

the Texas Ag Extension Service.

In Texas, two state agencies have primary jurisdiction over land application of municipal sewage. The Texas Department of Water Resources is responsible for systems financed by the Environmental Protection Agency Construction Grants Program and/or the Texas Water Quality Enhancement Fund.

The most stringent requirements apply to public access lands such as recreation areas and to wastewater application systems that would involve an indirect discharge to surface or groundwater. Land application of treated sewage effluent is generally permitted if surface and ground water quality will not be impaired.

Sewage applied to public access land must have received secondary treatment following primary, which is solids separation. Texas does have a limit on bacterial quality and irrigation should not take place when areas are open to the public.

Private agricultural land may be irrigated with water receiving only

solids separation, provided discharge to surface or ground-water is prevented. Sweeten says the city or farmer may own the storage facility.

The application systems include irrigation without discharge, overland flow and infiltration-percolation. The application rate for the systems varies with soil type and depth, percolation rate, slope, water table level, crop growth and other related factors.

More than 200 Texas cities and towns have installed land application systems for treatment and disposal of municipal sewage effluent.

## IRRIGATION

### Temperature can show when to water

There is now a "gun" on the market that will measure the canopy temperature of a crop and the air temperature and give a digital readout of the difference. The gun weighs about 2 pounds, is carried

in a holster, and has rechargeable batteries.

The theory behind use of the gun is that when evapotranspiration depletes the soil moisture below the plant's needs, the plant's temperature rises, due to stress. When the crop temperature exceeds the air temperature for a certain length of time, depending on the crop, it is necessary to irrigate. This concept has been under study by USDA scientists at the U.S. Water Conservation Laboratory in Phoenix, Ariz., for the past few years.

The concept is being "fine-tuned" by three scientists with USDA's Science and Education Administration-Agricultural Research. Ray Jackson, Robert Reginato and Sherwood Idso have developed a system that they call "stress-degree-days". Wheat, for instance, on Phoenix area soils has a tentative stress-degree-day classification of +10. If the differential reading on a wheat field one day is +2, the next day +3, and the following day +5, the total accumulation of +10 indicates that

the crop needs water.

We need a turf scientist to come up with figures for turfgrasses. Then when to irrigate will be as easy as that.

## COURSES

### Pinehurst no. 2 closed for original restoration

The Pinehurst no. 2 course, designed by Donald Ross, is currently closed for restoration of the layout to its original design and condition. The seven-year-old Penncross bent greens were stripped and are currently being resodded with a Bermuda hybrid strain similar to the grass Ross last used.

Three greens have undergone further surgery — only minor, again to restore the course to the design and shape that existed just after Ross' death in 1948.

A second step in the restoration program involves returning the greens to their original size.

"Over the last 20 years, the greens of No. 2 have shrunk . . . so slowly that it was hardly perceptible except to the trained eye," Miller said. "But the greens had lost at least two dozen excellent pin placements in the process." Restoring greens size does not involve redesigning but requires, simply, cutting larger greens. The enlarging will return more than 50 per cent in green dimensions and will bring several mounds once again more closely into play.

A third step entails restoring 17 sand traps that had been converted to grass bunkers over the last 30 years. These will not add appreciably to course difficulty, Miller said, but will provide contrast for depth perception and hole definition.

Those involved in the restoration note that firm greens were once a trademark of No. 2 Course. Returning to Bermuda-grass greens will "put the pitch and run shot back into No. 2," said golf course architect Tom Fazio of the design team of George and Tom Fazio, who built the Pinehurst No. 6 Course and completed redesign work at Inverness Club in Toledo, Ohio, for the 1979 U.S. Open. "Bermuda-grass greens will eliminate the approach shot hit directly to a pin placement. Rather, as is more common on Bermuda-grass greens, players can expect a big first bounce before an approach shot holds," Fazio said.

GOLF BUSINESS pulse report — March*	% of sample	average expenditure	total expenditure within sample	total expenditure projected to universe**
dry turf fertilizer	79	\$2694.36	\$118,552	\$25,000,000
liquid turf fertilizer	11	513	3,080	650,000
tree fertilizer	25	400	5,600	1,200,000
pre-emergence herbicide	46	780	20,272	4,300,000
post emergence herbicide	63	667	23,352	5,000,000
aquatic herbicide	29	319	5,096	1,000,000
fungicide	66	1709	63,224	13,000,000
turf insecticide	50	518	14,504	3,000,000
tree insecticide	25	200	2,800	590,000
seed	61	781	26,544	5,600,000
sod	14	1617	12,936	2,700,000
trees	34	1512	28,728	6,100,000
ornamentals	25	1948	27,272	5,800,000
soil amendments	34	799	15,176	3,200,000
tractors:				
under 10 hp	9	1523	7,616	1,600,000
10-20 hp	5	3808	11,424	2,400,000
21-30 hp	0	1	—	—
31-50 hp	7	11,172	44,688	9,500,000
larger	4	2500	5,000	1,100,000
tractor drawn mowers:				
rotary	4	2828	5,656	1,200,000
reel	14	2345	18,760	4,000,000
flail	7	1204	4,812	1,000,000
self-propelled mowers:				
rotary	30	2994	50,904	11,000,000
reel	34	5123	97,328	21,000,000
flail	2	400	400	85,000
irrigation equipment:				
pumps	18	7717	77,168	16,000,000
sprinklers	43	2480	59,528	13,000,000
pipe	43	1204	28,896	6,100,000
controls	30	2253	38,304	8,100,000

\*56 strategically located superintendents reported their expenditures for the month of March. GOLF BUSINESS presents these figures as an ongoing effort to accurately picture the dollar volume in the golf market.

\*\*These figures are based on the assumption that what is true of the superintendents responding to the questionnaire is true of superintendents in general. A universe figure of 11,885 superintendents is used.