration of transgenic plants from the commercial apple cultivar Royal Gala.
Yao, J. L.; Cohen, D.; Atkinson, R.; Richardson, K.; Morris, B. *Plant-cell-rep* v.14(7): p.407-412. (1995)
Includes references.

Descriptors: malus-pumila; genetic-transformation; transgenic-plants; agrobacterium-tumefaciens; shoots-; in-vitro-culture; regenerative-ability; culture- media; kanamycin-; beta-glucuronidase-; enzyme-activity; herbicides-; herbicide-resistance; glean-

Abstract: A transformation system was developed for the commercial apple (Malus X domestica Borkh.) cultivar Royal Gala. Leaf pieces from in vitro-grown shoots were cocultivated for 2 days with Agrobacterium tumefaciens strain LBA4404 containing the binary vectors pKIWI105 or pKIWI110. Shoots were produced on a shooting medium containing kanamycin (50 mg.L-1). A 2-day incubation period on kanamycin-free medium prior to antibiotic selection enhanced the regeneration of kanamycin-resistant shoots. The majority of the kanamycin-resistant shoots also expressed GUS (beta-glucuronidase) activity. The putatively transformed shoots were rooted on a medium containing kanamycin (50 mg L- 1). Rooted plants were established in a greenhouse, and plants transformed with pKIWI110, which contains a mutants Arabidopsis acetolactate synthase gene, were shown to be resistant to the herbicide Glean. Integration of T-DNA into the apple genome was confirmed by PCR and Southern hybridization analyses.

147.
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. *Crop-Sci* v.32(4): p.1049-1053. (1992 July-1992 Aug.)
Includes references.

Descriptors: nicotiana-tabacum; herbicide-resistance; sulfonylurea-herbicides; transgenics-; agrobacterium-; genetic-transformation; genotypes-; application-rates; seedlings-; treatment-; selection-criteria; gene-expression; genetic-analysis; Canada-

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 the transgenic lines was more resistant to herbicide application than the other indicating that selection for maximum gene expression among transgenic lines is a necessary part of transgenic cultivar development. It was concluded 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.

148.
NAL Call No.: 100-L93-3
Rice and wheat improvement through biotechnology.
Croughan, T. P.; Croughan, S. S.; Braverman, M. P.; Regan, R. P.; Meche, M. M.; Wang, X. H.; Trumps, D. B.; Cao, H. X.; Harrison, S. A.; Linscombe, S. D. *Annu-res-rep-La-State-Univ-Baton-Rouge,-La*, (85th): p.116-156. (1993)

Descriptors: food-biotechnology; crop-production; oryza-sativa; triticum-aestivum; variety-trials; cultivars-; clones-; genetic-resistance; herbicide- resistance; crop-plants-as-weeds; herbicides-; Louisiana-

149.
NAL Call No.: QK710.P63
Selective agents and marker genes for use in transformation of monocotyledonous plants.
Wilmink, A.; Dons, J. J. M. *Plant-Mol-Biol-Rep-ISPMB* v.11(2): p.165-185. (1993 June)
Literature review.

Descriptors: monocotyledons-; genetic-transformation; selection-; marker-genes; antibiotics-; resistance-; herbicide-resistance; gene-expression; vectors-; literature-reviews

150.
NAL Call No.: S530.J6
Should public funds support biotechnology development? A case about herbicide-resistant cotton.

Vietor, D. M.; Chandler, J. M.; Thompson, P. B.; Ketchersid, M. L. *J-nat-resour-life-sci-educ* v.24(2): p.173-178. (1995 Fall)
Includes references.

Descriptors: agricultural-education; herbicide-resistance; biotechnology-; research-support; public-finance; agricultural-financial-policy; ethics-; teaching-methods; case-studies; higher-education; gossypium-hirsutum; genetic-engineering; induced-resistance; bromoxynil-; weed-control; policy-analysis; agricultural-controversies

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

151.
NAL Call No.: 442.8-Z8
Silicon carbide fiber-mediated stable transformation of plant cells.
Kaeppler, H. F.; Somers, D. A.; Rines, H. W.; Cockburn, A. F. *Theor-Appl-Genet* v.84(5/6): p.560-566. (1992)
Includes references.

