# PROGRESS REPORT ON CULTIVATION AND GYPSUM STUDIES

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The problem of compaction is basic to any turf area subjected to traffic from people, animals and maintenance equipment. Numerous solutions for the compaction problem have been proposed. Perhaps the most widely followed practice has been some type of cultivation (i.e. coring, spiking, slicing, etc.). Physical and chemical amendments have been used to ameliorate compaction. In addition, traffic control and the use of flotation tires have reduced compaction to some degree. The research reported here involves two bentgrass cultivation studies and an evaluation of gypsum ($CaSO_4$) as a chemical soil conditioner on fine textured soils.

## Bentgrass Cultivation Studies

Two experiments were initiated during the summer of 1977. The first study was designed to examine the influence of soil moisture content, artificial compaction, frequency of application and size of tines of a Ryan aerifier on the soil macro and micro structure and the overall turf quality of Penncross creeping bentgrass at the Soils Farm, Michigan State University. Treatments were initiated in early July and only preliminary data was collected and will not be presented at this time.

The second study compared the Ryan, Dedoes and Hahn aerifiers with and without topdressing and the Maple Lane and Power Spiker under artificially compacted conditions. An outline of the experiment is found in Table 1. The experimental site was a 14 year old Toronto bentgrass green with a considerable thatch-mat layer. The coring treatments were applied July 20 and repeated during the October 4 thru 18 period and were topdressed shortly after each treatment. The topdressing material was composed of a mix of sand-soil-peat and was applied at the rate of 1/4" or 0.77 cu.yd./1000 sq. ft. Spiking was initiated on July 20 and continued at weekly intervals to October 31. Compaction started on July 28 and was applied 2 to 3 times a week depending on weather conditions. The plots were 5' by 6' in size.

Visual quality ratings, taken in August, October and November are shown in Table 2. Several general trends are apparent. First, that topdressing of the cored and untreated plots resulted in an overall better quality turf. This positive effect of topdressing may be due in part to a nitrogen response from the topdressing material. Second, the turf quality in October and November was slightly better on the compacted half of each plot. On all cultivated plots, slight to severe damage occurred on the uncompacted sections compared to the compacted side. The damage was in the form of scalping of the turf as a result of an uneven cutting surface left after cultivation. The Dedoes, Hahn and the Ryan 1/4", 3/8" and 1/2" treatments gave similar results under compacted conditions. The Maple Lane Spiker gave a slightly superior turf than the Power Spiker; however, both caused turf damage to some degree.

One root sample per plot was taken in late September, washed free of all soil and debris and oven dried at 55°C (Table 3). Generally, compaction as expected slightly reduced root growth. In almost all cases, plots cored and topdressed had less roots than plots that were cored only. This probably occurred since the coring holes were filled with the topdressing material decreasing the space for rooting which negated the beneficial aeration effects of coring. However, the

plot with topdressing had greater root growth than the untreated check. Under compacted conditions, the Maple Lane Spiker and the Ryan 5/8" untopdressed treatments limited root growth to a degree. Since statistical analyses of the data has not been performed at this time further comments will not be made.

Research will be conducted within the next year at the two field sites, which will give us further insight into this area.

Evaluation of Gypsum for use as a Soil Conditioner on Fine-Textured Michigan Soils

Gypsum has been used to a limited extent on turfgrass as a source of both calcium and sulfur where pH alteration is not required. The primary use of gypsum in agriculture is for the reclamation of high sodium soils. It has also been proposed that gypsum can be used to improve the structure of fine-textured soils, especially those soils containing a low level of calcium.

The purpose of this research report was to examine:

(1) the effects of gypsum applied to the surface or incorporated into a poorly structured fine textured soil (typical of many fine-textured Michigan soils) on initial sod root growth and top growth of Merion Kentucky bluegrass; and

(2) the effects of gypsum on overall turfgrass quality and soil physical properties of field test plots.

