by Dr. James B. Beard

TURFGRASS RESEARCH REVIEW

Wetting agents are not cure-alls

Effects of nonionic surfactants on monocots. *R. M. Endo, J. Letey, N. Valoras and J. F. Osborn. 1969. Agronomy Journal. 61(6): 850-854. (from the Departments of Plant Pathology and Soils and Plant Nutrition, University of California, Riverside, Calif. 92502).*

The effects of two nonionic surfactants on seed germination, shoot growth and root growth of six grasses were investigated. The grasses included in the root and shoot growth inhibition study were barley, common bermudagrass, creeping bentgrass, Italian ryegrass, Kentucky bluegrass and tall fescue. Additional studies concerning the effects of surfactants on seed germination were conducted with barley. The two surfactants included in the study were (a) Aqua Gro, 50 per cent polyoxyethylene ester and 50 per cent polyoxythylene ether and (b) Soil Penetrant 3685, polyoxyethelene ethanol.

The root and shoot growth inhibition studies with the six grasses were conducted in a greenhouse using solution culture techniques. The Hoagland's nutrient solution contained treatment concentrations of 0, 3, 6, 12.5, 50, 100, 150, 200 and 400 parts per million (ppm) of the specific nonionic surfactant. Seed germination and shoot growth inhibition studies using barley were conducted on two soil mixtures which were compacted to a bulk density of 1.25 gms/cm^3. The two soils included were (a) a Krilium-treated Yolo silt loam and (b) a 1-1 mixture of sand and peat. The nonionic surfactants were applied to the soils at concentrations of 0, 330, 1,000, 2,000 and 4,000 ppm. Effects on shoot and root growth were determined 22 days after treatment.

Results of these studies showed no inhibition of root growth, morphology or development by the two nonionic surfactants when applied at rates of 3, 6, and 12 ppm in the solution culture studies. Toxic effects were observed at excessive rates of application ranging from 25 to 400 ppm in the solution culture studies. Soil Penetrant was more toxic than Aqua Gro. Root hair development and growth was particularly sensitive to inhibition by the surfactants at concentrations of 25 ppm or more. Differences in species response to root hair inhibition were also evident with bermudagrass being more susceptible to injury than ryegrass. Complete suppression of root hair formation occurred at 200 ppm. Shoot growth was also inhibited by the nonionic surfactants at rates of 50 ppm or higher. Soil Penetrant was more inhibitory than Aqua Gro as was observed in the case of rooting.

There was a drastic reduction in phytotoxicity to the roots and shoots of barley plants when grown in treated soils rather than in solution cultures. Aqua Gro was less phytotoxic than Soil Penetrant in the soil studies. Phytotoxic effects from Aqua Gro applications were only evident on soils treated at high concentrations of 1,000 ppm or above. The reduced phytotoxicity in soils compared to nutrient solutions is attributed to the absorption of a portion of the surfactant by the soil. The differential in phytotoxicity between the two wetting agents is attributed to Aqua Gro being absorbed to a greater extent than Soil Penetrant. The degree of phytotoxicity also

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varied with the specific soil type. At a given concentration of surfactant, phytotoxicity was greater when grown on a treated silt loam than on a one to one mixture of sand and peat.

Root growth of turfgrass is more sensitive to inhibition or phytotoxicity by surfactants than shoot growth, whereas seed germination is the least sensitive. Soil Penetrant significantly reduced seed germination of barley at concentrations of 1,000 ppm or above whereas soil treated with Aqua Gro at 4,000 ppm did not reduce germination.

Comments: Nonionic surfactants are nonelectrolites which are chemically inactive. They are most effective in hard water and at warm temperatures. Several of the nonionic surfactants are used in turfgrass culture as wetting agents for the purpose of increasing the ability of water to moisten a solid substance such as the soil or thatch. Basically, a wetting agent lowers the surface tension, resulting in increased effective wetting of solid surfaces. Wetting agents vary in the degree of effective wetting they produce.

Wetting agents can be utilized in improving the wetting of hydrophobic soils, thatch and localized dry spots. Beneficial effects associated with the improved wetting include a reduction of the (a) evaporation rate, (b) incidence of dew and (c) amount of water lost by surface runoff. Potentially detrimental effects include (a) a reduction in the water holding capacity of the soil and (b) an increase in thatch accumulation resulting from the increased droughtiness of the thatch layer which restricts microbiological decomposition. There may be no beneficial effects from the use of wetting agents on soils which are not hydrophobic.