Descriptors: zea-mays; nicotiana-tabacum; genetic-transformation; transgenics-; direct-dna-uptake; cell-suspensions; silicon-; carbides-; fibers-; gene- transfer; reporter-genes; beta-glucuronidase-; herbicide-resistance; phosphotransferases-; kanamycin-; drug-resistance; neomycin-phosphotransferase-ii; gus-gene; bar-gene; nptii-gene

Abstract: Maize (Zea mays, cv 'Black Mexican Sweet') (BMS) and tobacco (Nicotiana tabacum, cv 'Xanthi') tissue cultures were transformed using silicon carbide fibers to deliver DNA into suspension culture cells. DNA delivery was mediated by vortexing cells in the presence of silicon carbide fibers and plasmid DNA. Maize cells were treated with a plasmid carrying both the BAR gene, whose product confers resistance to the herbicide BAS-TA, and a gene encoding beta-glucuronidase (GUS). Tobacco cells were treated with two plasmids to co-transfer genes encoding neomycin phosphotransferase (NPTII) and GUS from the respective plasmids. Thirty-four BASTA-resistant BMS colonies and 23 kanamycin-resistant tobacco colonies recovered following selection contained intact copies of the BAR gene and NPTII genes, respectively, as determined by Southern blot analysis. Sixty-five percent of the resistant BMS colonies and 50% of the resistant tobacco colonies also expressed GUS activity. Intact copies of the GUS gene were observed in Southern blots of all resistant BMS and tobacco colonies that expressed GUS activity. These results indicate that a simple, inexpensive DNA delivery procedure employing silicon carbide fibers can be used to reproducibly transform cells of both monocotyledonous and dicotyledonous plant species.

152.
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. *Pestic-biochem-physiol* v.47(1): p.51-59. (1993 Sept.)
Includes references.

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.

153.
NAL Call No.: QH301.N32
Site directed mutagenesis of a chloroplast encoded protein.
Przibilla, E.; Yamamoto, R. *NATO-ASI-Ser-Ser-A-Life-Sci. New York, N.Y. : Plenum Press. 1992. v. 226 p. 561-565. ill.*
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.

Descriptors: chlamydomonas-reinhardtii; genetic-engineering; mutants-; thylakoids-; herbicide-resistance; phenolic-compounds

154.
NAL Call No.: QK725.P532
Site-specific mutagenesis of the D1 subunit of photosystem II in wild-type Chlamydomonas.
Przibilla, E.; Heiss, S.; Johanningmeier, U.; Trebst, A. *Plant-Cell* v.3(2): p.169-174. (1991 Feb.)
Includes references.

Descriptors: chlamydomonas-reinhardtii; targeted-mutagenesis; genes-; photosystem-ii; genetic-transformation; direct-dna-uptake; chloroplasts-; mutants-; nucleotide-sequences; herbicide-resistance; psba-gene; molecular-sequence-data

Abstract: The structure and functional mode of photosystem II reaction center protein D1 can be studied by analyzing the effects of amino acid substitutions within the binding niche for QB, the second stable electron acceptor of photosystem II, on herbicide binding. Here we report on site-directed mutagenesis of the psbA gene coding for the D1 protein in the unicellular alga Chlamydomonas reinhardtii. The chloroplasts of wild-type cells were transformed using the particle gun. The plasmids introduced carried an in vitro mutated fragment of the psbA gene. We obtained a double mutant with replacements of amino acids 264 and 266 and a triple mutant having an additional substitution in position 259. The sensitivities of both mutants toward several types of herbicides are given and compared with those of a mutant having only a substitution at position 264.

155.
NAL Call No.: S494.5.B563B56
Somaclonal selection for tolerance to streptomycin and herbicides through rice cell culture.
Kinoshita, T.; Mori, K.; Mikami, T. *Biotechnol-Agric-For* (14): p.383-404. (1991)
In the series analtyic: Rice / edited by Y.P.S. Bajaj.

Descriptors: oryza-sativa; cell-culture; somaclonal-variation; in-vitro-selection; herbicide-resistance; streptomycin-; resistance-; salt-tolerance

156.
NAL Call No.: QK725.P53
Stable transformation of barley callus using biolistic particle bombardment and the phosphinothricin acetyltransferase (bar) gene.
Stiff, C. M.; Kilian, A.; Zhou, H.; Kudrna, D. A.; Kleinhofs, A. *Plant-cell,-tissue-organ-cult* v.40(3): p.243-248. (1995 Mar.)
Includes references.

