Integrated Biological and Chemical Pest Management

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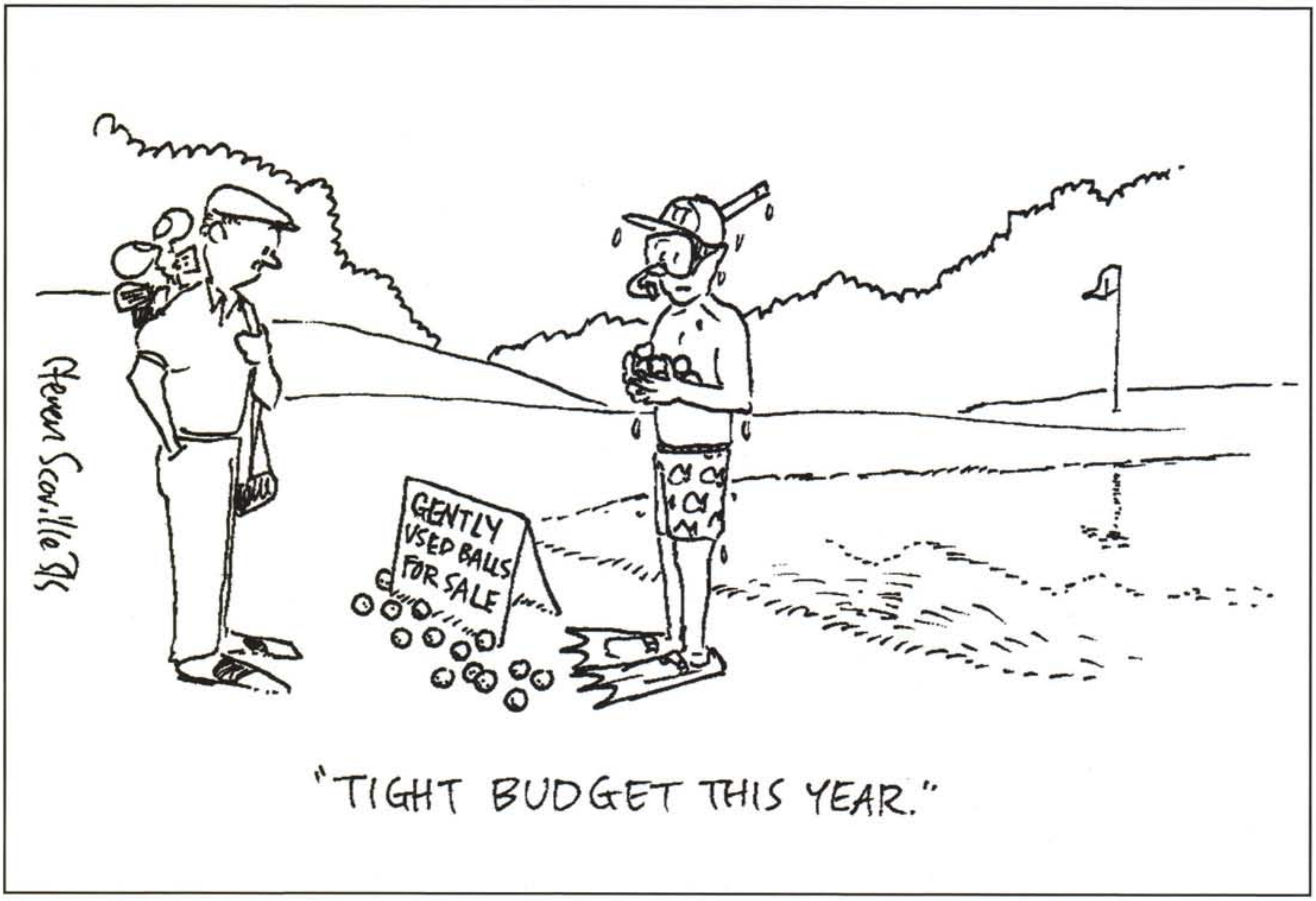
Editor's Note: Professor Rossi will be returning to Wisconsin in November and December as part of the program at our Wisconsin Golf Turf Symposium and as the instructor of a GCSAA seminar on annual bluegrass. For the past seven years at Cornell Frank has gained national attention with his work on annual bluegrass and his interest in biological controls for golf course pests. This article looks at the latter and appeared in the Spring 2003, Volume 14, No. 1 issue of CUTT - Cornell University Turfgrass Times. It appears with Frank's permission.

The future of golf turf management will be shaped by what we seek answers for today. Turfgrass research is maturing where more basic science is being used to understand practical observations. More research projects that address plant genetics, physiology and soil microbiology will lay a solid foundation for future management programs.

Applied research programs that address environmental concerns - such as reduced reliance on potable water and reducing pesticide use as a means of pollution prevention - are vital in an increasingly regulatory environment. Clearly, we are entering an important transitional phase where more people will be asked to use non-potable water and will be required to reduce pesticide use to be more environmentally compatible.

