

Aphid Resistant Alfalfa Plants

inexpensive control of spotted alfalfa aphid can be expected as result of plant breeding program to develop new varieties

Ernest H. Stanford

A report of progress in the development of alfalfa resistant to the spotted alfalfa aphid conducted in cooperation with the Entomology Research Branch, Agricultural Research Service, U.S.D.A.

Experimental results to date leave little doubt of the successful development of alfalfa varieties resistant to the spotted alfalfa aphid.

Chemical treatments can give good control of the aphid, but the application of insecticides is costly; and if they are not applied promptly—when needed—considerable loss will result. Biological control—the distribution of natural enemies of the aphid—offers promise of reducing aphid populations under some conditions but it is doubtful if it will give complete control under all conditions. However, if resistant alfalfa varieties are developed—on which the aphid cannot survive or multiply—control will be sure and inexpensive.

The alfalfa variety Lahontan—developed by the Nevada Agricultural Experiment Station and the United States Department of Agriculture for resistance to the stem nematode—also shows resistance to bacterial wilt and outstanding resistance to the spotted alfalfa aphid.

In one planting trial, involving several alfalfa varieties, the seedlings were attacked severely by the aphid and the stands of all varieties except Lahontan were destroyed. Lahontan maintained a good stand.

At the Meloland Field Station, 35 varieties have been subjected to natural attacks by the aphid during a two-year

period. The plots were well established and stands of all varieties were uniformly good before being attacked by the aphid. In May 1956, Lahontan still had a perfect stand while the other varieties had from 0% to 10% stands. Although subjected to heavy infestations in these trials, Lahontan showed very little injury, and only traces of honeydew were apparent on the plants. Observations at other locations indicate that the resistance of Lahontan will give good aphid control under field conditions.

With all the diversity of California's climate, two varieties of alfalfa will meet the adaptation requirements for the majority of hay-producing areas. These are the variety Africa, for the desert valleys of the southern portion of the state and for limited use in the southern San Joaquin Valley, and the variety Caliverde suitable for most of the remainder of the state.

In trials at Davis—covering a number of years—Lahontan has yielded about 8% less than Caliverde. In the northern part of the San Joaquin Valley, Lahontan can be expected to yield 10% to 15% less than Caliverde. The difference in the lower San Joaquin Valley may be 20% or 25%. However, yields of Lahontan have been very good in the Antelope Valley. In the north Sacramento Valley, Lahontan is expected to yield at least as well as at Davis. Much of the lower yield of Lahontan can be ascribed to its tendency to go dormant in cool weather; hence it does not produce any crop during the winter months.

A search for sources of resistance to the aphid has produced plants which—for the most part—originated in the Turkistan area of Russia. Lahontan also traces back to Turkistan. All the Turkistan material has the habit of going dormant in cool weather, a characteristic that must be eliminated in a variety resistant to the aphid and with the adaptation of Africa and Caliverde.

An important part of the plant breeding program is the testing of individual plants for their aphid resistance. Only the plants having the highest resistance are continued in the breeding program. A cooperative program between the University of California and the United States Department of Agriculture has been set up. Effective technics have been

developed for testing plants for their resistance to the aphid and for evaluating material used.

Because none of the other Turkistan materials seem to be superior to Lahontan in adaptation and because of its high level of resistance to the spotted alfalfa aphid, the stem nematode, and bacterial wilt, Lahontan was chosen as the source of aphid resistance in the present breeding program.

Lahontan is a synthetic variety. That is, it is the result of the selection of a few superior plants from a large number tested and of recombining or synthesizing those superior plants to produce the improved variety. Tests showed that two of the original plants—designated as C-84 and C-89—which went into the variety Lahontan were superior in resistance to the other parent stock. Therefore, those two were selected as the resistant parents in the current program.

As soon as the resistance of the individual plants of the variety Lahontan was known, the most resistant were crossed with Africa and Caliverde plants. The first generation— F_1 —plants of C-84 and C-89 crossed with the variety Africa have been tested for aphid resistance. The high resistance of Lahontan has been retained in certain of these F_1 plants. The winter growth habit of the F_1 plants is nearly equal to that of Africa. These plants are being backcrossed to Africa, with the expectation that many of the backcross plants will retain a high degree of aphid resistance and exhibit the desirable growth and yield characteristics of the Africa parent.

When aphid resistance and the necessary growth and yield have been attained in the plants and their offspring, they will be combined, or synthesized, into a new variety, and seed will be increased for distribution. The program for adding resistance to Caliverde will parallel that for Africa.

It is apparent that if the level of aphid resistance present in Lahontan can be transferred to adapted varieties, the resulting new variety should do much to solve the aphid problem.

Ernest H. Stanford is Associate Professor of Agronomy, University of California, Davis.

The above progress report is based on Research Project No. 1646.

Testing hybrid alfalfa plants in plant breeding program for resistance to the spotted alfalfa aphid.