Descriptors: hordeum-vulgare; cell-suspensions; genetic-transformation; callus-; gene-transfer; beta-glucuronidase-; glufosinate-; herbicide-resistance; transferases-; enzyme-activity; gene-expression; transgenic-plants

157.
NAL Call No.: QK725.P54
Stable transformation of Phaseolus vulgaris via electric-discharge mediated particle acceleration.
Russell, D. R.; Wallace, K. M.; Bathe, J. H.; Martinell, B. J.; McCabe, D. E. *Plant-Cell-Rep* v.12(3): p.165-169. (1993)
Includes references.

Descriptors: phaseolus-vulgaris; seeds-; apical-meristems; genetic-transformation; dna-; gene-transfer; electric-discharges; particle-velocity; transgenics-; gene-expression; regenerative-ability; laboratory-methods; accell-

Abstract: Transgenic Phaseolus vulgaris or common bean has been produced using electric-discharge particle acceleration. The method uses particle acceleration to introduce DNA into bean seed meristems. Multiple shoots are then generated and screened to recover transgenic plants at a rate of 0.03% germline transformed plants/shoot. We have been able to recover transgenic plants using both GUS and herbicide screening to introduce the gus, bar, and bean golden mosaic virus coat protein genes into the navy bean cultivar, Seafarer. The transgenic plants have been characterized over 5 generations of self-fertilization with no loss of introduced genes or expression. In addition, several families have been crossed with non-transgenic parents and these plants also show expected inheritance patterns. The introduced bar gene has been shown to confer strong resistance in transgenic beans to basta herbicide application in the greenhouse.

158.
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. *Plant-Cell-Rep* v.11(10): p.494-498. (1992)
Includes references.

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.

159.
NAL Call No.: QK710.P62
Structure and function of selectable and non-selectable transgenes in maize after introduction by particle bombardment.
Register, J. C. I.; Peterson, D. J.; Bell, P. J.; Bullock, W. P.; Evans, I. J.; Frame, B.; Greenland, A. J.; Higgs, N. S.; Jepson, I.; Jiao, S. *Plant-mol-biol* v.25(6): p.951-961. (1994 Sept.)
In the special issue: Molecular breeding.

Descriptors: zea-mays; genetic-transformation; gene-transfer; reporter-genes; phosphotransferases-; beta-glucuronidase-; acyltransferases-; phosphotransferases-; in-vitro-selection; kanamycin-; drug-resistance; bilanafos-; herbicide-resistance; cell-suspensions; inheritance-; gene- expression; epigenetics-; genetic-regulation; callus-; biolistic-transformation; bar-gene; pat-gene; nptii-gene; uida-gene; phosphinothricin-acetyltransferase; gene-silencing

Abstract: Zea mays transformants produced by particle bombardment of embryogenic suspension culture cells of the genotype A188 X B73 and selected on kanamycin or bialaphos were characterized with respect to transgene

integration, expression, and inheritance. Selection on bialaphos, mediated by the bar or pat genes, was more efficient than selection on kanamycin, mediated by the nptII gene. Most transformants contained multicopy, single locus, transgene insertion events. A transgene expression cassette was more likely to be rearranged if expression of that gene was not selected for during callus growth. Not all plants regenerated from calli representing single transformation events expressed the transgenes, and a nonselectable gene (uidA) was expressed in fewer plants than was the selectable transgene. Mendelian inheritance of transgenes consistent with transgene insertion at a single locus was observed for approximately two thirds of the transformants assessed. Transgene expression was typically, but not always, predictable in progeny plants--transgene silencing, as well as poor transgene transmission to progeny, was observed in some plant lines in which the parent plants had expressed the transgene.

160.
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. *Plant-physiol* v.100(2): p.662-668. (1992 Oct.)
Includes references.

Descriptors: arabidopsis-thaliana; oryza-sativa; marker-genes; oxo-acid-lyases-; mutations-; mutants-; genetic-transformation; transgenic-plants; in- vitro-selection; herbicide-resistance; chlorsulfuron-; direct-dna-uptake; protoplasts-; acetolactate-synthase

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).

161.
NAL Call No.: 450-P692
Superoxide dismutase enhances tolerance of freezing stress in transgenic alfalfa (Medicago sativa L.).
McKersie, B. D.; Chen, Y.; De Beus, M.; Bowley, S. R.; Bowler, C.; Inze, D.; D'Halluin, K.; Botterman, J. *Plant-physiol* v.103(4): p.1155-1163. (1993 Dec.)
Includes references.

