BREEDING SOUTHERN GRAPES

Scuppernong and Other Rotundifolia Varieties Offer Promise of Large Returns to the Breeder—Technique of Cross-Pollination—Characters That Should Be Improved

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IN MANY of the South Atlantic States, excellent grapes of the species *Vitis rotundifolia* grow wild in profusion. They were brought under cultivation as early as the first half of the eighteenth century, when tradition says that a particularly good vine found on the wooded bank of Albemarle Sound was domesticated and given the name of Scuppernong. This variety is still the most important and most widely disseminated, a fact which shows that very little systematic improvement of the species has been made, although one variety or another is now to be found in almost every garden along the coast of the Carolinas. Within recent years the great potential value of the rotundifolia grapes has been recognized and their improvement attempted.

Improvement of the grape may follow along several distinct lines. As a wine grape (for which the rotundifolia species has been much used) one set of characters must be selected and intensified; as a table grape other characters must be accumulated and improved, or entirely new ones introduced from another species. Since the wine industry in this country has been demoralized by the prohibition movement, the greatest opportunity of improvement among rotundifolia grapes today lies in the production of a superior table grape. The Scuppernong, as is well-known, together with its kindred varieties in the red and in the black colors, although possessing high qualities and flavors, is decidedly deficient in such characters as are intimately associated with a dessert grape. For example none of the varieties of rotundifolia grapes can be called a bunch grape and none of the better varieties even produces berries that adhere to the stem. This means that the skins at the point of contact are usually broken, micro-organisms make themselves at home in the exuding juices, and the grapes soon begin to sour. Even if the utmost precaution is taken not to break the berry skins the natural sprightly flavor in the fresh fruit of most varieties disappears soon after picking, leaving the fruit less palatable. If we add to all of this the extreme thickness of the berry skins, the very large seeds, and a very high acid content of the pulp we begin to realize the need for improvement in this group of grapes.

Permanent improvement in this species might be attained in two distinct ways: first, by inter-crossing desirable varieties within the species; second, by the out-crossing of desirable varieties with selected vines from without the species.

GREAT VARIABILITY

A survey of the material that has been secured in the way of varieties and seedlings indicates that it may not be necessary to go outside of the species for improvement, but that in due time the patient and persistent plant breeder will succeed in producing a grape worthy of taking its place among the best table varieties.

Although the rotundifolia species with its many undesirable qualities is considered by many persons as very stable, this conception is altogether erroneous, because the species has been found not only to include almost all of the characters that can be desired, but to have them in wide range, so that it will yield great results in the skilled hands of the plant breeder. For instance, the variety Scuppernong generally produces its fruits in clusters of from two to six

THE USUAL DEFECT OF ROTUNDIFOLIA GRAPES

While the species has many excellencies, it also has many drawbacks, one of the most conspicuous being that the clusters are very small. Another is that the berry usually falls from its stem when picked; that is, the clusters shatter. The first object of breeders is to remedy these two defects, which in the past have made the species useful only for the manufacture of wine. (Fig. 3.)

berries, small clusters being the rule. By careful selection of parent vines seedlings have been obtained that generally produce bunches of from ten to twelve berries. Exceptional clusters have been found on rotundifolia vines consisting of from twenty-seven to thirty-three and thirty-five berries; these, however, are quite unusual. By judicious crossing and stringent selection the clusters no doubt can be increased in size so as to include a much larger number of berries until a vine is produced that will rank second to none of the native grapes with respect to size of cluster.

Another instance of variability is the bloom or waxy coat on the surface of the fruit. The berries of the Scuppernong and of other rotundifolia varieties are devoid of the heavy bloom generally so conspicuous on table grapes. Some seedlings of this species, however, have produced a coat of bloom that would do real credit to almost any dessert grape. Again, generally speaking the fruit of

A PROMISING VARIETY FOR THE GRAPE BREEDER

The clusters of Luola, above shown, are really respectable in size, and it also has a fairly good flavor. As rotundifolia grapes are admirably adapted to the section in which they grow wild, it is believed that the production of a few superior varieties will ensure a very large industry in the Carolinas and neighboring States. (Fig. 4.)

Vitis rotundifolia drops from the vine as soon as it ripens. There are some vines, however, whose fruit clings more tenaciously to the pedicels than many a grape of the so-called bunching varieties. In this case it again is simply a matter of transmitting this character by careful crossing to the desired seedling vines.

