RESEARCH REVIEW OF SAND

A research review of sand as a seedbed or rootzone medium closely parallels the growth and development of the turfgrass industry and its role in the expansion of outdoor recreational activity, especially golf, and in more recent times, athletic fields. Sand is the most widely used soil textural class for construction and maintenance of turfgrass facilities, especially those areas like golf greens that receive intensive usage. Also, it is the most important because of its relationship to soil stability and to the soil air-water relationships.

Most early golf links in Scotland, England and The Netherlands were laid out along coastal areas. One may assume therefore that the dominant soil textural class was sand, or at the least, sandy loam. As the popularity of the game, and the number of courses increased, non-coastal areas came into play, especially in the U.S. Non-coastal sites more often than not were predominantly clay, clay loam, silt loam -- non-sandy; but, understandably, little thought was given to soil modification. In fact, in many areas local sedimentary peat -- black dirt, muck and similar -- often were added if the soil for greens (or athletic fields) proved to be too "sandy". However, as traffic or play increased, alert practitioners seeking to prevent or to avoid severe turf loss in times of stress, noted the relationship between soil texture, soil compaction, water logging of soil and similar problems. The need to research soil and soil related problems became apparent, and help was sought from a number of sources -- the land grant colleges, the U.S.D.A. and the U.S. Golf Association, Green Section.

The USGA Green Section played a key role in early research efforts. John Monteith, Fanny Fern Davis and Fred Grau were among the early Green Section directors responsible for conducting and supporting turfgrass research. In the late forties and early fifties, Grau granted USGA Green Section fellowships to a number of graduate students (among them Daniel, Harper, Nutter, Watson) to study soil and soil related problems. Within the ensuing decade, Marvin Ferguson, as Director of Research for the Green Section, gave support and direction to studies which culminated in the publication of the "Green Section Specifications for Building Putting Greens". Research contributions from work conducted by Garman, R. Davis, Kuntze and Howard, among others, provided basic information for these specifications. Garman helped to establish parameters for the organic matter fraction (20 percent or less). Howard and Kuntze developed infiltration rates (1 + 1/2 inch per hour) and porosity levels **after** compaction for putting green mixtures (30 to 35 percent total porosity, 12-18 percent non-capillary and 18-22 percent capillary pores). In addition to the 80-90 percent of sand found to be preferred for a seed bed mixture, a layer of coarse sand was used immediately below the mix to create a perched or false water table. (This is no longer called for in recent modifications of the Green Section specifications.)

During this same period (50's) and beyond, a number of other research workers were studying "sand". Among them: Lunt, Keen, Bingamen, Duich, Daniel, Ward, Horne, Madison, Schmidt, W. Davis and, more recently, Brown, Blake, Duble and others have continued to establish criteria for qualifying sand as a medium for turfgrass growth. Also, as in the case of Ferguson, his successor as Director of Research for the Green Section, Al Radko continued to support many of these as well as other projects.

Duich and associates established threshold values necessary in mixtures to ensure a bridging of coarse particles; confirmed that compaction occurs mostly in the top one inch and rarely exceeds a three inch depth -- similar to the results obtained by Alderfer and Robinson working with heavily grazed pasture soils. Keen confirmed the importance of medium sand (0.25 or 0.50 mm) and also the importance of high percentages (85-90) of sand in the mixture. Madison and W. Davis delineated preferred particle sizes for construction and for topdressing -- medium sand.

Concurrent with the work directed specifically toward golf greens, other investigators were studying soil problems of athletic fields. In this group one may expand the above list to include European investigators working almost exclusively on sports turf -- athletic fields. Skirde and associates in Germany; Petersen in Denmark; Adams in Wales; Jansen and Langvad in Sweden; and Daniel, Bingamen, Freeborg and Robey at Purdue were devoting most of their efforts toward development of rootzones for athletic fields.

Their studies and observations dealt with the role of sand as a factor in infiltration rates, percolation rates, surface stability and other pertinent soil physical properties. Their findings further confirmed the importance of sand, and demonstrated that in the correct amounts of the proper size, it performed in a manner similar to that found for putting greens.

While the above list of research workers is far from complete, it does serve to point out the wide range of studies devoted to sand as a stabilizing factor in intensively used turfgrass areas.

Gradually, the fund of knowledge accumulated from research and from field use contributed to a better understanding of the causes for success and failure with sand. Based on knowledge of its performance in golf greens and in athletic fields it is now being used as the base for turfed race tracks (horses). David and Madison of California have been the primary proponents of this approach.

The story of review of sand would be incomplete without brief mention of two other areas.

The first, **topdressing** with sand. Since Madison's report on sand as a topdressing material at the GCSAA conference in Portland, Oregon, much the same thing is happening as occurred when sand was first proposed as a medium for turfgrass growth. A number of golf course superintendents have adopted the practice, others are opposed to its use. There has been success and failure -- from all reports more success than failure! Research programs have been initiated but results are not yet forthcoming. More time is needed.

Secondly, there is a need to determine why the practice of using high sand contents for intensively used areas has not been more widely adopted. For the most part, failures can now be explained. Yet, many still do not use the material. And, in some cases -- northern climes -- there may be justification, for all the answers are not clearly evident. Perhaps it will fall upon some of you in this room to continue that research.

Yet, I am of the opinion that the problem of acceptance perhaps relates to other areas -- economics, unavailability of the right type of sand, lack of understanding of the importance of mineral origin, relationships of particle size and distribution.

What concerns me most, is that the problem may be one of **communications** -- failure or inability to communicate the basic concepts to those responsible for making the decision pertaining to seedbed mixes.

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