Descriptors: medicago-sativa; freezing-; stress-response; cold-tolerance; superoxide-dismutase; catalytic-activity; transgenic-plants; genetic-regulation; inheritance-

Abstract: Activated oxygen or oxygen free radicals have been implicated in a number of physiological disorders in plants including freezing injury. molecules in the cell. To further examine the relationship between oxidative and freezing stresses, the expression of SOD was modified in transgenic alfalfa (Medicago sativa L). The Mn-SOD cDNA from Nicotiana plumbaginifolia under the control of the cauliflower mosaic virus 35S promoter was introduced into alfalfa using Agrobacterium tumefaciens-mediated transformation. Two plasmid vectors, pMitSOD and pChlSOD, contained a chimeric Mn-SOD construct with a transit peptide for targeting to the mitochondria or one for targeting to the chloroplast, respectively. The putatively transgenic plants were selected for resistance to kanamycin and screened for neomycin phosphotransferase activity and the presence of an additional Mn-SOD isozyme. Detailed analysis of a set of four selected transformants indicated that some had enhanced SOD activity, increased tolerance to the diphenyl ether herbicide, acifluorfen, and increased regrowth

after freezing stress. The F1 progeny of one line, RA3-ChlSOD-30, were analyzed by SOD isozyme activity, by polymerase chain reaction for the Mn-SOD gene, and by polymerase chain reaction for the neo gene. RA3-ChlSOD-30 had three sites of insertion of pChlSOD, but only one gave a functional Mn-SOD. following freezing stress than those progeny lacking the functional Mn-SOD transgene, suggesting that Mn-SOD serves a protective role by minimizing oxygen free radical production after freezing stress.

162.
NAL Call No.: SB610.W39
Technology transfer for herbicide-tolerant weeds and herbicide-tolerant crops.
Knake, E. L. *Weed-Technol-J-Weed-Sci-Soc-Am* v.6(3): p.662-664. (1992 July-1992 Sept.)
Paper presented at the Symposium, "Development of Herbicide-Resistant Crop Cultivars", Weed Science Society of America, February 6, 1991, Louisville, Kentucky.

Descriptors: transgenic-plants; crops-; herbicide-resistance; weeds-; biotechnology-; weed-control; technology-transfer

163.
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. *Plant-physiol* v.101(3): p.751-757. (1993 Mar.)
Includes references.

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; phosphinothricin-acetyltransferase; nptii-gene; bar-gene; neomycin-phosphotransferase-ii

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.

164.
NAL Call No.: S494.5.B563B56
Transformation in Linum usitatissimum L. (flax).
Jordan, M. C.; McHughen, A. *Biotechnol-agricult-for. Berlin, W. Ger. : Springer-Verlag. 1993. v. 22 p. 244-252.*
In the series analytic: Plant protoplasts and genetic engineering III / edited by Y.P.S. Bajaj.

Descriptors: linum-usitatissimum; genetic-transformation; agrobacterium-tumefaciens; transgenic-plants; herbicide-resistance; glyphosate-; glufosinate-; gene-transfer; sulfonylurea-herbicides; regenerative-ability

165.
NAL Call No.: QK725.P54
Transformation of potato (Solanum tuberosum) cv. Mantiqueira using Agrobacterium tumefaciens and evaluation of herbicide resistance.
Figueira Filho, E. S.; Figueiredo, L. F. A.; Monte Neshich, D. C. *Plant-cell-rep* v.13(12): p.666-670. (1994)
Includes references.

Descriptors: solanum-tuberosum; genetic-transformation; agrobacterium-tumefaciens; cultivars-; genetic-engineering; plant-breeding-methods; herbicide-resistance; glufosinate-; transgenic-plants; culture-; culture-media; shoots-; regenerative-ability; Brazil-

Abstract: In search of establishing a system for genetic transformation of Brazilian potato cultivars, Agrobacterium tumefaciens carrying the plasmid pGV1040, was used to transform leaf discs of three cultivars of local importance, i.e., Aracy, Baronesa and Mantiqueira. This plasmid contains marker genes for resistance to kanamycin and phosphinothricin plus the gene for the enzyme beta-glucuronidase. A two step regeneration/selection procedure produced shoots of potato cultivar Mantiqueira with in vitro resistance to kanamycin and to phosphinothricin. After transfer to the greenhouse, the potentially transgenic plants, sprayed with the herbicide Finale (20% a.i.; Hoechst) remained green as compared to control clones that died immediately afterwards. Southern blot analysis and histochemical and fluorimetric assay for beta- glucuronidase indicated that the gene coding for the enzyme was integrated in the potato genome and could be expressed in potato tissues. No success was obtained for transformation of cultivars Aracy and Baronesa using this procedure.

