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## How Penn State Strives to Breed Ideal Greens Bent

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**T**O THE GREAT majority of golfers to a somewhat smaller proportion of green-committee members, and to a few greenkeepers, Bent grass is simply Bent grass. Similarly, "stolons" is an all inclusive term applying to any vegetated turf regardless of its pedigree. But as all the initiated know, the *Agrostis* or Bent genus of grasses really consists of a number of different species, some four or five of which are valuable for fine turf production. Fewer of us, however realize that within each species there are numerous varieties or strains which differ from each other in many characters that make them individually valuable or worthless on a green. This is true whether we are thinking in terms of seed or of stolons.

Strains within a species may differ in their external appearance. Thus, the foliage color may vary. Foliage texture may be fine or coarse. Stolons may be short with many joints or long with few joints, or there may be no stolons at all. Or the internal make-up of plants may differ, causing material variations in disease resistance, winter hardiness, feeding ability, etc. It is these relatively wide differences between individual strains within the species that offer the possibilities of improvement over types available at present.

### Planning the Attack.

Systematic isolation of strains and care-

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This is the first authoritative, extensive statement on one of the most important tasks undertaken by golf's patient and competent research scientists.

Turf experts attached to the Pennsylvania State College School of Agriculture and Experiment Station are working on the development of a grass that has interesting, important possibilities. The assistance of Pennsylvania greenkeepers in this selection and testing of bent strains at the experiment station is proving of estimable value, say Penn State scientists.

Although it is too early to report conclusive results from this work, it has impressively demonstrated the practical benefits of close cooperation between laboratory science and practical greenkeeping.

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A section of the propagating rows. White stakes separate individual plants in the rows.

ful observation of them under known conditions seems to be the quickest and easiest path to improvement. This is called *pedigree selection* and is practiced very generally by plant breeders. There is nothing mysterious about it. It really amounts to a capacity for close observation, attention to detail and a willingness to do a large amount of work with the knowledge that only a small part of it may be productive of better types.

In the case of the Bent grasses, two paths of selection work are open, namely, seed selection and stolon selection. At the present time our efforts are confined largely to the latter method because it is very much simpler and more rapid than the former. There are so many things connected with seed production in this genus of grasses which are not definitely known that it seemed desirable to get a few more landmarks before starting into the seed selection woods. Cross fertility is one of the stumbling blocks.

The Bent grasses are highly cross-fertile. This being the case, a seed, the offspring of different parent plants, may have some of the characteristics of both and may not produce a plant similar to either. Consequently, a seed selected from a parent having certain desirable characters may not breed true for those characters. And so we are no closer to improvement than before the selection was made. Under such conditions strain development becomes a complicated process; further complicated by the fact that after we once have it we must keep it away from other

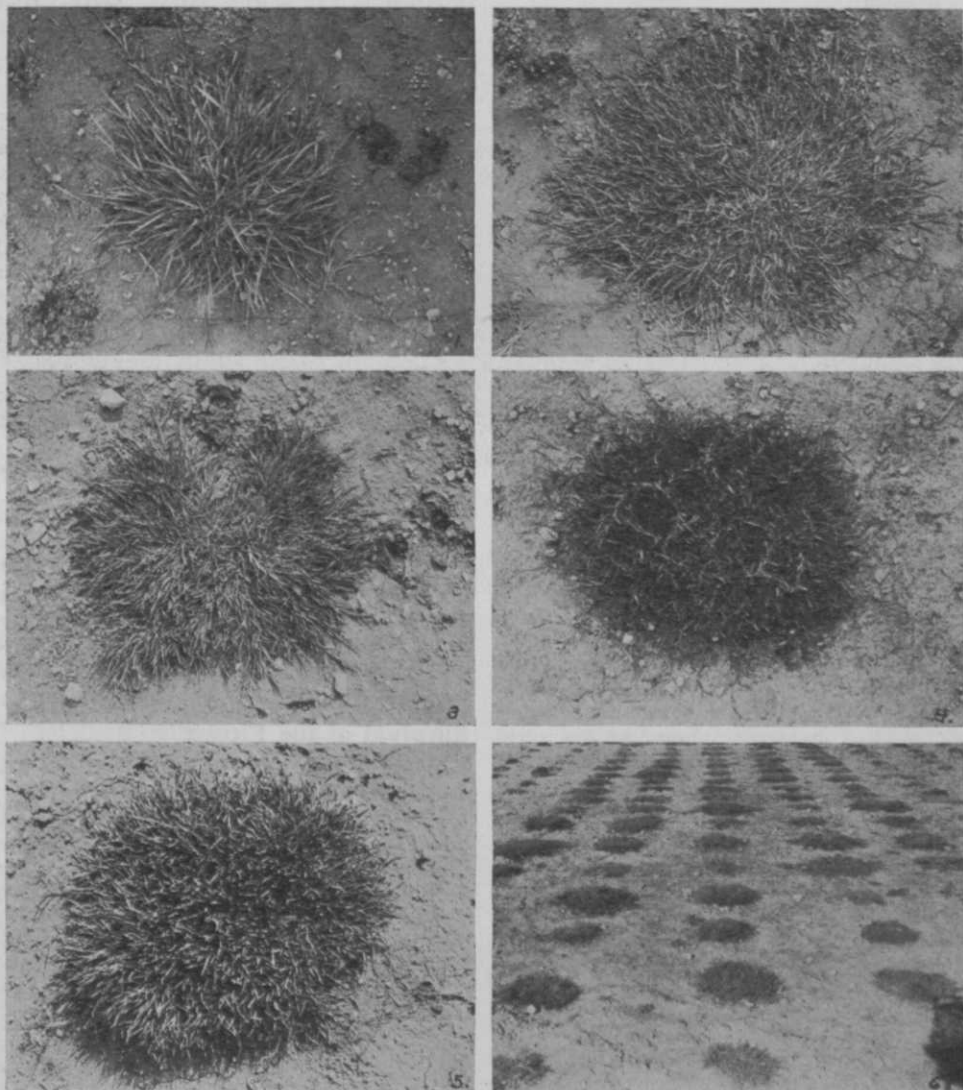
strains or it will become mixed by crossing with them.

