TABLE 1: SUGGEST D PARTICLE SIZE RANGES FOR SAND USED IN GOLF GREEN CONSTRUCTION AND TOPDRESSING

Sieve opening (mm)	U.S. standard sieve number	U.S.D.A. class	Construction		Topdressing	
			Desired	Accepted	Desired	Accepted
2.38 2.00	8 10	Fine gravel				
1.68 1.41 1.19 1.00	12 14 16 18	Very coarse sand		0-10%		
.841 .707 .595 .500	20 25 30 35	Coarse sand	0-15%	80-90%		0-15%
.420 .354 .297 .250	40 45 50 60	Medium sand*	80-95%		100%	75+%
.210 .177 .149 .125 .105	70 80 100 120 140	Fine sand				
.088 .074 .063 .053 .044	170 200 230 270 325	Very fine sand	4-8%	5-10%		0-8%
.037	400	Silt and clay				

NOTE: The proportions proposed are tentative guidelines only. Individual sands should be considered in terms of the infiltration rate when compacted and the moisture release curve. These will be affected by the particle size distribution within the limits proposed. The shape of the sand particles also must be considered, because round sand particles do not compact as readily as sharp sand particles.

* The key fraction is the medium sand. It should be the dominant fraction.

(Sands cont'd.)

coarse should probably be amended to increase plant-available water. For a review of sands recommended for putting greens see Davis (1973 a,b).

In selecting sand to meet the physical requirements for traffic soil, to what extent is fertility sacrificed? Sands have little or no cation exchange capacity; sands taken from below the surface foot have no organic matter and probably a small microbial population. Visual inspection of some sands suggests that they consist primarily of quartz. Such sands would require careful and complete fertilization. Other sands appear to be rich in primary minerals, such as mica, feldspars and ferr-magnesium minerals. Thus, some sands appear to have no plant nutrient-bearing minerals, while others seem to have a full complement of such minerals.

Fertility of sands

The pot test method was used to assess fertilizer requirements of 35 sands obtained from various commercial sources in central California. It consists of treatments with elements in various combinations with elements subtraced one by one - e.g. PKS minus N (N_0). Treatments consisted of: NPKS: full; PKS: N_0; NKS: P_0; NPS: K_0; NPK: S_0; —: Check.

Plants were grown in 4-inch plastic pots containing 650 grams of sand. The fertilizers were applied as chemically pure salts at the following rates:

Nitrogen was applied as a split applicaton with one-half applied 45 days after planting.

One-hundred mg of sand of bentgrass (*Agrostis tenuis* cv. 'Penncross') were planted per pot. The grass was grown for 60 days, and three harvests were made by taking clippings, 30, 45, and 60 days after planting. Total dry weight yield per pot was obtained by summing the three harvests. There were four replicates per treatment. Relative yield (yield of subtractive treatment per yield of full treatment, x 100) is used to compare fertilizer responses between sands.

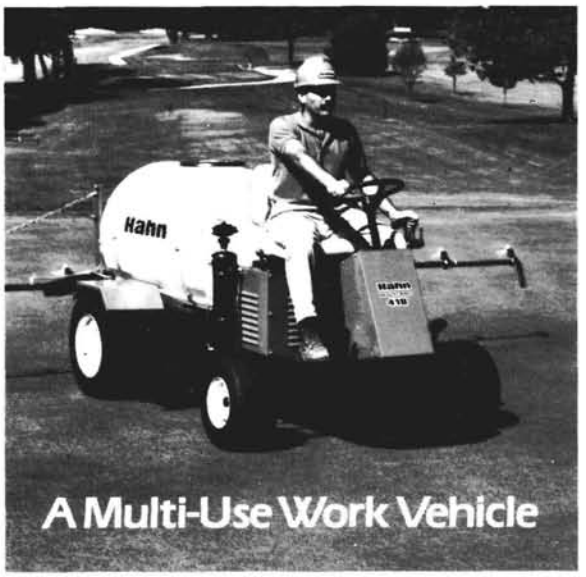
All experiments were performed in a cool greenhouse (night temperature 55°F and day temperature 80°F) from April through October.

Results

The following table summarizes the extent and frequency of fertilizer responses obtained for 35 sands.

