

ENDOPHYTE-INFECTED TURFGRASSES

FOR SUSTAINABLE INSECT MANAGEMENT

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Certain turfgrass species, notably perennial ryegrass, tall fescue, and fine-leaf fescues, can form mutualistic relationships with fungi in the genus *Neotyphodium*. Because these fungi occur exclusively within the plants they are called endophytes. The fungus can be found only in the above ground parts of the plants and is transmitted by seed and vegetative propagation. Endophytic fungi depend on their grass host for nutrition, whereas endophyte-infected plants have been observed to have enhanced growth and vigor, germination and seed set, drought resistance, and resistance to certain pathogens and insects. Insect resistance is associated with the production of toxins, called alkaloids, by the endophytes. While the alkaloids do not harm the grass, they are deterrent or toxic to some insect pests that feed on stems, leaves, and leaf sheaths.

In perennial ryegrass, endophyte-infection generally confers resistance to billbugs, sod webworms, hairy chinch bug, and greenbugs, and partial resistance to fall armyworms. In tall fescue, a grass species that is generally less susceptible to insect damage even without endophytes, endophytes have been observed to increase resistance to fall armyworm, billbugs, sod webworm, leafhoppers, and greenbugs. In fine-leaved fescues, increased resistance to the hairy chinch bug and fall armyworms has been observed. Root-feeding insects such as white grubs generally don't seem to be significantly affected by the presence of endophytes, probably because little of the protective alkaloids is translocated into the turfgrass roots.

Figures on the degree of protection against insects that endophytes confer to turfgrasses are variable because resistance levels may not only vary with turfgrass and insect species but also with turfgrass cultivar, environmental conditions (e.g. highest alkaloid concentrations in spring and in fall), soil fertility, and other parameters. In a field study in New Jersey in the late 1970, perennial ryegrass cultivars with > 90% endophyte infection generally sustained only 1-5% damage by billbugs whereas cultivars with < 10% endophyte infection sustained generally > 25% damage (up to 83%). However, in the same study some cultivars with 100% endophyte infection sustained 25% damage and some cultivars with 0% endophyte infection sustained only 7% damage. In another study in New Jersey in the late 1980s, tall fescue infected with endophytes sustained only 1% damage by billbugs whereas endophyte-free tall fescue sustained 25% damage.

From a historical perspective in the past 2 National Turfgrass Variety Trials all top performing perennial ryegrasses contained a high level of endophyte. The following new improved turf-type perennial ryegrasses performed well in New Jersey turf trials: AllStar2, Amazing, Applaud, Brightstar II, Brightstar SLT, Cabo, Charismatic, Churchill, Citation Fore, Exacta, Fiesta III, Gator III, Integra, Jet, Kokomo, Pace Setter, Palmer III, Paragon, Pizzazz, Pinnacle II, Premier II, Promise, Repell II, Seville II, Somerville, SR 4820, Stellar. Similarly, all top performing tall fescues in the National Turfgrass Evaluation Trials contained a high level of endophyte. The following improved turf-type tall fescues have performed well in New Jersey turf trials:

Arid 3, Bingo, Biltmore, Bonsai 2000, Coyote, Crossfire II, Finesse, Focus, Forte, Gazelle, Justice, Masterpiece, Millennium, Mustang 3, Plantation, Olympic Gold, Oncue, Picasso, Rebel Exeda, Rebel Sentry, Rembrandt, Shenandoah II, Scorpion, Sr8250, Tarheel, Watchdog, Wolfpack.

Recent studies in Ohio indicated that insect pests can also be suppressed in mixed stands of Kentucky bluegrass and endophytic perennial ryegrass. Thus, population densities of bluegrass billbug and bluegrass sod webworm decreased significantly as the percentage of endophytic perennial ryegrass (Repell II) increased in mixed stands with Kentucky bluegrass until the proportion of endophytic perennial ryegrass reached 40%. Higher percentage of endophytic perennial ryegrass did not result in further reduction of pest populations. In the same study, another endophyte enhanced perennial ryegrass cultivar (Triple Play) did not decrease billbug populations.

Viability of the endophyte in seed declines rapidly under warm, humid conditions. Therefore the seed should be stored under cold (32-40°F) and dry conditions, and should be planted as soon as possible to guarantee the higher endophyte infection levels after establishment. Overall, the use of endophyte-enhanced turfgrasses is a useful tool in the management of surface-feeding insects and can significantly reduce the need for insecticide applications. ▲

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