The results of this study indicate that the nonionic wetting agents can be phytotoxic to turfgrass plants when used at excessive rates. The root system, especially the root hairs, are much more sensitive to injury than the shoots. These results emphasize that wetting agents should not be used indiscriminately. The recommended rate of application should be followed closely. These studies also indicate that the potential degree of phytotoxicity will vary with the specific (a) wetting agent used and (b) soil type. Soils containing a higher amount of clay will have a greater tendency to absorb the surfactant and thus reduce its potential phytotoxicity. Potential phytotoxicity is far greater in solution culture studies than when turfgrass plants are grown in a soil media. Foliar injury of turfs by wetting agents are generally associated with (a) periods of high temperature, stress and (b) excessive rates of application.

In summary, nonionic surfactants or wetting agents are not cure-alls for turfgrass cultural problems. They are effective in improving water penetration into hydrophobic soils or thatch. A wetting agent is one of the tools available to the turfman in maintaining a quality turf. Wetting agents should be applied at the recommended rate in order to avoid potential phytotoxicity. In addition, consideration must be given to the particular temperature conditions, soil type and turfgrass species when selecting the rate and time of application of a wetting agent. Further research is needed regarding the beneficial or detrimental affects of wetting agents, particularly from long term, continual use.

Reaction of Kentucky bluegrass strains to feeding by the sod webworm.

R. C. Buckner, B. C. Pass, P. B. Burrus and J. R. Todd. 1969. Crop Science. 9(6): 744-746. (from the Kentucky Agricultural Experiment Station, Lexington, Ky.).

The objective of this investigation was to determine the relative degree of resistance to sod webworm injury present among various cultivars and selections of Kentucky bluegrass. The plot area was established in August, 1962. Detailed evaluations of sod webworm (*Crambus* spp.) injury were conducted during the 1964 to 1966 growing seasons. The experimen-

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tal area was mowed weekly at a height of two inches. Data collected included visual evaluations of injury to individual Kentucky bluegrass cultivars as well as actual counts of number of larvae.

Results of the studies showed considerable variation in resistance to sod webworm injury among certain cultivars and selections of Kentucky bluegrass. The authors concluded that there are good sources of resistance to sod webworm injury available for use in breeding programs to develop resistant bluegrass cultivars.

Kentucky bluegrass obtained from naturalized stands of Kentucky grown seed contained relatively high levels of resistance to sod webworm injury. Selections of Kentucky bluegrass which were obtained from the more southerly locations in the United States also tended to be more resistant. In contrast, Newport, Park and Merion were quite susceptible to sod webworm injury. Evidently, there has been a natural selection for more resistant types of Kentucky bluegrass in the more southerly location due to the greater sod webworm activity in these areas.

Investigations regarding the nature of resistance to sod webworm injury failed to provide a complete explanation. Preferential feeding trials, total sugar content and silica content of the shoots were not associated with resistance to sod webworm. However, the more resistant selections tended to have heavier rhizome weights than susceptible selections. Further studies are needed before the specific nature of resistance is elucidated.

Comments: Current breeding programs for improved turfgrass cultivars have emphasized primarily improved resistance to turfgrass diseases. However, insect problems can be just as important as disease problems in certain regions. This paper is one of the few studies available relating potential resistance to insect injury among turfgrass cultivars. This study shows that an acceptable degree of resistance exists among certain selections of Kentucky bluegrass. On southern turfgrass species, there is evidence of resistance with (a) certain selections of St. Augustinegrass to chinch bug and (b) certain selections of bermudagrass to the bermudagrass mite.

The use of insect resistant turfgrass cultivars is preferable to the application of insecticides since it is less costly and time consuming as well as being a preventative approach which avoids potential pollution problems. Unfortunately there are very few turfgrass cultivars which have been developed with specific resistance to a given turfgrass insect pest. More emphasis will be placed on this problem in the future as breeding programs become more extensive. □

OTHER PAPERS OF INTEREST

1970 golf course survey for Northern Ohio Chapter of the Golf Course Superintendents Assn. *1970. Northern Ohio Turfgrass News. 13(3):1-3. (from Editor John P. Dunlap, 1518 Warrensville Center Road, Cleveland, Ohio 44121).*