(cont'd. page 16)

HAHN Multi-Pro 418



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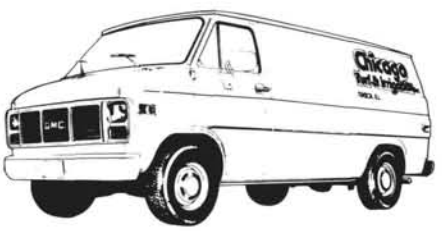
  TORO*, ALLEN AIR CUSHION
- **SEEDERS & THATCHERS**
  TORO*, OLATHE



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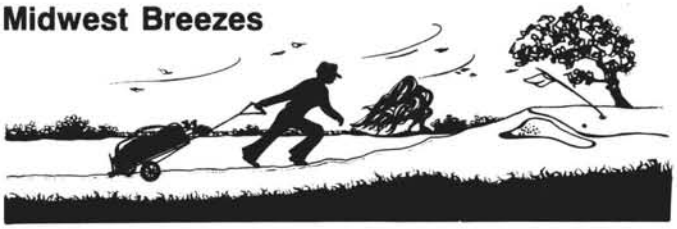

Upcoming Events — Mark Your Calendar

July 17 — MAGCS meeting at Chapel Hill G.C.
August 15 — MAGCS meeting at Popular Creek G.C.
September — MAGCS meeting at Woodmar G.C.
October 2 — ITF Golf Day at Flossmoor & Ravisloe C.C.
October — MAGCS meeting at Prestbury C.C.
November — MAGCS annual meeting
November 28-30 — Turfgrass and Ornamental Chemical Seminar, Purdue University. Contact Jeff Lefton (317) 494-9737
December —
January 22-24 — Midwest Regional Turf Conference

The Editor would like to apologize to Kevin Czerkies for not properly listing him as the Superintendent at Sportsman C.C. on the cover of the June issue of **The Bull Sheet**.

Art Benson at Butterfield is a proud father due to the exploits of his daughter, Sandy, who was chosen as "All Tournament 3rd Base" at Pekin during the Illinois State Finals. Sandy's team finished the season with a record of 33-4. Sandy who will be a junior this year has also been chosen captain of her basketball and softball team for the upcoming seasons.

Don Gerber reports that every day is like a Sunday now that he has retired. He is discovering that the chores he once did seem now to take longer to do them. It's the old rule — work expands to fill the time allotted. But he states it is very enjoyable not to worry about the heat or no rain or too much rain, etc., etc.

Cliff Jones, once the assistant at Timber Trails, is now the new Superintendent at Lansing C.C. Cliff and Cheryl are the proud new parents of Jeffrey Allan who was born on June 13th (three weeks early) and Jeffrey weighed in at 6 pounds, 3 ounces, and stretched out to be 19 inches long. Congratulations, parents!

For Sale:
3 MIR 2200 Motorola Zone Irrigation Controllers. Contact: Marty Baumann, Mt. Prospect Park District Golf Course, (312) 259-7218.

July High

July — the High Five of Summer,
Fire Cracker time, challenging Nose-thumber.
Gather in the warmth, relax in the Sun,
The essence of dedication has begun.
Nature's determine an Annual Invitation,
Avid Golfer, Inviting Course — Interrelation.
As We handle the reins that steady the race,
Absorbing the dilemma that We may face,
Confident We can control all Nature Deals,
Gives to Our Venture, that Gracious Appeal.

Kenneth R. Zanzig

There is a new lotion on the market called "Ivy Shield" that has been tested by the University of California Medical School and the U.S. Forest Service. "Ivy Shield" forms an invisible non-greasy, impenetrable barrier that stops the contact of the skin irritants. It lasts for hours and resists wash-off, and facilitates removal of the irritating resin. For a list of distributors who carry "Ivy Shield", contact Interpro, Inc., P. O. Box 1823, Haverhill, MA 01831 or call 1-800-45 NO IVY.

EVENT:	Illinois Landscape Contractors Association's Annual Summer Field Day
PLACE:	Kankakee Nursery, Aroma Park, IL
DATE:	Wednesday, August 2, 1989
TIME:	8:30 a.m. — 4:30 p.m.

ILCA's Summer Field Day features 172 exhibit booths for dealers of tractors, lawn maintenance equipment, stone, mulch, concrete products, pots and containers, chemicals and fertilizers, nursery stock, greenhouse plants, and other green industry services. The day mixes the business of demonstrations and sales contracts with the pleasure of tours, a grilled steak lunch, beer, soda and the annual horseshoe tournament. Attendance last year exceeded 1650 and more are expected this year.

For further information, contact ILCA at 312-932-8443.

Western Open MAGCS Tent 1989

The Western Open will be held on Thursday, June 29, 1989 thru Sunday, July 2, 1989. The Midwest Associataion of Golf Course Superintendents will have a public relations tent at the tournament again this year. Association members are needed to help by manning the tent throughout the tournament schedule. The hours for the tent would be as follows:

1) Thursday, June 29, 1989 — 9:00 a.m. to 3:00 p.m.
2) Friday, June 30, 1989 — 9:00 a.m. to 3:00 p.m.
3) Saturday, July 1, 1989 — 10:00 a.m. to 3:00 p.m.
4) Sunday, July 2, 1989 — 10:00 a.m. to 2:00 p.m.

Any member interested in manning the tent should contact Timothy Kelly at 469-2077 days, in order to sing up for a particular shift. Through the generosity of Tee to Green Corp., Western Golf Association, Butler National, and Superintendent Oscar Miles, the MAGCS has an excellent opportunity to promote ourselves and our profession. Any help that a member can provide will be greatly appreciated.