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

166.
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. *Bio/Technol* v.10(3): p.309-314. (1992 Mar.)
Includes references.

Descriptors: beta-vulgaris-var; -saccharifera; agrobacterium-tumefaciens; genetic-transformation; transgenics-; gene-transfer; genes-; bilanafos-; ligases-; glufosinate-; sulfonylurea-herbicides; herbicide-resistance; acyltransferases-; glufosinate-ammonium-; phosphinothricin-acetyltransferase; bar-gene; acetolactate-synthase

167.
NAL Call No.: 448.3-Ap5
Transformation of the fungal soybean pathogen Cercospora kikuchii with the selectable marker bar.
Upchurch, R. G.; Meade, M. J.; Hightower, R. C.; Thomas, R. S.; Callahan, T. M. *Appl-environ-microbiol* v.60(12): p.4592-4595. (1994 Dec.)
Includes references.

Descriptors: cercospora-kikuchii; genetic-transformation; reporter-genes; marker-genes; bilanafos-; herbicide-resistance; acyltransferases-; bar-gene; phosphinothricin-acetyltransferase

Abstract: An improved transformation protocol, utilizing selection for resistance to the herbicide bialaphos, has been developed for the plant pathogenic fungus Cercospora kikuchii. Stable, bialaphos-resistant transformants are recovered at frequencies eight times higher than those achieved with the previous system that was based on selection for benomyl resistance. In addition to C. kikuchii, this improved method can also be used to transform other species of Cercospora.

168.
NAL Call No.: 472-N21
Transgenic crops against parasites.
Joel, D. M.; Kleifeld, Y.; Losner Goshen, D.; Herzlinger, G.; Gressel, J. *Nature* v.374(6519): p.220-221. (1995 Mar.)
Includes references.

Descriptors: lycopersicon-esculentum; brassica-napus; transgenic-plants; orobanche-; striga-; parasitic-weeds; herbicide-resistance; resistance- mechanisms; crop-yield; weed-control; genetic-engineering; efficacy-; transgenic-herbicide-resistance-crops

169.
NAL Call No.: QH442.6.T74
Transgenic flax with environmentally and agronomically sustainable attributes.
McHughen, A.; Holm, F. A. *Transgenic-res* v.4(1): p.3-11. (1995 Jan.)
Includes references.

Descriptors: linum-usitatissimum; transgenic-plants; herbicide-resistance; metsulfuron-; triasulfuron-; agronomic-characteristics; crop-yield; flowering- date; maturity-; field-experimentation

170.
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. *Plant-Cell-Rep* v.11(5/6): p.219-224. (1992)
Includes references.

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.

171.
NAL Call No.: SD13.C35
Transgenic larch expressing genes for herbicide and insect resistance.
Shin, D. I.; Podila, G. K.; Karnosky, D. F. *Can-j-for-res. Ottawa, National Research Council of Canada. Oct 1994. v. 24 (10) p. 2059-2067.*
Includes references.

Descriptors: larix-decidua; transgenics-; genetic-transformation; gene-transfer; gene-expression; pest-resistance; bacillus-thuringiensis; toxins-; herbicide-resistance; glyphosate-; genes-; agrobacterium-rhizogenes; regeneration-

Abstract: Transgenic European larch (Larix decidua Mill.) plants expressing a Bacillus thuringiensis Berliner (B.t.) toxin gene or the glyphosate tolerance (aroA) gene have been produced using Agrobacterium rhizogenes mediated gene transfer. This procedure relies on direct organogenesis on wounded hypocotyls following A. rhizogenes infection. Hypocotyls of seven-day-old larch seedlings were inoculated with A. rhizogenes strain 11325, harboring the oncogenic nopaline-type pRi11325 and either binary vector pCGN1133 containing 35S NPTII and 35S ssu/aroA or pWB139 containing 35S NPTII-B.t. gene. Adventitious shoot buds were induced 4 weeks after infection. Shoots were excised, elongated, and rooted on selection medium containing kanamycin.

Needles from greenhouse-grown plants were confirmed to have and to express the B.t or aroA gene through Southern, Northern, and Western blot analyses and bioassays. This is the first report of regeneration of transgenic conifer plants expressing value-added genes using Agrobacterium-mediated gene transfer.

