ing attention. When we analyze the situation we have about a dozen men caring for 160 acres of fine turf, or an equivalent of about 13 acres apiece. If we didn't use work analysis studies I don't know how we would get along as well as we do.

Routing and Assignment

Job assignment is part of the answer to efficiency, but a point not to be overlooked is the routing of the men and equipment. Here again there are about as many variations as there are golf courses. My experience has covered 18, 36, and 54 hole operations of square, rectangular and random property outlines. All this enters into the picture of the studying and analyzing of operations. Sometimes the centralized system of having one centrally located service building is the answer to greater efficiency. At other times the decentralized system with several outlying tool sheds may help to reduce excessive unproductive travel time to and from assignment areas.

Equipment Studies

We have thus far concerned ourselves mainly with the use of men. What about some of the major equipment items? Do they also need to be studied for efficiency? Yes, perhaps more than they have been. A few years ago at the Beverly in Chicago, I realized that I was fighting a losing battle in the maintenance of close cut bent and poa annua fairways.

The irrigation system had a capacity of 450 gpm, meaning we could probably water fairways about once every three nights. I often saw short-rooted poa annua grass wilting before my eyes for the lack of moisture. Still I knew it would be at least another 24 hours before we could give relief with another watering. I felt that we had only one alternative to improve the situation — by changing our irrigation system so that we could water all tees, greens and fairways in one night. Investigation revealed that by installing a second pumping station, we could accomplish this. Upon presentation of our findings to the committee and board, the wisdom of the study was understood and accepted. There has been a considerable improvement in the fairways with a minimum loss of poa annua from lack of water.

Study Mowing Operation

Mowing of the various areas of the course is another item of equipment usage that should be constantly noted with an eye towards eliminating waste of time

and effort. A simple example might be taken from the mowing of the collar adjacent to the putting surface. I noted that my men were making as many as four complete circles around the greens to mow variable width collars. It appeared that by reducing collars to a uniform width we could cut the mowing in half with only two mower widths for the collar. It worked and we have made this standard procedure ever since. Another thought on equipment is the use of multiple units. I find, for instance, that by using two 7-gang fairway mower units, we reduce an over-all job from about 8 hours to a 3½ hours.

Fairway Fertilization

Fairway fertilization is another operation that has always taken its toll of hours. It required about three days with an old conventional 6- or 8-ft. spreader to fertilize our 18 fairways. Weather changes, play, and other factors sometimes entered into the picture, too, and we found it was taking a week or more to get the job done. We needed a more efficient method of fertilizer distribution. We came up with an improved technique of using a cyclone type spreader covering approximately 40 to 50 ft. to a swath and a three-day job was reduced to no more than six hours or less. We also worked out a plan for using the same machine on our tees and now all 18 are handled in about 50 minutes by one man instead of two working all day.

Construction Guide

(*Continued from page* 52)

All banks of water hazards should be graded to facilitate maintenance with power equipment. Provisions for sanitation and vegetation control are important in the construction of water hazards.

Irrigation Requirements

The irrigation system should be designed to produce and distribute all water necessary to maintain good turf under all weather conditions. Extended periods of drought and an inadequate irrigation system have been expensive for many clubs. As this subject is so large and complex, it is impossible to discuss all of the items which must be considered. Climate, water requirements of the grasses, surface drainage, internal drainage, type of soil, rate of application, spacing of outlets, adequate pressure, prevailing winds, control valves, pressure controls, provision for draining, depth of bury, access

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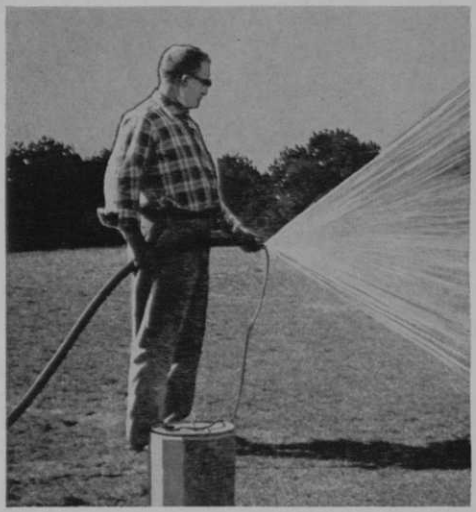

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to controls, minimum sizes of mains and laterals and many other items must be considered in the design of an adequate irrigation system. A well designed and adequate irrigation system pays for itself many times over.

The construction of greens is the most important part of golf course construction. The architect's drawings should indicate contours, elevations and the number of fair cupping areas for each green. This is very important for clubs anticipating tournaments and heavy play. Contours difficult to maintain and large, unusable areas of greens increase maintenance costs out of proportion to benefits received. Collars, aprons and slopes around the putting area should be finished to facilitate mowing and maintenance with power equipment. The location of trees and plantings should be surveyed during construction. These should be removed when there is a possibility of their roots growing into the green. In wooded locations openings should be provided to allow free air circulation.

