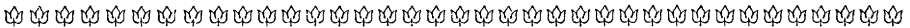


# THE CERTIFICATION OF SEEDS



## Variety Is a

## Key Word

MARTIN G. WEISS AND ELBERT L. LITTLE, JR.

TO BUY, sell, and grow seeds and plants without confusion, we need a system of naming, distinguishing, and classifying the many thousand different kinds and varieties.

We must know also whether one lot of seeds or plants will give the same results as another or differs enough to require a separate name.

The key word "variety" is used for plant populations in two different ways—for a botanical variety and for a cultivated variety.

THE PLANT KINGDOM comprises about 350 thousand known species, or kinds, of living wild plants, of which more

than 250 thousand are seed plants. For comparison and study, these plants are classified by their characteristics into higher and higher ranks, or categories.

The scientific names of plants are in Latin form following the *International Code of Botanical Nomenclature* and are universally adopted around the world. The scientific name of a plant consists of its genus and species names. *Trifolium pratense*, for example, is the scientific name for red clover.

The most important rank, the species, is composed of individual plants or plant populations that are similar in appearance and can reproduce or breed among themselves and produce other individuals that resemble the parents.

A genus—plural, genera—is a group of related species. The genus *Trifolium*, clover, includes also the species *Trifolium repens*, whiteclover, and many others.

A family is composed of related genera. Clovers, alfalfa, beans, peas,

black locust, and similar plants belong to the legume family, Leguminosae.

Varieties have been recognized in some species. A variety (botanical variety, from Latin *varietas*, abbreviated "var.") is a rank or minor unit within a species composed of individuals which differ slightly from the others. *Trifolium pratense* var. *foliosum*, Orel clover, has been designated as a botanical variety of red clover.

Subspecies (abbreviated "subsp.") is an optional rank below the species but above the variety, based on minor characters and usually having an exclusive geographic range.

Form (abbreviated "f.") is an optional rank based on more trivial characters than a variety—for example, color of flower or shape of the leaves.

Other groups sometimes are distinguished without scientific names.

A race is a group of individuals or population within a species that have general similarities discontinuous and distinct from other populations, although not sufficient for designation by a scientific name.

A geographic race is restricted in distribution to a particular region.

A physiologic race differs in life processes or functions but not necessarily in form—for example, in resistance to disease or in rooting ability.

An ecotype is a race or ecological variation whose characters adapt it to a distinct habitat, such as soil and climate.

THE CULTIVATED VARIETY is the variety of cultivated plants, seeds, and commerce. Equivalent terms are commercial, agronomic, horticultural, and garden variety and cultivar, the shortened form.

The Federal Seed Act of August 9, 1939, defined kind as "one or more related species or subspecies which singly or collectively is known by one common name; for example, wheat, oat, vetch, sweetclover, cabbage, cauliflower, and so forth."

Under the Act, the term "variety" means "a subdivision of a kind which

is characterized by growth, plant, fruit, seed, or other characters by which it can be differentiated from other sorts of the kind; for example, Marquis wheat, Flat Dutch cabbage, Manchu soybeans, Oxheart carrot, and so forth."

*International Code of Nomenclature of Cultivated Plants* (1958) contains this definition: "The term 'variety (cultivar)' denotes an assemblage of cultivated individuals which are distinguished by any characters (morphological, physiological, cytological, chemical, or others) significant for the purposes of agriculture, forestry, or horticulture, and which, when reproduced (sexually or asexually), retain their distinguishing features."

All individual plants of a variety have one or many characters in common that hold them together under the same name and serve for identification yet separate them from all others. Although the degree of uniformity differs within varieties, different samples of seeds and plants of the same variety generally perform similarly under the same conditions. The distinguishing characters must be maintained or inherited when the plants are reproduced over a period of years. The method of propagation, whether vegetative or by seeds, is immaterial.

Cultivated varieties are further distinguished from botanical varieties by their capitalized names in modern languages before the common name of the kind or species, as in Dollard red clover, or after the scientific name. Information for naming new varieties is given in *Rules and Regulations Under the Federal Seed Act* (sec. 201.34) and in the Code. The variety name shall not be misleading.

