Giant-Berry Grapes

This is the fourteenth article in a series of brief progress reports on the application of the science of genetics to commercial agriculture.

principles of genetics employed to propagate varieties producing berries of larger size

H. P. Olmo

Two new varieties of table grapes are being propagated for large sized berries and good fruitfulness.

Many grape growers are acquainted with a peculiar type of vine that occasionally appears in new vineyard plantings. These unique vines are recognized as a changed form of the usual variety, and are characteristic in having a very thick type of growth and straggly fruit clusters.

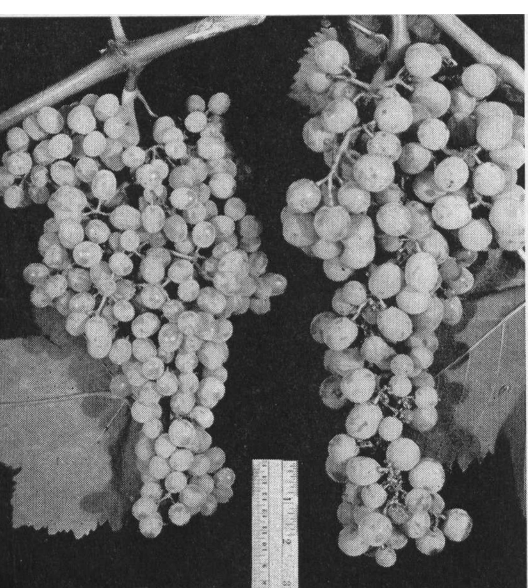
Growers often call these vines *bull, male, freak* or *giant.* This in a single word denotes an inability to bear regular crops and likewise a more robust appearance.

It is rare that a grower will consider such a vine as diseased, as it will renew growth year after year, maintaining these same characteristics. Even less often is such a vine pulled out. It is usually tolerated as an oddity.

The grower of table grapes is especially attracted to these vines by an occasional fruit cluster that happens to set well and has the much larger berries. To the grower of quality table grapes, large berry size brings a premium in price.

When compared with the parent form, the leaves are much darker green, thicker in texture, with margins less indented. The canes are shorter, stubbier and fewer in number, nor do they branch as much. Actually these vines only give the appearance of being giant, not because they produce more total growth, but simply owing to the greater thickness of trunk, leaves, stems, and clusters—as well as larger berries.

A normal *left* and tetraploid *right* cluster of Thompson Seedless.

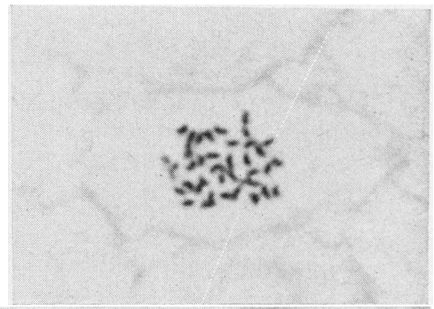


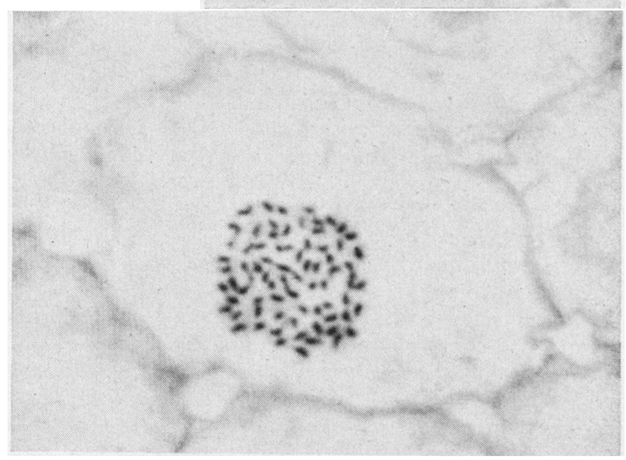
The growth habit is undesirable for such a variety to be grown in the usual commercial manner. The tender shoots are easily broken by strong winds in the springtime, as the tissue is more fragile. Fewer shoots and leaves are produced, which often exposes the ripening bunches to the hot summer sunshine, and they are often scorched or may dry up altogether. When good clusters are obtained, the stems are so brittle they break easily.

Despite these difficulties, the giant-sized Thompson Seedless has been propagated from cuttings by growers who hoped the vine might be improved in growth and fruit setting and yet maintain the large berry size. Such efforts to commercialize this giant form have been monotonous failures.

Photomicrograph of a root-tip cell of the usual diploid grape, *right*, showing 38 chromosomes, and, *below*, in the tetraploid or "giant" forms showing 76 chromosomes.

Note the larger size of the cell in the tetraploid. Magnification 2000 x.





As early as 1918 in California, such a giant form of the Thompson Seedless was described by research workers and several years later giant forms of the Flame Tokay, Muscat of Alexandria and Zinfandel were reported.

The nature of these *gigas* varieties in the grape was first clearly demonstrated at this University just 20 years ago.

The rapidly dividing cells found in young root tips—when examined under the microscope—were found to be about twice the usual volume and contained 76 chromosomes instead of 38. In some way, these carriers of the hereditary units or genes—the chromosomes—had just doubled in number.

Each chromosome ordinarily has a partner in normal varieties of grapes, where there are two sets of 19 chromosomes each. Such normal plants are called diploids. In the giant vine, there are four sets present, or a total of 76 chromosomes. These are called tetraploids.

The giant types—the tetraploids—seem to arise in the following way:

Occasionally as a shoot or root develops, a cell may accidentally fail to produce a dividing wall, even though the chromosomes have each split laterally and the daughter chromosomes have separated. A giant cell of about twice the normal volume is formed, but since the chromosomes have divided, it will have 76 chromosomes—four sets of 19 each.