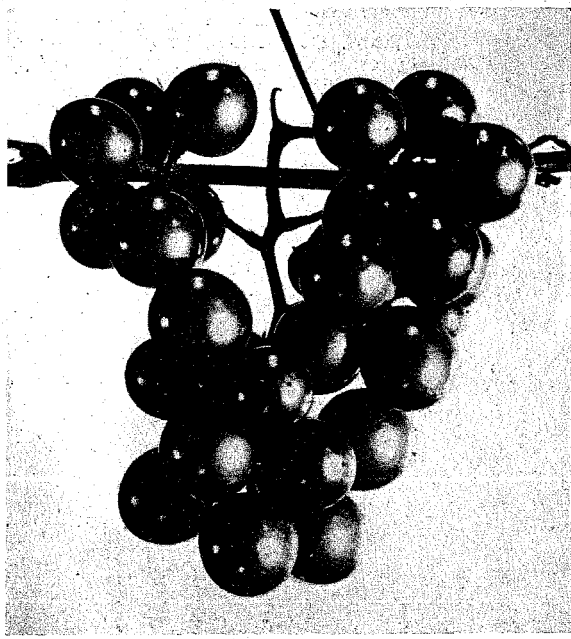
In this same way all of the many other desirable characters from other varieties but of the same species can be assembled, or corralled as it were, the undesirable ones eliminated, and the resultant seedling would still be a rotundifolia grape vine true to type.

The out-crossing method for the improvement of this group of grapes consists essentially of the crossing of selected vines with those of a related species, thereby introducing characters that are foreign to the group. This is often a more rapid method for securing improvement but to the breeder the identity of the species is thereby lost either in part or altogether. The general public, however, cares little about such fine points in methods of achievement and is interested only in the final product, a good table grape.

TECHNIQUE IN CROSSING

The reader, it is presumed, is sufficiently informed as to the methods that are generally used in the crossing of flowers, therefore I shall dwell chiefly on points which may be a departure from the general rule and which might be applicable specifically to *Vitis rotundifolia.*

Grape pollen may be gathered and handled in several different ways. One method that was found to be very convenient is the following. Pollen material is best collected in the morning hours, between 7 and 9 o'clock, because at this time of day very few if any of the



A GOOD CLUSTER OF SANMONTA

Rotundifolia grapes are normally pollinated by insects, the pollen being too heavy and sticky to be carried by the wind. Whether the crop is good depends to a large extent on whether enough insects have been working in the vineyard. In this case a bunch of flowers was bagged, and a bee (family Andrenidae) put in the bag. The efficiency of his work is evident. Photograph natural size. (Fig. 5.)

flower buds have opened and scattered their pollen. Material that is collected on the preceding day is generally not matured enough to go through the regular process of liberating the pollen and difficulty may be experienced in its extraction. Flower clusters with mature buds, and mainly such as will bloom during the same day, are selected and gathered in quantities large enough to insure a sufficient amount of pollen. This material is thoroughly rinsed with clean water to remove or destroy all adhering foreign pollen, hastily dried by removing the excess water either by swinging the material sharply in the air or with the aid of blotting paper, and immediately placed in suitably labeled paper trays. These trays are lightly covered with a piece of clean paper, placed in a dry but airy room, and the buds are allowed to open up naturally, which they will do within a comparatively short time. By noon all of the mature buds will have opened but the contents of the trays are not removed until the following day when the plant material will be sufficiently dry so that the pollen can be extracted.

The process of separating the pollen from the dried flowers is a very simple operation. All that is required is (1) a glass test-tube into which a conveniently small amount of the dried material is placed and shaken. By jarring or gently tapping the tube the fine dry pollen will sift down to the bottom from whence it can be trans-

ferred by means of (2) a small camel's hair brush into (3) a small clean glass vial. After a sufficient amount of pollen is thus secured the vial is lightly stoppered and labeled so that its identity will not be lost when placed among other but similar vials previous to pollination.

Should pollen-bearing flowers for any reason not be plentiful a different method of procedure may be resorted to. The flower buds are gathered, washed, and allowed to open and cure in the paper trays according to the usual methods, but the pollen, instead of being shaken from the dried anthers, is transferred together with them from the paper tray direct to the small receiving vial. Instead of using a camel's hair brush for this transfer a clean forceps is preferred, because the waxy grape pollen is sufficiently adhesive to cause the entanglement of large numbers of the grains with the dried flower material and with the fine hairs of the brush, thus incurring a great loss of pollen. This waste may be prevented by the use of a clean, fine pointed, steel forceps to which only a comparatively small amount of pollen adheres, and by not shaking the pollen from the anthers but keeping it confined until it is to be applied to the pistils of the female vine.