One variety often becomes known under several names. If no differences can be demonstrated between two or more so-called varieties, the name assigned by the originator is retained, with rare exceptions.

Rejected variety names that have become recognized through broad general usage are known as synonyms.

Some workers, especially in horticulture, have adopted the word "cultivar," an exact equivalent of variety, as a formal, scientific, and international term different from botanical variety. Variety, however, is firmly established in agriculture and is required under the Federal Seed Act and most State seed laws.

*Rules and Regulations Under the Federal Seed Act* define the term "lot of seed" as: "A definite quantity of seed identified by a lot number, every portion or bag of which is uniform, within permitted tolerance, for the factors which appear in the labeling." A lot thus contains seed treated alike or processed in the same way but has no connotation relative to identity of the seeds.

Under the Federal Seed Act, the term "type" may mean "a group of varieties so nearly similar that the individual varieties cannot be clearly differentiated except under special conditions." The southern brome grass varieties, for instance, such as Lincoln and Fischer, constitute a type that is distinct in leafiness and other characters from varieties of the northern type, such as Manchar.

Some seeds, such as lawn seed of grasses, represent mixtures of two or more varieties, often in definite percentages. As defined by *Rules and Regulations Under the Federal Seed Act*, "The term 'mixture' means seeds consisting of more than one kind or variety, each present in excess of 5 percent of the whole."

The word "strain" sometimes has been used to designate an improved selection of a variety. Under the Code, any such selection that shows sufficient differences from the parent variety to render it worthy of a name is to be regarded as a distinct variety. Strain has been applied to unnamed experimental varieties. It is considered broader than a variety. Because of the varied usage, it seems preferable not to associate strain with a certain level of classification. Whenever used, its meaning should be explained.

"Blend" is sometimes applied to

mixtures of lots of seed within or between varieties but is not equivalent to a variety. For example, a blend may be composed of two seed lots of the same variety with different germination percentages mixed together. Or, blends may be mixtures of varieties or species prepared for different geographic regions.

The term "stock seed" often is applied loosely to designate seed used in the propagation and maintenance of a variety. Breeder seeds, foundation seeds, and registered seeds are frequently referred to as stock seed. In vegetable crops, the term "stock seed" has a more limited implication and often is used to denote foundation seed.

"Common" is a term applied to seed that cannot be identified as to variety and is often a mechanical or genetic mixture. In reference to alfalfa, the term "Common" has been used to denote local strains resulting from natural selection. Such selections have been identified by State of origin, such as Kansas Common, Oklahoma Common, or Utah Common.

A "brand" is a trademark adopted by a particular company or distributor for its seed or plants. A brand is neither a varietal designation nor part of a variety name. Instead, the brand precedes the variety name and may be applied to material of many different varieties or kinds of crops. Variety names have common usage and cannot be trademarked.

**ASEXUALLY REPRODUCED CROPS** are propagated without the sexual processes of pollination and fertilization in seed formation.

These vegetatively propagated varieties are grown or multiplied from some part of the plant other than the seed. Familiar examples are vegetative propagation by roots, divisions, tubers, bulbs, cuttings, runners, layers, stem sections, grafts, and buds. Any plant part used to reproduce an individual asexually is called a propagule.

A plant grown from a part of another is in effect a continuation of the same

tissues and hereditary characteristics.

Obviously, vegetatively propagated varieties are true to type and can be maintained pure indefinitely unless modified by the infrequent, sudden hereditary changes known as mutations or bud sports.

A clone consists of uniform plants or material derived from a single original individual and propagated entirely by vegetative means, as, for instance, by cuttings, divisions, or grafts. The original plant may have been wild, a chance variation or mutation, or a complex hybrid unlikely to breed true from seed.

The clonal members are all plants or progeny that originated by repeated multiplication from a single parent plant. A clonal variety consists of the vegetative propagules of one plant.

