Dwarf Resistant Alfalfa

seed of new California Common 49 to be released next season for commercial hay production in certain areas

Byron R. Houston

The dwarf disease of alfalfa is now an important factor in the rapid thinning of stands during the second and third season of growth in about one third of the alfalfa producing area of California.

The disease was first reported about 20 years ago and at that time was localized in Riverside and adjacent counties. At the present time the disease is very active in the San Joaquin Valley as far north as Stanislaus County.

Infected plants gradually lose vigor over a period of several months, as evidenced by the production of an excessive number of small spindly stems with small dark-green leaves. The internal symptom is characterized by gum formation in the water conducting elements with a yellow-brown discoloration in the woody portion of the roots and crown branches. Plants usually die six to eight months after infection.

The disease is caused by a virus which is transmitted from plant to plant by either of two leafhoppers in the group commonly referred to as sharpshooters. When these leafhoppers feed upon a dwarf diseased plant they take the virus into their bodies and it is retained by the insect for several months. During this period of time the leaf-hoppers may spread the virus to a number of healthy plants in the process of feeding. Movement of these viruliferous—infective—leafhoppers from field to field accounts for the only known method of spread of the disease. The only practical means of control of such a disease lies in the use of resistant varieties.

Varietal tests in the field and in the greenhouse from 1941 to 1943 indicated that no available variety of alfalfa carried any degree of resistance greater than that shown by the California Common variety. Many of the varieties were much more susceptible. Observations of four-year-old fields of California Common after practically 100% of the plants were either dead or infected with the virus indicated that about one plant in each 2,000 square feet was still making a normal top growth even though root symptoms showed that the plants had been diseased for a period of one to two years.

A number of such plants were selected, transplanted and self-pollinated to produce seed. The progeny from these plants were artificially inoculated in the greenhouse by caging viruliferous leafhoppers on each plant.

Observations of the inoculated plants over a period of two years showed that the progeny, or a portion thereof, from most of the selected plants were quite tolerant to the virus and maintained normal growth for periods of two to three times that of the California Common check plants. These results indicated the possibility of selecting a dwarf resistant strain from the Common variety without changing in any way the other desirable qualities of this variety.

In the fall of 1944, about 800 plants showing some resistance in the field were selected from 18 different fields in three counties in the southern San Joaquin Valley. These plants were planted in an isolated block at Davis and allowed to naturally interpollinate and set seed during the summer of 1945. Seed was harvested separately from each of 425 of the plants. The remainder of the original selections either did not survive the transplanting, showed the effect of the virus, or failed to set seed.

The seed from each of the above plants was planted in three-row blocks replicated three times, in a test plot in each of the three counties of Fresno, Tulare and Kern. Each tenth block was planted to ordinary California Common for comparison. The plantings were made in commercial fields in areas where dwarf had been very prevalent the past years.

The final results from these plots in the spring of 1949 showed that the progeny from 60 to 70 of the original selections were quite tolerant to the dwarf virus and held a normal growth and a good stand.

To further test the dwarf resistant qualities of the original selections, cuttings from 320 of the better plants were rooted in the greenhouse and artificially inoculated with the virus by the use of the

Continued on page 10

Two three-row blocks from the field trial in Fresno County after three and one half seasons of production. The rows on the left were from a dwarf susceptible parent; those on the right, from a resistant parent.

Potatoes for Poultry

value of dried potatoes as feed for chicks and poults investigated

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Under normal economic conditions it probably is not feasible to consider potatoes as a feedstuff for poultry.

At the present time surplus potatoes for feeding purposes may be obtained at a very low cost, and the question of their feeding value for poultry has been asked many times.

Cooked potatoes are used as a feed for chickens in Europe, often as the principal carbohydrate source in the ration. There has been little work reported in which potatoes have been fed to turkeys.

An experiment was conducted at Davis with both turkeys and chickens in which comparisons were made of the growth and feed efficiency of rations containing potatoes prepared in various ways.

Four procedures were used for preparing the potatoes. By the first method whole potatoes were ground in a food chopper and spread on trays to dry in the sun. By the second method the potatoes were ground in a food chopper and dried in an oven at 50° C. The third procedure was similar to the second except that the drying temperature was increased to 85° C. The last method used was to boil the potatoes in water heated by steam followed by sun-drying.

