(not shown) for Penncross, Penneagle and Emerald, respectively. The late fall applications ranked well much of the year considering the rate of nitrogen application.

The thickness of the "thatch" layer tended to be higher at higher rates of nitrogen but there was sufficient variability in the data (Tables 20-22) that differences were not significant. Similarly the amount of organic matter in the thatch tended to increase with the higher nitrogen levels, depending on the grass. Higher nitrogen levels reduced dollarspot numbers for Penncross and Penneagle but were not consistent on the Emerald plots.

Table 23 gives soil test information for two treatments from samples taken in Fall, 1987. Higher nitrogen decreased available phosphorus and potassium levels in both thatch and soil while calcium was reduced somewhat and magnesium was not affected. Levels of available nutrients in soil samples taken from below the thatch layer were markedly lower than in thatch. This may be due to fertilizers being applied on the surface (concentrating the nutrients at the surface) and to the lower density of the thatch layer as mentioned previously.

Another long-term nitrogen fertility study initiated in 1982 was completed on a Penncross creeping bentgrass green at the Hancock Turfgrass Research Center. Emphasis was on nitrogen carriers and timing. Carriers included IBDU, sulfur-coated urea, urea, ammonium nitrate, Milorganite and a greens quality commercial fertilizer, 18-4-10, provided by the Lebanon Chemical Company.

Numerous turf quality and color ratings taken during the year revealed no unusual responses to treatments. Those plots receiving 1 pound nitrogen as a late fall treatment (after growth ceases, about November 5 in central Michigan most years) ranked well throughout the year. Lower rates on greens might be advisable (1/2 to 3/4 pound N). As nitrogen rate was increased from 1 to 7.5 pounds per 1000 sq ft annually, the thickness of the thatch layer increased from 4.5 mm to 10.6 mm.

Soil tests on selected plots revealed few differences among nitrogen carrier effects. Those products not containing P had available soil P levels of 35-39 pounds per acre at the conclusion of the study while plots receiving P had higher soil test levels. Plots treated with 18-4-10 have received 6.2 pounds P_2O_5 over the 7 year period while those treated with Milorganite received 9.3 pounds P_2O_5, assuming the analyses of Milorganite is 6-2-0. The soil P tests at the conclusion of the study were 86 and 116 pounds per acre, respectively for 18-4-10 and Milorganite treated plots. Thus the soil P levels increased dramatically as a result of the continued use of P containing fertilizers.

Phosphorus Needs On Sodded Turfs

Turfs established on subsoils frequently suffer from a lack ofnutrients, especially nitrogen and phosphorus which are naturally very low in subsoils. A study to evaluate phosphorus response on a sodded Kentucky bluegrass lawn in Novi growing on a compacted subsoil was established in 1985. Treatments applied are outlined in Table 24. These treatments have not been repeated. Turf quality ratings in 1986 indicated response to applications of 1 pound of