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Hunting For The Perfect Grass

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THE systematic selection and critical testing of new strains of the fine turf grasses is a slow process. It involves a rather large amount of time and labor and the patience to wait over a five or six-year period for anything in the nature of definite results. Further than this, its final value not only depends on the degree of success attained in the development of improved varieties, but just as definitely on the extent to which those who can use these new types are familiar with how they have been produced and the characteristics which differentiate them from others.

H. B. MUSSER
Who has been very active and successful in developing turf culture in Pennsylvania.

All too frequently it happens that, when an attempt is made to put the findings of experimental work into practice the results are disappointing. It appears fairly evident that this must be due, primarily, to one or both of two causes. (1st) The trouble may lie with the man who was responsible for the experiment. He may have failed to interpret it properly, or to point out clearly the conditions under which it was performed and the limitations in the practical applications of results. Or, (2nd) the failure may be due to the fact that the man who is attempting to use the results has, himself, misinterpreted the facts as presented and is trying to fit a set of experimental results to conditions for which they were not designed.

In either event, most of the trouble might be avoided if those who are attempting to use the results can be kept in touch with the progress of the experiment; if they have followed it through the initial stages, know the conditions under which it has been conducted and the factors that have been considered in interpreting the results.

For these reasons I greatly appreciate the opportunity to place before the members of the N. A. G. A. the plan of breeding work with the fine turf grasses at the Pennsylvania Experiment station; and to describe, within the time limits, the procedure in securing new types and the method used in testing them.

The plan includes (1st) the isolation by selection of as many distinct types as possible from the various species, and (2nd) a critical study of these types to determine their definite characteristics and the probable conditions under which they may be expected to give the best account of themselves.

It will be noted that this plan does not include any preconceived idea of what constitutes the ideal

grass. This is a rather unorthodox procedure in plant-breeding work. The plant breeder usually has in mind a very definite picture of the qualities desired in the new type he is attempting to produce.

In order to have such a mental picture in the case of breeding work with the fine turf grasses, it would first be necessary to supply an adequate definition of "the perfect grass." In the first place, such a definition would have to be based on the use that is to be made of the grass. Obviously, from the standpoint of its use on a green, it must produce a perfect putting surface. And yet, our most expert players are by no means unanimous in their opinions as to what a perfect putting surface should be. Again, to qualify as perfect, in the restricted sense of the word, a grass should grow equally well under all conditions of weather, treatment, soil fertility and play to which it may be subjected.

Anyone who has worked with plants to any extent, particularly with grasses, soon comes to realize that, while there is always the possibility of finding such a type, the odds are great that the search will be long and probably barren of results. The chances of finding a universal grass are probably just about as good as they would be of finding a man who can play perfect golf, bat .350 against any kind of pitching, who can settle the foreign debt question to everybody's satisfaction, plead a perfect case, preach a perfect sermon and do the hundred and one other things required by a complex civilization better than anyone else can do them.

There are so many species of grasses and so many families within a species, and they have such widely separated individual characteristics—inherited differences in form, structure and adaptability to their surroundings—that we can hardly hope to find all the desirable points concentrated in one individual. It would seem, therefore, to be a mistake to limit a breeding program to a search for such an ideal type.

TYPES OF GRASS VARY WITH CONDITIONS

In contrast with such a policy, the aim has been to find as many types as possible and to study those types in a critical way to determine to what extent their individual characteristics would adapt them to any particular set of conditions. This is simply putting to work, in a more or less systematic way, a practical truth that the greenkeeper learned a long time ago. A grass that may do well on one course may give all kinds of trouble on another and there may even be very marked differences in the performance of a strain on different greens of the same course.

It is too bad that many of our golf players have not had a chance to learn this lesson, also. The sooner the members of the Squee-dunk club, with its low shaded greens, realize that there is something more to securing good putting surfaces, than insisting that the same type of grass be used that is making perfect greens on the course over the hill, with their high, open conditions, the more grief and expense they will save themselves.

In the development of a breeding program as above outlined, the starting point is the production of as large a number of individual plants as the limits of time and budget will permit. The seed from which these plants are grown comes from two sources. Bulk lots of the various species are secured through seedsmen. We sometimes have material growing from as many as ten different lots of seed of the same species secured in this way.

The second source of seed is from our own nursery plantings. Seed from this latter source is usually pedigreed material. That is, we know and have records on the parent plants producing it. The probabilities of a large number of different types of plants developing in the plant nursery are good for two reasons. (1st) The practice of securing seed from many different sources, whenever possible from growers themselves, provides reasonable assurance that material will be secured that has been produced under a wide range of growing conditions, and (2nd) Plants produced from seed taken from individual plants in the nursery, should show an exceptionally wide range of variations in type due to the fact that so many different types are growing so close together. Any plant may cross with any other plant in the entire nursery, with the possibility of a new combination of characteristics coming out in the plant that develops as a result of the cross.