As it is almost always necessary to use the soil available at the course site or from a nearby borrow area, modification of this soil is imperative. Proper composition of the soil mixture for a green is a subject on which there is a wide range and difference of opinion. Some research has been carried out but much more is needed. The GCSA believes the soil mixture for a green should have these properties:

1. Fertility—a mixture capable of growing and supporting good putting turf;
2. Structure—the mixture must permit rapid passage of surplus water to the subsoil or underdrainage;
3. Stability—the mixture must stand heavy traffic without compaction. Compaction and poor drainage are the two great enemies of a good green. Compaction results in poor water and air movement in the soil and inadequate root systems for supporting good turf. A compacted green will not hold a well played approach shot.

Surface drainage of a green is part of the architect's responsibilities. Design of the green should be such that surface water will not stand on any area of the green. Under-drainage, if necessary, should be built into the green at the time of construction.

Vegetative Bent

(*Continued from page* 58)

sulted from the hand-me-down type of distribution which has been so prevalent with vegetative strains.

Many new greens have been seeded to common quality bents because the better vegetable strains were not available for planting. In other cases $150 worth of seed appeared many times cheaper than the outright purchase of stolons for planting an entire course's greens. Another common problem, unfortunately, is when the decision on what to plant is made by the unqualified or the uninformed.

Widest Adaptation Range

Based on practical use observations, Congressional bent appears to possess the widest range of adaptation of the vegetative strains. Cohansey stands out in the higher temperature regions, whereas the older Washington strains appear best adapted in cooler areas where dollarspot prevails as the major disease. The velvets are definitely limited to New England and in the Midwest we see the best adaptation of Old Orchard, Collins and Toronto.

The seeded Seaside gives its best account in less humid areas where diseases are definitely less prevalent. One can also find satisfactory greens of Seaside where natural selection has eliminated the weaker types over a period of years. In these cases we must also recognize the efficiency of individual supts. as a determining factor.

Best of Seeded Strain

The first departure from the relatively simple method of selection has been the synthetic or polycross approach used by Musser to develop Penncross seeded bent. This consisted of using one of the systematic methods of breeding that is available to plant breeders. Objectives of this program were to produce a superior seeded bent and to overcome some of the very apparent limitations of vegetative strains.

Practical experience is now confirming experimental results which showed that as a synthetic with a broad gene-base, Penncross would perform over a much wider region than a single strain. It will produce significantly better turf than any other presently available commercial seeded bent, and it will compare very favorably with the better vegetative strains in most areas, and surpass others in fringe areas. However, it is not a supergrass and requires good sound management just as

any other type of grass.

Fairways: Orphans of Course

Fairways continue as the chronic overall problem. Many retain the designation of 25 years ago as being "the orphan" of the golf course. The most plausible explanation appears to be the non-existence of grasses capable of satisfactory performance under the level of management given fairways. The problem is most perplexing with the cool season grasses, especially in the crabgrass belt.

Bluegrass can't be held on close-cut, watered fairways, especially when weakened by diseases, high temperature and excessive water. At best, its density leaves something to be desired. Fescue is even less adept under these conditions.

Introduction of leafspot resistant Merion was looked upon as a major development for both irrigated and non-irrigated fairways. Although it was formally released 13 years ago, we have yet to see exactly where it fits into our region of adaptation picture.

Merion will provide a tight, dense turf when adequately fertilized. It tolerates reasonably close clipping due to its decumbent growth habit. Its overall average performance is definitely superior to common and other current bluegrass varieties. However, diseases may still be a major problem in some areas, especially when the grass is subjected to excessive water or low fertility.

Accumulate Thatch

Older stands of Merion show a tendency to accumulate a heavy thatch layer. Thatch will always be a problem with any vigorous grass, stoloniferous or rhizomatous, and must be contained by good management.

Our most promising approach in the near future with the bluegrasses is a seed mixture of improved types. Individual strains wil have to be compatible in germination, seeding vigor, general vigor and fertility requirements. Similar texture and color are desirable but not an absolute necessity.

Creeping bent is impractical on large fairway areas due to its growth characteristics and demands. Vigorous growth during favorable conditions quickly results in a spongy, thatched sod which perpetuates its high susceptibility to many diseases and insects.

Colonial May be Useful

Colonial bent, though, offers hope for irrigated fairways in cooler areas. High leaf density and rapid growth permit

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quick recovery from injuries and makes them tolerant to close mowing. Colonials do not thatch as readily as the creepers.

Most commercial seed is contaminated with creepers and susceptibility to disease, especially brownpatch. It must be realized that no improved types exist and our knowledge of the species is limited.

U-3 Bermuda and Meyer zoysia are now being accepted as a practical approach toward solving the perplexing question of fairway and tee grasses in the 'no man's land 'area between our northern and southern climatic zones. The decision was undoubtedly reached only after a fair trial was given to these grasses, and due credit must be given to those individuals who pioneered the effort by abiding by the principles of good turf management and rational thought. Trials consisting of "just plugging these grasses and waiting to see what happens" contributed very little practical information.

Musser Text Revised

"Turf Management," has been revised and brought up to date by its author, H. B. Musser, professor emeritus of Pennsylvania State University. It soon will be published by McGraw Hill Books, Inc., for the USGA green section.

Ryder Cup Matches

The 1961 Ryder Cup matches will be played over Royal Lytham and St. Anne's, St. Anne's-by-the-Sea, Eng., Oct. 13-14. This will be the 14th meeting of PGA teams representing U. S. and Great Britain.