172.
NAL Call No.: QH573.N37
Transgenic maize by electroporation of pectolyase-treated suspension culture cells.
Spencer, T. M.; Laursen, C. M.; Krzyzek, R. A.; Anderson, P. C.; Flick, C. E. *NATO-ASI-ser,-Ser-H-Cell-biol. [Berlin ; New York : Springer-Verlag, c1986-. 1994. v. 81 p. 559-565.*
In the series analytic: Plant molecular biology: Molecular genetic analysis of plant development and metabolism / edited by G. Coruzzi and P. Puigdomenech.

Descriptors: zea-mays; genetic-transformation; electroporation-; transgenic-plants; direct-dna-uptake; hydro-lyases-; pretreatment-; cell-suspensions; gene-transfer; reporter-genes; bilanafos-; herbicide-resistance; bar-gene

173.
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. *Planta* v.187(1): p.142-151. (1992)
Includes references.

Descriptors: nicotiana-tabacum; daucus-carota; agrobacterium-tumefaciens; transgenics-; glufosinate-; metabolism-; transferases-; enzyme-activity; genetic-code; nucleotide-sequences; molecular-sequence-data

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.

174.
NAL Call No.: QK725.P54
Transgenic plants of ramie (Boehmeria nivea Gaud.) obtained by Agrobacterium mediated transformation.
Dusi, D. M. A.; Dubald, M.; Almeida, E. R. P. de.; Caldas, L. S.; Gander, E. S. *Plant-cell-rep* v.12(11): p.625-628. (1993)
Includes references.

Descriptors: boehmeria-nivea; genetic-transformation; agrobacterium-tumefaciens; transgenic-plants; regenerative-ability; laboratory-methods; culture- media; gene-expression; beta-glucuronidase-; plasmids-; herbicide-resistance; genes-; glufosinate-; marker-genes; bar-genes; npt-ii-genes; uid-a-genes

Abstract: A regeneration and transformation protocol for ramie (Boehmeria nivea Gaud.) is presented. Regeneration was obtained from leaf discs placed on solid B-5 medium (Gamborg et al. 1968) containing adequate concentrations of auxin and cytokinin. Co-cultivation of leaf discs with Agrobacterium tumefaciens

and subsequent regeneration resulted in transgenic plants as shown by Southern blot and analysis of expression of the GUS-marker gene.

175.
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. *Bio/Technol* v.10(6): p.691-696. (1992 June)
Includes references.

Descriptors: festuca-arundinacea; genetic-transformation; transgenics-; protoplasts-; gene-transfer; direct-dna-uptake; reporter-genes; phosphotransferases-; acyltransferases-; cell-suspensions; in-vitro-selection; hygromycin-b; glufosinate-; drug-resistance; herbicide-resistance; callus-; embryogenesis-; regenerative-ability; phosphinothricin-acetyltransferase; hph-gene; bar-gene; hygromycin-phosphotransferase

176.
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. *Proc-Natl-Acad-Sci-U-S-A* v.90(23): p.11212-11216. (1993 Dec.)
Includes references.

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.

177.
NAL Call No.: 442.8-Z8
Two T-DNA's co-transformed into Brassica napus by a double Agrobacterium tumefaciens infection are mainly integrated at the same locus.
Block, M. d.; Gent, B.; Debrouwer, D. *Theor-Appl-Genet* v.82(3): p.257-263. (1991)
Includes references.

Descriptors: brassica-napus; agrobacterium-tumefaciens; genetic-transformation; gene-transfer; transgenics-; dna-; reporter-genes; marker-genes; phosphotransferases-; kanamycin-; drug-resistance; acyltransferases-; glufosinate-; herbicide-resistance; in-vitro-selection; hypocotyls-; explants-; linkage-; phosphinotricin-acetyl-transferase; neomycin-phosphotransferase; transferred-dna; co-transformation-; neo-gene; bar-gene

Abstract: Hypocotyl explants of three Brassica napus varieties were infected with two nopaline type Agrobacterium strains each carrying a distinct disarmed T-DNA containing different selectable markers. Selection was done for only one of the markers, after which the regenerated plants were screened for the presence of the second marker. High co-transformation frequencies of both T-DNA'S were obtained (39%-85%

of the transformants). Where the two T-DNA'S were integrated linked, they were usually present in an inverted orientation relative to each other; in all of the cases observed the two right borders were adjacent. Tandem orientations occurred less frequently. The T-DNA'S were mainly integrated as intact copies and deletions did not often occur. The co-transformation system described favors a genetically linked integration of the two T- DNA'S (78%), although in a single transformed plant both linked and unlinked copies of both T-DNA'S may be present.