#### Nature May Help or Hinder

If a digression may be permitted at this point, nature does a very thorough job in the development of strains from seed in the case of cross-fertilized plants. This is how she works: Assume a seeding of a bulk lot of seed of any of the Bent species under any given set of soil and climatic conditions. Certain plants will be better adapted to those conditions than others. In the course of time these plants crowd out the others and only such plants will remain as are very much alike in their habits and requirements. "Birds of a feather flock together." At times this may be very desirable. Where seedings are to be made under conditions similar to those under which the seed was produced, all well and good. On the other hand if there is a wide difference in soil and climatic conditions between the seed producing area and the area to be seeded trouble may result. This may be one reason why there is so much diversity of opinion among greenkeepers as to the relative merits of various brands of seed. It would seem that the proper measure of the value of seed for any course should be not only its purity, viability and cost, but its adaptability as well to the set of conditions under which it is expected to grow.

#### Chips Off the Old Block

While the large amount of variation among plants produced from seed is a very

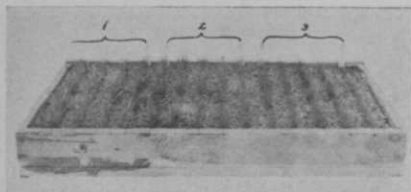


Figures 1 to 5, to the same scale, show plants from seed of the same parent, and are of the same age. Fig. 6 is part of the nursery from which selections are made. Note varied size and texture despite identical treatment.

effective bar to rapid progress toward improvement by seed selection in the Bent grasses, it is the hope and chief tool in stolon selection work. A stolon is a modified stem of the parent plant, so constituted that it can develop a new plant at every joint. These new plants, however are simply vegetative continuations of and identical in characteristics with, the parent plant. Literally, they are chips off the old block.

Right here is the opportunity for the de-

velopment of better strains by stolon selection. When a new plant develops from a seed produced by the crossing of parent plants it may inherit characters from both that make it very desirable for turf forming purposes. If, however, we must depend on the seed of this plant to perpetuate these desirable characters there is little hope of maintaining them. To produce seed our plant must cross with some other. Consequently, there may be an entirely new combination and we have lost the con-



Flat of young plants grown in the green house. This particular flat contains plants from 3 lots of seed as indicated by row labels.

centration of the things we want that we had originally.

On the other hand, when a stolon of our plant produces a new plant, that new plant has all the characteristics of old; and so we maintain all the good qualities of the original. This offers the shortest possible method of securing and perpetuating improved types by selection.