GROWING SEED IN THE NURSERY

Plants for the nursery are secured by starting seed in flats in the greenhouse about the first of February. Four or five rows of plants in each plot are grown from the same lot of seed. About May first,

or as near that time as weather conditions permit, the plants are transferred from the flats to the plant nursery.

Approximately 100 plants are taken at random from each lot in the flats, except in the case of those which are grown from the plant nursery seed. In this case only twenty plants are usually saved from a group grown from seed of an individual parent. The plant rows in the nursery are two feet apart and the plants are spaced at two-foot intervals in the rows, so that each plant has an area of four square feet in which to develop. The plants are held in the plant nursery through two full seasons.

The detailed study of individual plants is started in the fall of their first season in the nursery. Records are made of foliage texture and color, habit and rate of growth, drought and disease resistance, color after frost, winter injury, earliness to start in the spring, general vigor, length of stolon nodes, if stoloniferous, and seed habits. Most of the above qualities are so intimately connected with the formation of good turf that a record such as this gives practical assurance that nothing will be discarded in the later selection work that has even remote possibilities of forming good turf.

TAKES TWO YEARS FOR SEED SELECTION

Actual selection work is begun during the late summer of the second season. The records which have been collected on individual plants, together with a final careful examination made at this time are the basis for either discarding or saving a plant for further testing. Following plant selection, the next step is the development of sufficient material from the selected plants to determine their sod-forming qualities. Obviously, not much can be learned about this in the plant nursery.

In the case of the stoloniferous types of plants the propagation of the needed material is a simple matter. The plants are lifted bodily out of the plant nursery, the stolons divided and planted in a propagation nursery. When plants are selected from which sufficient seed must be developed to test their sod-forming qualities, the process is not so simple. The fact is, we have not developed a satisfactory technique for the maintenance of pure strains by the use of seed.

The bent grasses are highly cross fertile. This means that every seed produced by a mother plant might have a different father. Under such conditions one would not expect much uniformity in the plants grown from seed of that mother plant, and we do not get it.

With so much variation in the physical appearance of the progeny plants the chances are good that there will be just as much in such characters as winter hardiness, disease resistance, etc. Consequently, any satisfactory plan for the development of pure strains by seed must provide for growing progeny plants from seed of the original parent long enough to determine how much uniformity and trueness to the parent type can be maintained. We have made a start with this but can not report much progress up to the present time.

While cross fertility is a very effective bar to rapid progress in improvement by seed selection, it is the hope and chief tool in the case of selection of plants that can be propagated vegetatively. A new plant developed at a stolon joint is simply a continuation of and is identical in characteristics with the parent plant. Cross fertility gives us a large number of variable forms from which to select and vegetative propagation perpetuates the desirable ones.

This brings us back, in our story, to the propagation nursery. This nursery, as the name implies, is used primarily to develop additional material from each selected plant for further testing. Plantings are usually made in the early fall. By the following fall the rows develop sufficiently to supply the necessary quantity of stolons to vegetate two 6′x6′ plots. Practically all plants that are moved up from the plant nursery to the propagating nursery are taken into the sod plots. Occasionally, a plant will show some weakness in the nursery row that either was missed or did not develop in the plant nursery. When this happens that plant is discarded.

The turf-forming qualities of the selections are tested on what might be called "the proving ground." This is a level area that has received soil preparation to make it as nearly comparable as possible to conditions on a good lawn or putting green. At the present time it consists of 96 plots 6′x6′ in size. The entire area is treated uniformly from the standpoint of watering, fertilizer applications and clipping. In applying top dressings of compost, however, the amount applied to any plot is regulated by the need of that particular strain as indicat-

ed by the appearance of the turf. We would like to do this also with watering, fertilizing and clipping but there are so many practical difficulties involved in varying these treatments on individual plots that it seemed desirable to keep them uniform.

To overcome this difficulty we are planning a series of what might be called quarantine plots, where strains that are otherwise good but do not seem to do their best under the common method of handling can be studied under different maintenance conditions.

CHECKING SOD PLOTS IS DIFFICULT

ONE of the greatest difficulties connected with the study of strains in the sod plots has been to find a satisfactory yard stick with which to measure the relative quality of the different plots. In order that there may be a uniform standard of comparison, against which all plots can be checked, every fourth plot of every second row has been planted to the same strain of grass. This planting scheme makes possible the comparison of each selection plot with a check that is growing next to it. We are using the Washington strain at the present time as the check strain. Any strain could be used for this purpose, the important thing being to have a standard of comparison against which everything can be checked.