178.
NAL Call No.: QH442.G456
USDA deregulates Calgene's bromoxynil-resistant cotton.
Dutton, G. *Genet-eng-news* v.14(5): p.1, 16. (1994 Mar.)

Descriptors: gossypium-hirsutum; transgenic-plants; bromoxynil-; herbicide-resistance; gene-transfer; deregulation-; USDA-; USA-

179.
NAL Call No.: A00109
USDA scientist develops herbicide-tolerant potatoes.
Gene-Exch v.2(2): p.7. (1991 June)

Descriptors: field-tests; biotechnology-; USDA-; plants-; USA-; federal-plant-pest-act

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Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

180.
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. *Plant-Mol-Biol-Int-J-Mol-Biol-Biochem-Genet-Eng* v.21(5): p.871-884. (1993 Mar.)
Includes references.

Descriptors: oryza-sativa; streptomyces-; genetic-transformation; transgenic-plants; protoplasts-; direct-dna-uptake; gene-transfer; structural-genes; acyltransferases-; glufosinate-; herbicide-resistance; in-vitro-selection; marker-genes; reporter-genes; beta-glucuronidase-; streptomyces-hygroscopicus; phosphinothricin-acetyltransferase

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.

181.
NAL Call No.: QD415.A1J62
Use of cyanobacterial diazotrophic technology in rice agriculture: scientific note.
Tiwari, D. N.; Kumar, A.; Mishra, A. K. *Appl-Biochem-Biotechnol. Totowa, N.J. : Humana Press. Spring 1991. v. 28/29 p. 387-396.*
Includes references.

Descriptors: gloeocapsa-; cell-culture; ammonia-; oryza-sativa; herbicide-resistance; biotechnology-; biofertilizers-

182.
NAL Call No.: QK710.P55
The use of mutants and transgenic plants to study amino acid metabolism.
Lea, P. J.; Forde, B. G. *Plant-cell-environ. Oxford, Blackwell Scientific Publishers. May 1994. v. 17 (5) p. 541-556.*
In the special issue: Use of transgenic plants and mutants to study whole plant physiology.

Descriptors: plants-; transgenic-plants; amino-acid-metabolism; mutants-; enzymes-; herbicide-resistance; literature-reviews

183.
NAL Call No.: QK725.P54
Use of paromomycin as a selective agent for oat transformation.
Torbert, K. A.; Rines, H. W.; Somers, D. A. *Plant-cell-rep* v.14(10): p.635-640. (1995)
Includes references.

Descriptors: avena-sativa; genetic-transformation; escherichia-coli; plasmids-; gene-transfer; neomycin-; phosphotransferases-; genes-; selection-; paromomycin-; transgenic-plants; gene-expression; genetic-markers; regenerative-ability; fertility-; tissue-culture; npt-ii-genes

Abstract: Friable, embryogenic oat (Avena sativa L.) tissue cultures were stably transformed with two different plasmids containing the E. coli tn5 neomycin phosphotransferase II gene (npt II). Selection was accomplished using the antibiotic paromomycin sulfate following microprojectile bombardment. From two independent experiments, 88 paromomycin-resistant tissue cultures were shown to be transgenic based on Southern blot analysis and detection of the neomycin phosphotransferase (NPT II) protein using ELISA. Copy numbers of the npt II gene ranged from one to eight copies per haploid oat genome integrated into high molecular weight DNA of the paromomycin-resistant cultures. Plants were regenerated from 32 of the 88 transgenic tissue cultures. Plants from 17 of the 32 regenerable cultures exhibited fertility. Stable transformation was shown by segregation patterns of the NPT II protein in R1 seedlings produced from 16 fertile culture lines that were tested. The overall results demonstrate that the combination of the npt II gene and paromomycin provides efficient selection of transgenic oat tissue cultures. Oat plants transformed with the npt II gene present reduced ecological risk compared to the previously used herbicide-resistance selection system.

184.
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. *Aust-j-plant-physiol. Melbourne, Commonwealth Scientific and Industrial Research Organization. 1994. v. 21 (1) p. 95-112.*
Includes references.

Descriptors: triticum-aestivum; oryza-sativa; gene-transfer; transgenic-plants; callus-; gene-expression; selection-; marker-genes; leaves-; enzyme- activity; promoters-

185.
NAL Call No.: QR360.A1J6
Vectors based on maize streak virus can replicate to high copy numbers in maize plants.
Shen, W. H.; Hohn, B. *J-gen-virol* v.76(pt.4): p.965-969. (1995 Apr.)
Includes references.