If this giant cell occupies a key position at the apex of the growing shoot, it will go ahead and divide, producing giant cells like itself. The end result will be a whole assemblage of giant cells forming all or a part of the tissue of the shoot.

Cuttings or buds from the enlarged cane can be used to perpetuate and multiply this new variety indefinitely. The plants now contain four sets of chromosomes in all of their cells and this new type of plant is called a tetraploid.

Until very recently, a search of many cultivated varieties from many different countries failed to unearth a single variety with any departure in chromosome number.

Interest in tetraploidy in the grape might have waned, except for a timely discovery. Descriptions of some grape varieties grown in greenhouses in England—a variety called the Muscat Cannon

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Insect Pests of Alfalfa Seed

proper timing of control measures increases yield and quality of alfalfa seed

Ray F. Smith, L. D. Anderson, and H. T. Reynolds

Maximum alfalfa seed yields can be obtained when harmful insects are controlled and pollinating insects are abundant.

Lygus bugs are the most important pests of alfalfa seed in California. They are sucking insects whose feeding may prevent the buds from producing flowers, or cause the flowers to drop, and the developing seeds to shrivel.

Under California conditions, lygus bugs usually are not very abundant in alfalfa until the fields come into bloom. With the first appearance of bloom, they start to increase and the numbers reach a maximum at full bloom. With the decline in bloom the numbers of lygus bugs decrease and relatively few are present in a field by the time the seed has reached maturity.

The number of lygus bugs in a field is determined by making sweeps through the plants with an insect net. The insect net should have a 24-inch handle and a hoop 15 inches in diameter. The net bag is made of muslin and is about 24 inches deep. The lower edge of the net is held eight to 10 inches into the alfalfa and the sweeps are made through a half circle from one side of the sweeper to the other. Counts of lygus bugs per sweep should be made at several positions in the field. The average of such counts are used in timing the insecticide applications.

Under most conditions, it is time to apply treatment in the prebloom stage if the population exceeds two lygus bugs per sweep. Where lygus bugs are a chronic and severe problem, it may be more practical to treat at a lower count. Such an insurance treatment will decrease the number of applications required when the alfalfa is in bloom. However, it can not be depended upon to give adequate control and a second treatment may be needed.

In the period from early to full bloom, treatment should only be applied if the number of nymphs—wingless forms—exceed the adults—fully winged—and the total count per sweep exceeds five.

When a field is past full bloom, it usually is not necessary to treat. Under some conditions, such as where there is considerable secondary bloom and the lygus bugs are abundant—over 10 per sweep—it may be desirable to treat in late bloom. If the above directions are followed, one treatment usually will be sufficient to give control of harmful insects. Neighboring fields of alfalfa hay and sugar beet seed are sources of lygus bugs and, if possible, treatment should be delayed until after these crops are harvested. Certified alfalfa seed is considerably more valuable than common seed and in this case treatments probably should be applied at lygus bug population levels slightly below those mentioned above.

No material should be applied to alfalfa seed in bloom which has proven harmful to the beneficial pollinators. For this reason parathion, benzene hexachloride and chlordane should not be used. DDT is recommended as the best material when considered from the standpoints of protection of the beneficial pollinators and adequate control of lygus bugs. Under most circumstances the application of DDT as a spray is as effective as or better than the application as a dust. Dusts are suggested where the plants are badly lodged. When compared with dusts, sprays have a longer residual action, that is, they kill lygus bugs over a longer period of time, and they leave more residue on the straw after harvest.

In the prebloom stage, the dosages recommended are one and one-quarter pounds of actual DDT per acre when applied as a spray and 30 pounds of 5% DDT when applied as a dust. When it is

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Hall—noted the very large berries. The Muscat Cannon Hall seemed to correspond exactly with the California-grown Muscat of Alexandria tetraploid. This surmise proved to be correct. The fruit of this giant variety and the usual type from which it came are illustrated on page 5.

Here was the first example that a tetraploid grape—at least under certain special cultural conditions—might become commercially useful.

In 1942 some cultivated varieties imported from Japan likewise proved to be tetraploids, and they were traced as being the giant forms of the well-known American varieties, Campbell, Catawba, Delaware and Niagara.

Recently the most widely grown Concord-type grape grown in California, the Pierce or California Concord, has been determined as a tetraploid.

Tetraploids and diploids differ in their behavior, but it soon became apparent that under some conditions at least, a giant variety might be produced which had desirable growth, fruited regularly and exhibited the sought-for increase in berry size.

No generalizations in behavior can be predicted. The important point is that the effects of chromosome doubling are dependent on the particular variety concerned. The Muscat tetraploid actually sets better-filled clusters than the diploid from which it arose, but the giant Zinfandel shows quite the reverse.

These differences extend to growth habit as well. The tetraploid Niagara has a sufficient number of canes and leaves to afford the fruit good protection from the sun, but the giant Flame Tokay seldom matures any clusters that are not partly or wholly sunburned.

It must be concluded that the characteristics of tetraploids—good or bad—are not only traceable to the increase in chromosome number—but also to the new relationships that this process sets up between the number and balance of the hereditary units or genes.

Recombining these hereditary units can be expected to modify profoundly the characteristics of the tetraploids. This has been done by growing many hybrids between various tetraploids. Among such plants appear segregates that resemble externally and behave like diploids—and yet the doubled chromosome number is maintained.

Even more important, large berry size and good fruitfulness sometimes appear in such modified tetraploids.

Two new varieties being propagated at Davis—for introduction—are expected to be the vanguard of a new *tetra* race of grapes.

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