Gypsum-Wetting Agent Greenhouse Study - Winter 1977

The experiment was arranged in a randomized complete block design containing 4 replicates of the following 16 treatments: gypsum applied at the rate of 1, 4, 8 and 16 ton/A to the surface or incorporated into the soil; two wetting agents, Hydro-Wet and Aqua-Gro applied at the rates of 16 and 32 oz/1000 sq ft and dry Aqua-Gro on a vermiculite base at the rate of 640 oz/1000 sq ft mixed into the soil; and 3 check treatments which include a check for the mixing operation, 640 oz/1000 sq ft of vermiculite mixed into the soil and a untouched check.

Treatments involving soil incorporation consisted of applying the material to the dry soil and mixing in a small soil mixer. Plastic columns, 4" I.D. by 9" long were packed with 2100 grams of treated and untreated soil to a height of 8.25 inches resulting in a bulk density of 1.25g/cc. Surface gypsum treatment and liquid wetting agents were applied to the soil surface of the pack columns then sodded with Merion Kentucky bluegrass grown on organic soil. Four weeks following sodding the liquid wetting agent treatments were reapplied.

Clipping yields obtained throughout the study are shown in Tables 4 and 5. Neither gypsum nor the wetting agents had any appreciable effect on top growth for the first 16 days of the study. However, after 23 days of the experiment several isolated treatments were significantly different but consistent treatment trends were not evident. The remaining part of the study reveals no treatment differences. When all clippings were totaled, as seen in Table 6, the accumulated top growth was not influenced by any treatment.

Gypsum applied at various rates to the surface or incorporated into the soil did not improve root growth (Table 7). Dry Aqua-Gro increased root growth in the surface 2 inches of the soil as compared to the vermiculite check but was not significantly different from the mixed check. Total root growth, shown in Table 6, was unaffected by the various treatments.

Oxygen diffusion rates (ODR), used to measure soil aeration, are found in Table 8. At the 2" soil depth, the ODRs generally were above the range of 5-20$_g$

sod rooting was unaffected by gypsum. It should be pointed out that the exchangeable Ca level of the natural soils of the 4 field sites and in the greenhouse study was very high, which is true for most of the fine textured soils of lower Michigan (3). A soil test should be taken to confirm a low exchangeable Ca level before a gypsum application is deemed necessary.

Gypsum can also be used as a source of sulfur. A sulfur response on turfgrass has not been observed in Michigan (2) but has been reported in Washington and Florida.

## LITERATURE CITED


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Table 1. An outline of creeping bentgrass Cultivation Study, M.S.U. Crops Farm - 1977.

| Type of Cultivation | Cultivation unit | Tine Size | Time of Application | Topdressing (1/4")* |
|---|---|---|---|---|
| Coring | Ryan | 1/4", 3/8" 1/2", 5/8" | Spring, fall | +, - |
| Coring | Dedoes | 1/2" | Spring, fall | +, - |
| Coring | Hahn | 1/2" | Spring, fall | +, - |
| Spiking | Power Spiker | | Weekly | - |
| Spiking | Maple Lane Spiker | | Weekly | - |

* + refers to topdressed plots, - refers to plots that were not topdressed.

Table 2. Visual turfgrass quality ratings (1 = best) as influenced by coring, topdressing, spiking and compaction from creeping bentgrass Cultivation Study, M.S.U. Crops Farm.