Important research addressing these issues is underway, especially the integration of biological control programs with synthetic pesticides. Studies have shown that certain biological products are more



effective when used in combination with pesticides. This will result in an overall reduction in pesticide use and an increased understanding of the mechanisms of biological control.

Your Daily Microbe?

Fungal diseases of turf are a major concern throughout northern climates and new diseases are wreaking havoc on southern turf. Diseases can work quickly to destroy high value areas and often preventative fungicide applications are required. Biological control of diseases has been plagued with poor performance (inconsistency) and an inability to suppress diseases during an intense epidemic.

A system was developed (Bioject System, Turf Labs, Inc.) to deliver a biological control organism, TX-1, proven in the laboratory to control dollar spot, brown patch and pythium diseases of turf. However, complications with the delivery system and an inability to deliver economic results has hampered its success.

Researchers Bresnahan and Drohen at the University of Massachusetts conducted evaluations of the Bioject System in 1998. One objective of the study was to evaluate the ability of the Bioject to suppress dollar spot on fairway turf.

Daily applications of the organism were made following a 12-hour fermentation cycle. The organism was applied with a watering can between the hours of 9 PM and 12 AM to simulate nightly irrigation, not through the Bioject System.

Dollar spot levels in the untreated plots were significantly greater than the action threshold that would require treatment (5 spots per 18 square ft. plot). Dollar spot levels did not reach the action threshold in Bioject treated plots and were similar to Daconil and Banner fungicide programs.

Under more severe disease pressure, the Bioject treatments provided 86% control but did not maintain acceptable quality turf, as dollar spot levels were well above the threshold. Still, the Bioject treated plots that only received Daconil or Banner when threshold levels were reached, reduced fungicide use approximately 70 - 80% as compared to fungicide treated plots with Bioject treatment.

This preliminary study is the type of integrated research vital for reducing pesticide use during the transitional period until more effective biocontrol systems are developed. Yet, questions continue to plague the delivery system via irrigation lines.

Clearly, the TX-1 organism developed by Dr. Joe Vargas at Michigan State University, when applied in the correct amount, is capable of reducing the need for fungicides. Further research will assist this technology by improving effectiveness. However, will superintendents be willing to reduce prophylactic sprays and set threshold that allow for some infestation?

Grub Slow Down

Insect pests - as a result of their mobility and unpredictability - present a unique challenge for golf turf managers. Disease and weed pests often occur in specific areas as a result of environmental or traffic stress. However, distribution of insects in time and space challenge the most avid integrated pest management practitioner.

Of all the pest issues influenced by the EPA's Food Quality Protection Act (FQPA), insecticide chemistry has been the most severely restricted. The focus on neurosystem-targeted chemistry, notably the organophosphate class of compounds, has eliminated the use of most rescue treatments (applications made once insect population is assessed). Consequently, the compounds left on the market offer mostly preventive control. This provides peace of mind but impedes potential reduction in overall pesticide use.

Entomopathogenic nematodes are an emerging biological organism for the control of soil inhabiting insects such as grubs. These wormlike organisms are able to infect the grubs and parasitize them, thereby causing their death. However, nematode performance, like most control systems that rely on a biological organism, is plagued by inconsistencies. Questions have been raised and addressed regarding soil moisture, the amount of organisms to apply and specificity for different grub species. Many questions remain unanswered.

Recently, Professor Albrecht Koppenhofer of Rutgers University in New Jersey has led a team of scientists from Ohio, California and New Jersey in investigating a strategy that integrates nematode and insecticide use. Field and greenhouse studies demonstrated a synergistic interaction between nematodes and imidacloprid (Merit, Bayer

Environmental Sciences).

The combination of the insecticide and the nematode improved grub control from each product used alone. Further, some important mechanistic and logistical issues are being reconciled.

First, the nematode can be effectively tank-mixed with the insecticide without any loss in efficacy, an uncommon attribute among most biological control organisms. It appears that the efficacy of the combination allows each compound to be used at a reduced rate. Benefits include increased efficiency of the nematode, which can be costly to produce at high levels, and a 50% reduction in insecticide needed, which reduces overall pesticide usage.

From a scientific perspective, a key finding was the mechanism of the observed activity. It appears that the insecticide slows the grub's movement which facilitates the nematodes' ability to attach to and penetrate the grub. This finding alone could explain the reduced effectiveness of other nematode species that simply are not able to acquire their target. Incorporating this information into biological control studies could lead to important breakthroughs in soil insect management.

Judgment

A society can be measured by its investment in education and research. Junk science scandals and a need for short-term gratification have encumbered scientific advancements. Turfgrass research is but a small part of our national scientific community, yet it offers a highly integrated approach to understanding intensely human-managed landscapes.

A diversity of research that is a blend of basic and applied science is a requisite for meeting the needs of the turf industry. Results from this research should be readily implemented and focused on integrating technologies in an effort to improve our environmental compatibility. After all, our compatibility is how the majority of society will judge our efforts, not greens that roll eleven feet.