Descriptors: maize-streak-geminivirus; zea-mays; genetic-vectors; gene-transfer; gene-expression; reporter-genes; acyltransferases-; glufosinate-; herbicide-resistance; recombinant-dna; genomes-; genetic-transformation; bar-gene; phosphinothricin-acetyltransferase; agroinfection-

Abstract: The genome of maize streak virus (MSV) consists of one molecule of circular, single-stranded DNA of 2.7 kb. A reporter gene (bar) coding for phosphinothricin acetyltransferase was inserted into the small non-coding region of the MSV genome. The recombinant bar- containing MVS vectors were introduced into maize seedlings via agroinfection. The chimeric viral DNA was found to replicate to high copy numbers in maize leaves resistant to the application of the herbicide Basta. This establishes the usefulness of MSV as an efficient replicating vector in cells of maize plants.

186.
NAL Call No.: 100-L939
Weed control in transgenic Buctril herbicide tolerant cotton.
Reynolds, D. B.; Crawford, S. H.; Rogers, R. L. *La-agric* v.37(3): p.13-14. (1994 Summer)

Descriptors: gossypium-hirsutum; weed-control; transgenics-; bromoxynil-; herbicide-resistance; weeds-; Louisiana-

187.
NAL Call No.: LB3475.A1S3
Working with mother nature.
Hanson, S. *School-foodserv-nutr* v.48(8): p.31-32, 34. (1994 Sept.)

Descriptors: food-biotechnology; food-products; crop-production; genetic-engineering; improved-varieties; nutritive-value; nutrient-improvement; drought-; drought-resistance; insect-control; disease-resistance; herbicide-resistance; tastes-; flavor-; color-; consumer-preferences; food-quality; food-composition; consumer-protection; food-safety; brand-name-products; nutrient-content; environmental-protection; natural-resources; food- policy; food-allergies; field-tests; reviews-; flavr-savrs

188.
NAL Call No.: 64.8-C883
Yield evaluation of a glyphosate-tolerant soybean line after treatment with glyphosate.
Delannay, X.; Bauman, T. T.; Beighley, D. H.; Buettner, M. J.; Coble, H. D.; DeFelice, M. S.; Derting, C. W.; Deidrick, T. J.; Griffin, J. L.; Hagood, E. S. *Crop-sci* v.35(5): p.1461-1467. (1995 Sept.-1995 Oct.)
Includes references.

Descriptors: glycine-max; lines-; herbicide-resistance; glyphosate-; transgenic-plants; application-rates; crop-growth-stage; developmental-stages; crop- yield; genetic-resistance

Abstract: Transformation of soybean [Glycine max (L.) Merr.] with a gene encoding a glyphosate-tolerance 5-enolpyruvylshikimate-3-phosphate synthase enzyme from Agrobacterium sp. strain CP4 resulted in the development of glyphosate-tolerant line 40-3-2. Glyphosate (N- phosphonomethyl glycine) is the active ingredient of Roundup herbicide. Line 40-3-2 was yield tested at 17 locations in 1992, 23 locations in 1993, and 18 locations in 1994. At those locations, broadcast applications of glyphosate at various rates were made over 40-3-2 or its derivatives from early vegetative growth to pod fill. No significant yield reduction was observed as a result of the glyphosate treatment at any of the locations. Development of glyphosate-tolerant soybean promises to provide the farmer with access to a new weed control system that should result in lower production costs and reliable weed control under a wide range of conditions.

189.
NAL Call No.: SB249.N6
Yield performance of transgenic cotton strains resistant to Buctril herbicide.
Coulombe, B. A.; Panter, D. M.; Stanton, J. J.; Ward, R. G. *Proc-Beltwide-Cotton-Conf. Memphis, Tenn. : National Cotton Council of America, 1991-. 1994. v. 2 p. 651.*
Meeting Held January 5-8, 1994, San Diego, California.

Descriptors: gossypium-; transgenic-plants; bromoxynil-; herbicide-resistance; crop-yield

---

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

Author Index

To:
A B C D E F G H I K L M N O P R S T U V W Y Z

Go to: Author Index | Subject Index | Top of Document
Citation no.: 1, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

Subject Index

To:
A B C D E F G H I K L M N O P R S T U V W X Y Z

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