| Cultivation Treatment | Topdressing† | Date of rating | | | | | |
|---|---|---|---|---|---|---|---|
| | | Aug. 31 | | Oct. 14 | | Nov. 21 | |
| | | compaction* | | | | | |
| | | + | - | + | - | + | - |
| Check | - | 1.5 | 1.7 | 1.8 | 2.2 | 2.0 | 2.5 |
| Check | + | 1.5 | 1.5 | 1.5 | 1.8 | 2.3 | 2.5 |
| Ryan 1/4" | - | 1.7 | 1.8 | 2.3 | 2.8 | 2.5 | 3.3 |
| Ryan 1/4" | + | 1.5 | 1.5 | 1.7 | 2.2 | 1.8 | 2.0 |
| Ryan 3/8" | - | 1.5 | 1.7 | 2.0 | 2.7 | 2.2 | 3.2 |
| Ryan 3/8" | + | 1.7 | 1.5 | 1.8 | 2.0 | 2.2 | 2.3 |
| Ryan 1/2" | - | 2.3 | 2.3 | 2.5 | 3.0 | 2.7 | 3.5 |
| Ryan 1/2" | + | 1.5 | 1.7 | 1.7 | 1.7 | 1.8 | 2.3 |
| Ryan 5/8" | - | 3.2 | 2.8 | 2.3 | 3.2 | 2.7 | 3.3 |
| Ryan 5/8" | + | 2.5 | 2.5 | 1.7 | 2.0 | 1.8 | 2.3 |
| Dedoes 1/2" | - | 1.7 | 1.8 | 2.0 | 2.0 | 2.3 | 2.7 |
| Dedoes 1/2" | + | 1.7 | 1.7 | 1.7 | 2.0 | 1.5 | 1.5 |
| Hahn 1/2" | - | 1.7 | 1.7 | 1.7 | 2.0 | 2.3 | 3.2 |
| Hahn 1/2" | + | 1.7 | 1.7 | 1.8 | 1.7 | 1.5 | 1.9 |
| Power Spiker | - | 2.7 | 3.8 | 2.3 | 3.0 | 2.5 | 3.3 |
| Maple Lane Spiker | - | 3.5 | 2.8 | 2.2 | 2.8 | 2.2 | 2.8 |

* + refers to compacted plots, - refers to uncompacted plots; †refers to 1/4" topdressing, spring and fall, - refers to no topdressing.

Table 3. Dry root weights as influenced by coring, topdressing, spiking and compaction from creeping bentgrass cultivation study at M.S.U. Crops Farm.

| Cultivation Treatment | Topdressing* | Compaction + Soil depth (cm) 0-4 | 4-8 | Total | Compaction - Soil depth (cm) 0-4 | 4/8 | Total |
|---|---|---|---|---|---|---|---|
| | | mg | | | | | |
| Check | - | 190 | 100 | 290 | 293 | 136 | 429 |
| Check | + | 230 | 154 | 384 | 337 | 143 | 480 |
| Ryan 1/2" | - | 257 | 110 | 367 | 282 | 156 | 438 |
| Ryan 1/4" | + | 177 | 80 | 257 | 336 | 130 | 497 |
| Ryan 3/8" | - | 215 | 141 | 356 | 246 | 138 | 384 |
| Ryan 3/8" | + | 181 | 110 | 291 | 204 | 122 | 326 |
| Ryan 1/2" | - | 224 | 140 | 364 | 243 | 153 | 396 |
| Ryan 1/2" | + | 187 | 121 | 308 | 337 | 152 | 529 |
| Ryan 5/8" | - | 229 | 113 | 342 | 261 | 165 | 426 |
| Ryan 5/8" | + | 147 | 84 | 231 | 191 | 118 | 309 |
| Dedoes 1/2" | - | 253 | 135 | 388 | 166 | 80 | 246 |
| Dedoes 1/2" | + | 285 | 271 | 556 | 266 | 130 | 396 |
| Hahn 1/2" | - | 237 | 143 | 380 | 234 | 150 | 384 |
| Hahn 1/2" | + | 174 | 128 | 302 | 267 | 106 | 373 |
| Power Spiker | - | 250 | 155 | 405 | 262 | 153 | 415 |
| Maple Lane Spiker | - | 154 | 88 | 242 | 294 | 121 | 415 |

* + with 1/4" topdressing, spring and fall; - is no topdressing.