Another step in creating a yard stick that will measure as accurately as possible, is the provision for duplicate plots. In maintaining plots of this type there is always the possibility that accidents will happen or that conditions may occur on a plot that are not easily accounted for. By maintaining duplicate plots of each strain the one can be checked against the other and the chances of error in record-making reduced. While this doubles the area of the test plots and doubles the time spent in caring for them and making observations, we feel that this is well worthwhile because of the added protection against mistakes. We would really feel much safer if we could have 3 or 4 plots of each selection. This seems out of the question, however, with our present budget.

A yard-stick to be of any value, must actually measure a yard. Similarly, a study of the qualities of different strains of grass must give us at least a reasonably accurate picture of their more important characteristics from a turf-forming standpoint. There is practically no limit to the number of detailed notes and records that can be taken throughout the four or five-year period during which a strain is under observation. The difficulty is that records which are too detailed become so unwieldy that they defeat their own purpose. No one, sometimes not even the man who made them, can tell what they are "all about." Records that are kept on each proving ground plot attempt to answer the following practical questions about each grass selection.

1. How fast does it grow in comparison with the standard?

2. How does it stand cold weather?

3. How early does it start in the spring?

4. Is it resistant to disease?

5. If it takes diseases, how quick does it recover?

6. What kind of turf does it make in comparison with the standard when growing conditions are good?

7. What is the condition of the turf in comparison with the standard when growing conditions are poor?

8. How is its general vigor with respect to resistance to weed infestation? (We use Poa annua as the measure because it volunteers very readily at this time of the year in our section of Pennsylvania.)

9. How badly does it grain in comparison with the standard? It will be recalled that each plot is composted separately according to its needs, to reduce graining to the lowest point possible for each strain.

At the end of each growing season the records on each strain are compared with those for the check plot that is closest to it. This provides a simple chart that interprets the characteristics of the selections in terms of those of the standard. It not only tells something about the value of any selection in comparison with the standard, but it gives a basis for comparing one strain with another. These comparisons, together with the earlier records obtained from the plant nursery, are used as the yard-stick to measure the possibilities of the strain.

RECORDS OF A FIVE-YEAR TEST

LAST season marked the end of the five-year period necessary to get a complete set of records on the first group of selections made in 1928. In that year records were made on approximately 1700 plants in the plant nursery. Thirty-one of these original plants have come through the second year in the sod plots. Records on seven of these thirty-one selections are so encouraging that they will be multiplied during the coming season for practical trials.

Since 1928 an average of approximately 800 plants have been grown each year in the plant nursery. As a result of selection from these we have forty-two strains of Agrostis canina growing in the propagating nursery. Fourteen of these have already had one season in the sod plots and the others will be put in as soon as possible. In addition to these the propagating nursery contains a total of fifty-three selections of Agrostis palustris, forty of which have been in the sod plots for from one to two years.

The greatest weakness of the selection work as described thus far, will be apparent immediately to the practical groundskeeper. It does not give us performance records of the new selections under growing conditions that are different from those at State College in Pennsylvania. In addition, it makes no provision for giving a new selection the most important test of all—its performance under actual playing conditions.

HOW GRASS STRAINS ARE TESTED

IT IS recognized that no study of new strains would be of general value unless it included tests of their adaptation to a wide range of soil and climatic conditions and of their ability to stand up under heavy play. As strains demonstrate in the preliminary study that they have desirable qualities from a turf-forming standpoint, such as a high degree of resistance to disease, winter hardiness, freedom from graining, etc., and deserve further testing, they are multiplied in a nursery maintained for this purpose.

As soon as sufficient material is available, small amounts of each strain are sent out to groundskeepers in different sections of the state who are willing to grow them in their nurseries and make the necessary observations on them. At the present time from four to seven new strains are being grown for observational purposes, on eight golf courses in various parts of the state.

Facilities at the Pennsylvania State College are excellent for making playing tests on the new strains. An eighteen-hole course is maintained by the college on which an average of approximately two hundred rounds of golf are played per day. One of the greens has been set aside for the strain tests and plantings will be made as fast as material becomes available and budget limits permit. It is probable that as additional strains are developed the number of greens used for experimental purposes may be increased.

One additional phase of the study of strains of the bent grasses, should be noted. In addition to the testing work being done with new selections we have a number of strains growing in the sod plots or propagating nursery that have been selected by greenkeepers on their golf courses. It is hardly necessary to say that a careful record is kept of the origin of these strains so that full credit may be given to the man who has found them. The same comparisons are made and records kept on these strains as on new selections.

We are interested in securing as many types as possible, particularly those that have already given some indication of adaptability under local conditions. Consequently, if any of you groundskeepers have selections that should be included in our tests we will be very glad to have them and to send you the performance records on them as these become available.

Greenkeepers Course at Amherst

Lawrence S. Dickinson, assistant professor of agronomy of Massachusetts State College announces the annual greenkeepers course to be held at Amherst, March 11 and 12. A splendid speaking program has been arranged together with the usual Question Box which has always been a feature. In addition there will be an exhibition of the very latest equipment used in turf culture.