FRESH POLLEN NEEDED

Rotundifolia grape pollen ought to be used preferably on the same day or the following day after it has been gathered, but in case of necessity can be stored a few days longer. In ordinary room temperature it begins to deteriorate rapidly after it is forty-eight hours old, and not infrequently earlier, hence it is best not to prepare the pollen sooner than twenty-four or thirty hours previous to the time of pollination.

While the pollen is being gathered and cured the flowers of the female parent vine should be prepared for cross-pollination. This can be done by either of two methods, all depending on the nature of such flowers: (1) If these flowers bear the reflexed type of stamen we know that they are self-sterile and also inter-sterile.[1] Being thus affected with sterility they need not have their stamens and pollen removed previous to crossing with other varieties. This knowledge is of the highest importance because by its application much time and labor can be saved to the grape breeder. All that is necessary then to prepare such imperfect hemaphrodite grape flower buds for the event of crossing is simply to inclose them in bags before any of them can open and thereby expose their receptive pistils. (2) If the grape flowers bear upright stamens we know that they are self-fertile and the method of preparing such flowers for cross-pollination is the one that is usually adopted by plant breeders of emasculating the flower buds previous to bagging and pollination. This can be done very conveniently by operating on fully matured buds in the afternoon, thirty-six hours previous to the application of pollen to the prepared pistils. A slight pressure firmly applied above the middle of the bud with a pointed forceps will usually cause the cap and also the inclosed stamens to become detached from the receptacle and leave the pistil bare. When all of the mature buds on the cluster have been thus treated they are thoroughly rinsed or dipped in clean water to wash off and destroy all adhering pollen, if there be any, that might have been discharged by an anther bursting during the emasculating operation. If this precaution is not strictly observed many of the flowers will become self-fertilized and perplexing results might be obtained. The prepared flower clusters are now inclosed within light paper or cloth bags to await the process of artificial hand pollination.

The methods of transferring pollen to the pistils of the bagged flowers are several and choice depends mainly on the amount of available pollen. When this is plentiful the work can be materially hastened by the use of a small camel's hair brush; when it is not so abundant as one might wish, the thumb nail method or the anther and forceps

[1] North Carolina Agricultural Experiment Station Bulletin No. 209.

READY FOR POLLINATION

In the upper part of the photograph are shown three baskets of flower-buds which, after being washed, have opened out and are ready to shed their pollen. Below are three glass vials with camel's hair brushes and some pollen ready to be used in cross-pollination. (Fig. 6.)

may be resorted to. In the former case the brush is used to expedite the actual crossing of the flowers, while in the latter cases economy of pollen determines the method.

When all of the flowers are cross-pollinated the bags are replaced and, if these happen to be made of a thin fabric, are left on the vine until the resulting fruit, if any develops, can be harvested.

STARTING THE SEEDLINGS

Grape seedlings may be started in various ways. The one-seed-to-one-pot method, when used in a greenhouse, becomes too expensive because the pots take up too much space; when used out of doors it is unsatisfactory because uniform conditions of moisture are difficult to maintain.

When greenhouse facilities are available, seeds which have been stratified, should be drilled about one-half inch deep in flats filled with a good, light, greenhouse soil. If no such facilities are available then the seedlings may be started in a similar soil but planted direct in a glass-covered cold-frame. Probably the only advantage obtained by starting the seedlings in a greenhouse is earliness. This method is especially recommended for seeds which have been obtained from flowers that were self-pollinated, because the resulting plants from such seeds are apt to lack vigor.

After the plants have attained a height of 3 or 4 inches they can be set out into nursery rows, in very much the same manner as cabbage plants are and without any serious setback. It is best, however, to shade the newly trans-

planted seedlings during the three following days by covering them with 3-inch flower pots during the daytime. These pots not only provide shade but also prevent rapid transpiration which is so fatal to newly set plants.

Rotundifolia grape seedlings, unlike other grapes, should be trained beginning with the first season by the process of disbudding all lateral growth. When the plants are 1½ feet tall they should be loosely tied to the lower wire of a trellis and as they grow taller they are tied to successive wires higher up. During the second year side branches are allowed to develop and the height of the plant is determined only by the height of the upper wire of the trellis. By the third year the plants, if well grown, should begin to bear fruit.

The study of the seedling vines really commences in the seed-bed and with the majority of them may be concluded in the nursery row. Most of the vine and fruit characters can be secured from the plants while they are growing in the nursery rows. Should the work of the breeder be centered mainly on the clusters and fruits, then the seedlings ought to be given more space for the perfect development of the whole plant.