The sun-dried preparations were found to contain from 8.1% to 10.3% moisture, while oven-dried samples ranged from 5.6% to 9.4% moisture. The crude protein in the dried samples varied from 8.3% to 10.0%.

The basal ration contained the following—in pounds per 100 pounds; soybean oil meal, 21.0; fishmeal, 5.0; dried whey, 3.0; alfalfa meal, 5.0; salt, 1.0; bone meal, 2.5; ground limestone, 2.0; wheat bran, 10.0; ground barley, 9.5; butyl fermentation product, 0.5; fish oil—1000A–400A–0.5; and manganese sulfate, 0.0125. The potato preparations were fed at either 20% or 40%, and the remainder of the ration was supplied by equal parts of ground wheat and corn. The complete rations varied in crude protein from 20.2% to 22.7%.

Bronze turkey poults which were 47 days of age were divided into comparable groups of 12 birds each and were fed the experimental rations for 22 days. Single Comb White Leghorn cockerels 61 days of age were randomly divided into groups of 12 each and were fed the same rations as the poults for 20 days. The results of these tests are shown in the table.

A reduction in growth of both poults and chicks was apparent when sun-dried potatoes were fed at 20% and was even greater at 40%. Oven-dried potatoes were approximately the same as sun-dried potatoes in their effect on growth. The group fed 40% potatoes which were cooked before sun-drying grew better than the group receiving 20% of sun-dried potatoes but did not grow as rapidly as the control group. The efficiency of feed utilization was decreased in groups in which the weight gains of the birds were reduced.

The experiments indicate that raw potatoes, when sun-dried or oven-dried, are not a satisfactory feedstuff for growing turkeys or chickens.

Although dried cooked potatoes caused a slight reduction in growth and feed efficiency of poults when fed at 40% of the ration, it is likely that they can be fed at the 20% level which, according to reports from other experiment stations, has proven satisfactory with chickens.

Unless an inexpensive method of cooking and drying potatoes becomes available, it is unlikely that potatoes will ever become a popular feedstuff for poultry.

Gains and Feed Efficiency of Poults and Chicks Fed Rations Containing Potatoes Treated in Various Ways

Group	Potato supplement	Level %	Poults		Chickens	
			Av. 22 day gain (gms)	Gain per feed consumed	Av. 20 day gain (gms)	Gain per feed consumed
1	None		1096	0.40	447	0.23
2	Sun-dried	20	859	0.31	383	0.19
3	Sun-dried	40	687	0.23	360	0.15
4	Oven-dried, 50° C	40	687	0.22	...	...
5	Oven-dried, 85° C	40	588	0.20	364	0.15
6	Cooked, sun-dried	40	915	0.31	...	...

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Continued from page 3

insect vector. After inoculation the plants were transplanted to an isolated block in the field along with a number of Common plants inoculated at the same time.

At the end of the second season of growth all of the latter were either dead or showed severe dwarfing, whereas about 65 of the selections showed no effect of the virus with the exception of root symptoms. Based upon these results and those of the above-mentioned field plots the more resistant selections were saved to cross pollinate naturally and set seed.

Since dwarf is the main factor responsible for short-lived alfalfa stands in certain areas of the state, particularly in southern California, the seed from the selections was released to the Agricultural Extension Service in Riverside County in the fall of 1948. It was planted in an isolated area to be used as the foundation for seed increase of dwarf resistant alfalfa. Further field tests with seed from this planting will be made this year.

This improved selection is to be called *California Common 49* and seed will be produced under the regulation of the California Crop Improvement Association. Seed of this selection to be used in commercial alfalfa hay production will be allocated only to those areas where dwarf is the primary cause of rapid loss of stands.

The best of the original dwarf-resistant selections will be used in the alfalfa breeding program now under way at the Experiment Station at Davis to transfer dwarf resistance into the bacterial wilt-resistant variety which will soon be released. Until resistance to both these diseases is incorporated into one variety each selection will be used in the appropriate area of the state depending upon the relative severity of each disease in that area.

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