(Sands cont'd.)

Relative yield (percent)	Percent of sands deficient in N_0	P_0	S_0	K_0
0 - 20	100	3.1	6.2	0.
20 - 40	—	6.2	18.8	3.1
40 - 60	—	25.0	31.3	6.2
60 - 80	—	15.6	25.0	37.6
80 - 100	—	50.0	18.7	53.1

Nitrogen

The N_0 treatment for all sands had relative yields (RY) of 0 to 20 percent. Yields of this treatment were no better than the check, which suggests that the sands were absolutely deficient in available nitrogen. This is not too surprising if the source of sand is considered. All came from subsurface deposits. Nitrogen-deficient grass was stunted and light yellow.

Phosphorus

Fifty percent of the sands tested were well supplied with available phosphorus (RY, 80 to 100 percent) and 9 percent were severely deficient. It is interesting to note that, in the P_0 treatments for some sands, growth rate increased after the first clipping. This suggests that, with time, more phosphorus became available. Moderately phosphorus-deficient grass is stunted and dark green with narrow blades.

Sulfur

Sulfur-deficient sands appeared to be more or less represented in all RY categories. It is speculated that S compounds originally present in these sands were leached with low sulfate waters, and since no organic matter is present, there is no mineralization from organic sources. Sulfur-deficient grass is very similar to N deficiency.

Potassium

Fifty-three percent of the sands were adequately supplied with available K. Three percent were severely deficient, and 38 percent were moderately deficient. Potassium-bearing minderals, such as mic and the feldspars (microline and orthoclase), would be the main sources of K; clay-derived K would be minor, since clay was generally less than 3 percent of the sand sample.

Micro-nutrient treatments were included in many of the sands, but no significant yield increment was obtained in these treatments. None of the sands tested indicated a need for lime, and no calcium (Ca) or magnesium (Mg) deficiency symptoms were noted, but this does not rule out the possibility that some sands will be deficient in these nutrients. Since only 35 sands were evaluated, no generalizations can be made regarding micro-nutrient and lime requirements.

Chemical analyses

The pot testing method provides a reliable means for assessing the fertility status of soils, but it requires proprer facilities and time. Soil tests are not as reliable, but if they are well correlated with fertilizer requirements, they are very useful. They are also less expensive. Soil analyses for phosphorus and potassium were performed on all sands and were correlated with appropriate subtractive treatments. The test for sulfur has not yet been done for these sands. Nitrogen need not be considered for obvious reasons. (cont'd. page 18)

(Sands cont'd.)

Phosphorus

Available phosphorus was estimated on untreated sand samples by two methods: 0.5M $NaHCO_3$ extractable P and water soluble P (Rible and Quick, 1960). For the $NaHCO_3$ method, extractable P is reported as ppm P on a soil basis, while water soluble P is expressed as ppm P in the extract. Both values are plotted against the RY of the P_0 treatment.

The correlation between P_0 RY and $NaHCO_3$ extractable P suggests that this procedure could be useful in predicting phosphorus fertilizer requirements. While the correlation is not excellent, a value of 3 ppm P appears to be near the critical level. This value is lower than is recommended for soil (6 ppm). The relation between P_0 RY and water soluble P provides a better correlation. The critical level is about 0.15 ppm P. This value is at the same as that cited by Bingham (1962) for soil, with cereals as the indicator plant. Both methods are useful in estimating phosphorus fertilizer requirements in sands.

Potassium

Available K was estimated by extracting with neutral normal NH_4OAc (ammonium acetate). Sands have a very low cation exchange capacity, and extractable K is expected to be low even in sands well supplied with K. Beyond 20 ppm. there is no response to K fertilization. This critical value is considerably lower than for soils containing clay, but it is in keeping with the critical level found for sands in Australia.[2]

In addition to P and K analysis, salt and pH should be determined. Salt should not present a problem since it is easily leached if the sand is a permeable one. Sands having a very low pH (4 to 5) indicate a need for lime or dolomite, while sand having a pH[5]8 may have lime present.

Conclusions

The results of the pot test for a limited number of sands indicate that they behave as might be anticipated for sub-soil. The extent and frequency of P deficiency is similar to surface soils which have been tested (Vlamis, 1966). Nitrogen is completely lacking. Occurrence of S and K deficiencies is probably more frequent in pot tests than in valley soils in California.

It is apparent that all sands will require N to start grass, and many will also require S. Soil tests can help decide whether P and K should be added also, but sand well supplied with P and/or K initially may eventually become deficient in these nutrients as clippings are removed. Soil and tissue tests may be useful to indicate when these nutrients should be applied.

The work is part of the Turfgrass Adaptive Research Program, supported by a grant from the Northern California Golf Association.

[2]T. Arkley, Agricultural Consultant, Perth, W. A. personal communication.