ALTERNATIVE TECHNIQUES FOR CONSTRUCTION AND ESTABLISHMENT OF ATHLETIC FIELDS

Donald V. Waddington
Department of Agronomy, Pennsylvania State University
University Park, PA

Choices among various alternatives must be made when constructing and establishing athletic fields. The selection of methods should be guided by good agronomic principles as well as factors related to maintenance requirements, type and intensity of use, and cost.

Soil. Three alternatives for soil are 1) use the native or natural soil on the site, 2) use modified soil and 3) use a soil-less medium (sand or sand-organic matter mixture).

A limitation to many fine- and medium-textured soils is their susceptibility to compaction. However, many of these soils can be used effectively if surface drainage is provided and if core cultivation is used on a regular basis to alleviate compaction. Sandy, or coarse-textured soils, have fewer problems with compaction. Fine- and medium-textured soils may be modified by the addition of sand to alter soil physical properties. In effect, soil modification makes the soil more sandy and less susceptible to compaction. Modified soils may be mixed off-site or on-site. Off-site mixing is preferred because it usually results in more uniform mixing. On-site mixing may be used to modify the entire root zone or only a shallower layer at the surface.

The soil-less or sand fields have excellent internal drainage and because of this characteristic they can be built with a flat surface to provide multiple sports use. The slopes needed with some soil fields are often too severe for best play of sports such as soccer and field hockey. Sand fields have low nutrient and water retention unless steps are taken to alter these properties. Sand fields are slow to establish from seed and require intensive management. Also poor traction occurs on worn areas due to the lack of cohesiveness of the sand. Water retention can be increased by placing the sand over a gravel drainage blanket or by placing it in a plastic liner, as is done with the Prescription Athletic Turf (PAT) system. Nutrient and water retention can be improved by additions of organic amendments--usually peat.

Drainage. Drainage and soil requirements cannot be considered independently. Either soil selection should dictate drainage requirements or drainage methods chosen should largely influence the selection of the proper soil. Alternatives for field drainage are 1) internal drainage only, 2) surface drainage only, 3) both internal and surface, and 4) little or none of either type. Choice number 4 should not be considered an alternative; however, it is listed because it represents conditions on some poorly constructed fields.

If a flat field is desired, the field should be very sandy to provide good internal drainage. Since no slope is present to remove water during periods of excessively high rainfall, the internal drainage must be adequate to prevent standing water on the field. The PAT and some other sand fields are

of this type. The PAT system uses vacuum pumps connected to a network of drainage pipes to accelerate drainage.

On a poorly-drained soil, whether natural or caused by compaction, surface drainage is essential for removal of excess water. The occurrence of natural fields with only surface drainage should not be by design. If the native soil is poorly drained, modify it or replace it with better soil. If poor drainage is due to compaction, use maintenance practices that will alleviate the poor conditions. Soils without internal drainage will be anaerobic and will not support turf meeting the requirements for athletic fields.

Most fields are designed and maintained to provide both internal and surface drainage. The soil must be permeable enough to allow for good grass growth. Soils meeting these needs may not be able to absorb water fast enough during or after high intensity storms to prevent standing water. Thus surface drainage is provided for these occurrences. Maintenance practices should be aimed at maintaining both types of drainage.

Surface drainage on football fields is provided by crowning the field. The crown may be up to 18" high in the center of the field. The 1.5 foot drop to the sidelines (a distance of 80 feet) gives a slope of 1.9%. Beginning at about the 20 yard lines the crown is usually gradually decreased to obtain a flat surface at the end of the end zone. A slope of 1% is generally recommended on soccer, field hockey, and baseball fields.

Subsurface Drainage. A drainage system should be included under modified soils and sands. This feature increases water retention in the soil above and allows for rapid removal of percolating water. It usually consists of a drainage blanket and tile system beneath the entire field. The drainage blanket is not recommended for fine- or medium-textured soils. Soils must be at saturation before water moves from the fine soil pores into the larger pores created by the layer of gravel or crushed stone that creates the blanket. In the case of these finer soils, too much water may be held under these conditions. Tile or perforated pipe is installed prior to placement of the drainage blanket.

Drainage tile placed beneath a high water table on a natural soil field can be used to lower the water table and thus decrease soil moisture near the soil surface. An important point to remember is that saturated soil conditions must exist before water moved from soil into the drainage tile or pipe. Tile placed above the water table will be ineffective in drying a wet field.

Vertical Drains. Vertical drains are placed around the perimeter of a field to collect runoff from the field. They may be in the form of slit trenches (back-filled with coarse sand or gravel) or catch basins. They should be located well off the playing surface. Prefabricated drains are available for such use, and some of these along with the slit drains can be used as cross drains to drain low spots or intercept runoff water before it reaches perimeter drains.

Irrigation. Alternatives for irrigation are 1) surface (permanent or portable), 2) subsurface (plastic lines or irrigation tubing) and none. A permanent irrigation system is a must for sand or highly modified fields. A

surface system is normally used. The plastic liner used in the PAT fields can be used in subsurface irrigation. Some type of surface irrigation is desirable on fields with fine- or medium- textured soils. This system can be used to maintain turfgrass growth during dry periods and to keep the field from becoming dry and too hard for optimum playing conditions.

Field Orientation. To minimize sun in the eyes of players during early morning or late afternoon, football and soccer fields are usually oriented with the long dimension in a north-south direction. On baseball fields, effects from sun in the late afternoon can be minimized by having the third base line running from home plate in a south to north direction and the first base line from west to east. (Provide sunglasses for the right fielders.)

Establishment. Turf can be established by using 1) seed, 2) sod, or 3) sprigs or stolons. With cool season grasses the alternatives are seed or sod. How soon the field will be used should enter into this decision. With seed, one must consider species, varieties, and quality. Good quality seed is always a must, however, grass selection can vary with location and use. Besides turfgrass type and quality of sod, one must pay particular attention to the soil that comes with the sod. Sod grown on organic soil is not normally recommended for the fields that have mineral soils. The soil texture of the soil with the sod should match the texture on the field. Do not use sod grown on fine-textured soil on sand or highly modified fields. It will impede water infiltration.

Additional Information. Parts of this presentation were taken from a Penn State publication prepared by John C. Harper II. This book "Athletic Fields: Specification outline, construction, and maintenance" is available for $1.50 from the Ag Mailing Room, Agricultural Administration Building, University Park, PA 16802. Guidelines have also been prepared at other universities.