The Selection of Naval Officers

That naval officers for the present war should be selected partly on their heredity and juvenile promise was the contention of Dr. Charles B. Davenport, of the Carnegie Institution's Department of Experimental Evolution, who addressed the National Academy of Sciences in Washington on April 17. Considering only the "fighting type" of sea captain like Nelson, Cushing, Farragut and Dewey, as distinguished from the exploring, inventive and diplomatic types, he found the following traits usually present in boyhood: (1) love of the sea; (2) nomadism, particularly marked in such a man as John Paul Jones; (3) hyperkinesis, an aggressive, restless temperament; (4) an adventurous disposition and absence of fear; (5) ability to command men. He believed that it would not be difficult to get the necessary data about young men who apply for commissions in the navy, and that selection of them from a eugenic point of view would aid greatly to secure an able body of men.

Delinquency in City and Country

There is a widespread idea that crime and delinquency are particularly problems of densely populated areas. J. Harold Williams has tested this idea by a careful investigation in Southern California (*Journal of Delinquency*, March, 1917). He finds (1) that delinquency is more prevalent in small towns, and rarest in the open rural country; (2) that no particular kinds of offenses committed by delinquent boys are especially associated with city, town, or rural population; (3) that the average level of intelligence is higher in delinquent boys from the cities than in those from the towns and rural districts. The proportion of feeblemindedness is greatest in rural districts.

Dr. Salmon Appointed on Immigration Committee

To fill a vacancy, Dr. Thomas W. Salmon has been appointed a member of the American Genetic Association's committee on immigration, of which Prescott F. Hall, of Boston, is chairman, and Prof. Robert De C. Ward, of Harvard University, is secretary. Dr. Salmon was formerly connected with the U. S. Public Health Service at Ellis Island, and is now medical director of the National Committee for Mental Hygiene.

THE CELIBACY OF TEACHERS

WHETHER women are more efficient teachers than men, and whether single women are more efficient teachers than married women, are disputed questions which it is not proposed here to consider. Accepting the present fact, that most of the school teachers in the United States are unmarried women, it is proper to examine the eugenic consequences of this fact.

The withdrawal of this large body of women from the career of motherhood into a celibate career is desirable if the women are below the average of the rest of the women of the population in eugenic quality. But it would hardly be possible to find enough eugenic inferiors to fill the ranks of teachers, without getting those who are inferior in actual ability, in patent as well as latent traits. And the idea of placing education in the hands of such inferior persons is not to be considered.

It is, therefore, inevitable that the teachers are, on the whole, superior persons, eugenically as well as personally. Their celibacy must be considered highly detrimental to racial welfare.

But, it may be said, there is a considerable number of women so deficient in sex feeling or emotional equipment that they are certain never to marry; they are, nevertheless, persons of intellectual ability. Let them be the school teachers.

This solution is, however, not acceptable. Many women of the character described undoubtedly exist, but they are better placed in some other occupation. It is wholly undesirable that children should be reared under a neuter influence, which is possibly too common already in education.

If women are to teach, then, it must be concluded that on eugenic grounds preference should be given to married teachers, rather than single ones, and that the single ones should be encouraged to marry. This requires (1) that considerable changes be made in the higher education of young women, so that they shall be fitted for motherhood rather than for nothing except school teaching, and (2) that social devices be brought into play to aid them in mating —since it cannot be doubted that a large proportion of celibate school teachers are single from necessity, not from choice, their profession not being favorable to finding mates.

It is, perhaps, unnecessary to mention a third change necessary: that school boards must be brought to see the undesirability of employing only unmarried women, and discharging them, no matter how efficient, if they marry or have children; and that the courts must be enabled to uphold woman's right of marriage and motherhood, instead of, as at present, upholding school boards in their denial of this right.

Against the proposal to employ married school teachers, two objections will at once be urged. It will be said (1) that for most women school teaching is merely a temporary occupation, which they take up to pass the few years until they shall have married. To this it may be replied that the hope of marriage too often proves illusory to the young woman who enters on the pedagogical career, because of the lack of opportunities to meet men, and because the nature of her work is not such as to increase her attractiveness to men, nor her fitness for home-making. Pedagogy is too often a sterilizing institution, which takes young women who desire to marry and deprives them of the possibility of marriage.

Again it will be said (2) that married teachers would lose too much time from their work; that their primary interests would be in their own homes instead of in the school; that they could not teach school without neglecting their own children. These objections fall in the realm of education, not eugenics, and it can only be said here that the reasons must be extraordinarily cogent, which