Some plants mature viable seeds by asexual reproduction (apomixis) without the normal process of fertilization. Instead of developing from the fertilized egg, the embryo plant in the seed may originate from mother tissues or from an unfertilized egg. An apomictic variety is a variety or clone that is propagated by seeds formed by asexual reproduction. Examples are found in bluegrass, dallisgrass, and other grasses.

**NORMALLY SELF-POLLINATED CROPS,** such as garden beans, wheat, and soybeans, may have varieties that are comprised of groups of pure breeding plants that have certain characteristics in common or pure line varieties.

Many crops were established by introduction from foreign countries of highly heterogeneous varieties, each with identifiable characters, such as Kherson oats, Turkey wheat, Manchuria barley, and Manchu soybeans. Such varieties conform more nearly to a race rather than a conventional variety. Single plant selections were subsequently made and the seed increased to produce pure line varieties, such as Richland oats, Kanred wheat, OAC 21 barley, and Mandell soybeans.

The term "line," according to the Code, is a "sexually reproducing popu-

lation of uniform appearance, propagated by seeds or by spores, its stability maintained by selection to a standard."

A pure line variety consists of the genetically identical progeny of a single, self-fertilized, homozygous, or true breeding, plant. Such an individual transmits through its gametes, or germ cells, identical genes—hence all its offspring are identical to it and each other. The variety thus remains pure, except for mutations.

Conversely, a plant from the union of genetically unlike germ cells is heterozygous, or hybrid, for each gene in which the gametes differ.

In self-pollinated crops, heterozygosis largely results from controlled or infrequent natural cross-pollination between plants with different germ plasm. Self-pollination in subsequent generations rapidly reduces the amount of heterozygosity, or genetic variability; in fact, it is halved in each generation.

Among all gene pairs, heterozygous in the first hybrid or first filial generation, commonly designated  $F_1$ , only half are heterozygous in the  $F_2$ , one-fourth in  $F_3$ , and so on. Very rapidly, therefore, the population derived from one hybrid plant becomes segregated into many true breeding plants, no two of which are identical.

Most improved varieties developed from hybrids in self-pollinated crops virtually are pure lines, because final selection of the progenitor plant of the new variety is delayed until a high degree of homozygosis has been attained. This uniformity has advantages in that, barring mixtures, further outcrosses, or mutations, the germ plasm will not change. As offtypes are usually detectable, the task of maintaining purity of the variety is simplified. Uniformity may be disadvantageous, however. If climate or soil is unfavorable for maximum production or if a disease epidemic occurs, every plant in the variety is equally affected.

Certain genetic variability among plants may provide a buffer against adverse environment or diseases. Some

plant breeders have developed varieties from plants selected from populations that have undergone only one or two generations of self-pollination, or they have composited a number of homozygous lines from the cross. The new variety *Traveler* oats is of this type. Such varieties, in effect, are a composite of many closely related plants but not a pure line. Generally the breeder should limit the range of visible characters so that the variety may be distinguished.

Normally cross-pollinated crops may have still greater range of genetic variability within varieties.

Cross-pollinated crops, frequently called open pollinated, can conveniently be grouped into those in which pollination is subject to control on a large-scale field basis and those in which natural cross-pollination must be relied upon for seed production.

Commercial hybrid varieties are supplanting open-pollinated varieties in crops that are subject to controlled pollination.

In crops such as corn and melons, the bearing of pollen (male) and ovule (female) flowers separately on the same plant permits removal of pollen flowers from seed plants.

In crops such as onions, sorghum, sugarbeets, and castorbeans, pollen of seed plants is eliminated through cytoplasmic or genetic male sterility.

In crops bearing pollen and ovule flowers on separate plants, such as spinach, male plants can be cut out of seed rows.

In crops with high self-sterility, such as cabbage and *Pensacola bahiagrass*, clones or lines may be interplanted.

*Rules and Regulations Under the Federal Seed Act* contains this definition of hybrid: "The term 'hybrid' means the first generation seed of a cross produced by controlling the pollination and by combining (1) two, three, or four inbred lines; (2) one inbred or a single cross with an open-pollinated variety; or (3) two varieties or species, except open-pollinated varieties of corn (*Zea mays*)."