### 8,000 Plants Examined

In practice, our stolon selection begins with the establishment of a plant nursery. We secure lots of seed from as many different sources as possible. This seed comes from seedsmen in various parts of the country and from plants in our own nursery. In this way we secure types developed under a wide range of conditions; with the added possibility that new forms will come out in the nursery where so many different plants have a chance to cross. The seed is planted in flats in the greenhouse in February and the plants transferred to the field nursery as soon in the spring as weather conditions permit. Each plant is given an area in the nursery of about 4 sq. ft., so that it has ample opportunity to spread normally and give some idea of its sod-forming ability. By choosing at random about 100 plants from each lot of seed we can keep down the size of the plant nursery to from 2000 to 3000 plants without running a very great risk of missing promising types. With a nursery limited to this size there is an opportunity to give every plant a thorough examination to determine its possibilities. By this plan we have been able to examine in a critical way during the past three years approximately 8000 individual plants of the important species of Bent. Records are kept on each plant.

It is not practicable in an article of this sort to go into all the details involved in the record making. They cover, however, a mass of observations including earliness

to start in the spring, foliage texture and density, apparent disease resistance, color retention in the fall, winter hardiness and drought resistance.

### The Sheep and the Goats

The plant nursery is held over to the end of the second season after planting. The records are then assembled and examined and selections made of plants showing possibilities. We find, of course, many plants that appear to be very much alike in their general appearance and habits. On the other hand, we find many different types showing a wide range of characters. These variations occur not only among plants coming from a bulk lot of seed but also among plants grown from seeds of a single plant.

This is illustrated very strikingly in the accompanying series of photographs. These are pictures of five plants approximately one year old, all of which are sisters. That is, all were grown from seed of the same parent plant. The photographs were all taken on the same day and on the same scale. It is from such widely different types as these that the selections are made.

### Survival of the Fittest

Selected plants from the nursery are set in a propagating nursery for further observation and multiplication. At the present writing we have approximately 150 selections growing in short rows in the propagating nursery. This represents selections over a two-year period from approximately 6000 plants of the several Bent species. It happens frequently that weaknesses show up in the propagating rows that did not appear in the plant nursery. Therefore, it is necessary to make a second elimination at this point. Roughly, between 10 and 15 per cent of the plants transferred from the plant nursery to the propagating rows are discarded.

As soon as a selection develops sufficient stolons it is ready to be given its first turf-forming test. This brings us to the end of the third season, as a plant spends two seasons in the plant nursery and one in the propagating row. The selections are laid in blocks of 36 sq. ft. on an area that has received soil preparation to make it as nearly comparable as possible to conditions on a good green. The area is divided into two sections and one plot of each selection is laid on each section. The entire area is treated alike with regard to general care, clipping, and fertiliz-



Part of the turf testing nursery.

ing, but one section is treated for disease control while the other is not. In this way records are obtained on each selection both with and without disease control. Complete records covering all the factors that indicate turf quality are kept on each selection in the turf plots.

The trials in the 36 sq. ft. plots are the semi-final tests of the new selections. The most drastic eliminations are made here. All strains are discarded that do not perform at least as well as standard strains which are available commercially. It would seem self-evident that no good is to be accomplished by adding to the number of types now available unless the new strain is distinctly superior to those already in use.

### Selection Strains in Practical Test

Under a conservative policy such as this a new selection must indeed show something before it is given consideration as a permanent addition to the family. As a result of selections in the first plant nursery started three years ago three strains have been isolated that seem to show promise. The principal features of these strains are: (1) a high degree of resistance to disease during the severe epidemic conditions of the past season, (2) a much reduced tendency to the graininess that is the commonest criticism of vegetated turf, and (3) a very high cold resistance, which means early starting in the spring and color retention late in the fall.

These three strains are being multiplied at the present time for the final tests. "The proof of the pudding is in the eating" was never so true as in the case of a strain

of fine turf grass. It is no good unless it can stand the grief of constant wear under actual playing conditions. The Physical Education school of the Pennsylvania State college maintains an 18-hole course where as high as 350 rounds of golf are played in a single day. This offers an exceptionally good opportunity to test the play resistance of new strains. During the coming season one or more greens will be turfed with the new strains together with a standard vegetative strain and comparable seeded areas. Until there has been an opportunity to observe the performance of new selections through a playing season we can only *hope* that we have hit the mark.

### Massachusetts to Have Golf Show, February 6-13

**G**OLF PLAYING, operating and maintenance equipment is to be exhibited at the New England Sportsman's and Motor Boat show to be held at Mechanics' Bldg., Boston, Feb. 6 to 13. A committee of the Massachusetts Golf assn. is in charge of the golf end of the exhibition. Price of spaces range from \$80 to \$100.

The show is run by the same people who are promoting the Philadelphia Sportsman's and Motor Boat show, Feb. 20 to 27.

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### NEW OFFICIALS' NAMES

should be given GOLFDOM immediately after elections, to keep our mailing list accurate and up-to-date.

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