

Research Thrusts

➤ Insect-Resistant Alfalfa: Good Things from the Wild

Tall buildings need deep firm foundations, but these are always hidden beneath the surface. Prominent applications of agricultural research are the same way. Though they may be obvious for everyone to see, the foundations on which they rest are laid below ground and out of sight.

Alfalfa cultivars with remarkable insect resistance are now beginning to find their way into the fields of Midwestern farmers. The foundation on which these cultivars are based was laid by Dick Shade and colleagues at Purdue in the late 1970's.

Shade knew that numerous insect pests of alfalfa—alfalfa weevil, aphids, and leafhoppers—cause substantial losses of yield and quality. He also knew that there were no really good sources of insect resistance among all the various cultivars and germ plasm pools of *Medicago sativa*, commercial alfalfa, that could be used to breed resistance into alfalfa. But he recognized that wild relatives belonging to the genus *Medicago* might contain resistance factors effective against the major pests of alfalfa. He collected seeds from all 60 wild species of *Medicago*, grew out the plants, and evaluated them for insect resistance. His hunch hit the bullseye. He found excellent resistance in *Medicago glandulosa* and *M. prostrata*. Resistance was due to the presence of abundant glandular hairs present on the stems and leaves.

Next, although not a trained plant breeder, he made thousands of crosses between these wild *Medicago* species and commercial alfalfa. He managed to obtain the wide cross involving all three species and showed that the insect-resistance trait was present. After much more back crossing to get rid of undesirable genes from the wild species, he eventually released, in 1982, new alfalfa germ plasm carrying the powerful insect resistance trait.

Years passed, and commercial alfalfa breeders used this germ plasm to bring the trait into agronomically superior lines and to stabilize it. At last, in the late 1990's, field tests have shown the remarkable insect resistance of these lines, and seeds are now available to farmers.

By increasing yields and reducing insecticide use, these improved alfalfa lines will generate big economic returns, estimated conservatively to be tens of millions of dollars annually to alfalfa growers in the United States. The new cultivars will have improved stand longevity, quality, and require reduced insecticide use.

Without the firm but hidden foundation laid by Professor Shade 20 years ago in his discovery of resistance in wild *Medicago*, there would be no such alfalfa lines.

Shade, R. E. and L. W. Kitch. (1986) Registration of 81IND-2 glandular-haired alfalfa. *Crop Sci.* 26: 205.

Shade, R. E., T. E. Thompson, and W. R. Campbell. (1975) An alfalfa weevil larval resistance mechanism detected in *Medicago*. *J. Econ. Entomol.* 68: 399-404.