A hybrid as a kind of variety is defined by the Code as "a uniform group which is a first generation hybrid ( $F_1$ ) reconstituted on each occasion by crossing two or more breeding stocks maintained either by inbreeding or as clones."

When plants of a crop are self-fertile, inbred lines usually are developed through self-pollinating plants of highly heterozygous populations. The first generation of inbreeding from controlled self-pollination is designated  $S_1$ , the second  $S_2$ , and so on. From a genetic standpoint, the  $S_1$  corresponds to the  $F_2$  generation following controlled hybridization. This process is analogous genetically to the development of pure lines from an induced hybrid in a naturally self-pollinated crop.

Commercial usage of the term "hybrid" is restricted to the first generation following hybridization. Several types of hybrids, however, are possible.

When inbred lines are the parental stocks, the hybrid may involve two, three, four or more inbreds, which may be indicated by such terms as "single-cross," "three-way-cross," or "double-cross hybrids."

Parental stocks of double-cross hybrids are single crosses. If the single crosses have been self-pollinated for one or more generations, however, the resulting cross is an advanced generation hybrid.

When the parental stocks involve an inbred line and an open-pollinated variety, the product is a topcross hybrid.

Variety classification is extremely variable in normally cross-pollinated crops where large-scale controlled pollination is not possible. These crops include many forage grasses and legumes; some vegetables, such as carrots, celery, and cauliflower; and many flowering ornamentals. Varietal designation often is given to populations, such as a race, that have evolved naturally under certain environmental conditions and have acquired somewhat constant characters.

Seeds of many modern varieties are

constituted by interplanting selected clones or seed-propagated lines and allowing them and their progenies to intercross under conditions free from foreign pollen. Varieties so formed are known as synthetic varieties. Seed stocks are increased by permitting random mating within the population in each generation. The first generation of seed resulting from intercrossing is known as Syn 1 and the second as Syn 2.

Syn 1 is called composite by corn breeders because it is in effect a composite of single-cross seeds.

The term "polycross" is at times associated with such varieties; probably the usage stems from the similarity of the random interplanting of clones and the establishment of a polycross nursery. Polycross, however, is a term that describes a type of experimental cross to measure the general combining ability of clones and has no commercial usage.

The term "chance hybrid" has been applied to hybrids recently produced without controlled pollination. Equal seed portions of four inbred lines of pearl millet, for instance, are composited for planting as a mixture. The resulting seed is a mixture predominantly of hybrid but with some inbred seed. Plants from the latter are weaker and largely are eliminated by competition during the seedling stage.

Thus, the variety, which is created and maintained by man, is the essential unit of classification in cultivated plants. Though usage differs greatly from crop to crop, varieties are distinguished by constant, inherent characters. Because of its importance, the variety has been called the basis of modern agriculture and horticulture.

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## Policies on the Release of Seeds

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NEW PLANT materials and new combinations of germ plasm are located or created by plant explorers, plant geneticists, and plant breeders, public and private. The creation, location, and release to the public of better plants is a major contribution of research to the advancement of agriculture and related industries.

The seed of a new variety or hybrid is a tangible, living organism, which we see and handle—not just an abstract idea. Seeds tie together, in a common undertaking, the plant geneticist, the plant breeder, the tester or evaluator, the seedgrower, the seed processor, and distributors and merchandisers of seeds with those who sow the seed, those who cultivate and harvest the plants, and those who process, market, and consume the products.

Mere location or creation of new plant materials is neither justification nor assurance of their release for use. Decisions as to the probable comparative values and usefulness must be made by the ones who originate or possess the new materials. Thorough testing and evaluation for all factors of performance and quality are therefore basic to the decisions regarding release.

Decisions to release or not to release must also depend upon the existence of adequate breeder's and foundation stocks and on effective nonexploitive methods of increase, so as to insure genetic identity and purity. Unless there are definite provisions for effective increases and merchandising, a decision to release may merely result