Boron Deficiency Symptoms Identified in Almonds

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Normal almond shoot at the left is from a tree that received a boron spray. The shoot at the right is from a boron-deficient tree. This photograph taken on March 31 illustrates the first symptom.

In addition to the usual boron excess symptoms, observed for many years in California, deficiency symptoms have been identified in Yolo County almond orchards in recent years. Shoots and branches die back, nuts become gummy and drop or leaves scorch and curl up at the tips. The condition may be corrected, however, with either soil or spray applications of materials containing boron.

Symptoms were found in 1957 in an almond orchard in Yolo County that resembled boron deficiency symptoms in other fruits. Leaf samples taken from this orchard showed that more boron was present in good than in poor trees. Leaves from trees with severe symptoms contained 10 and 12 ppm (parts per million) of boron, those from trees with moderate symptoms, 20 and 23 ppm, and leaves from normal trees, 29 and 38 ppm.

Practically all the symptoms were eliminated by broadcasting borax (36.5 per cent B_2O_3) on the surface of the soil at the rate of 50 to 100 pounds per acre. A single application has kept the trees healthy for four years. From experience with other fruits, it is probable that a single application may sometimes be good for five years. Good response was also obtained with a spray material (66 per cent B_2O_3) when applied annually at the rate of 1 to 2 pounds per 100 gallons of water. The time of spraying is probably not critical since good results were ob-

Boron-deficient almond nuts. With this amount of injury, they will usually drop in May or June.

tained in July, August, and October. The first experimental plots were located in a nonirrigated hillside orchard in Yolo County, but boron deficiency has been identified and successfully treated in irrigated orchards in Merced, Butte and Stanislaus counties.

Most of the orchards studied were irrigated with water containing such small amounts of boron that soil or spray applications were required to eliminate the deficiency symptoms. However, one previously nonirrigated orchard in Yolo County no longer showed deficiency symptoms after being irrigated with water containing appreciable amounts of boron.

Soil and spray applications both have been satisfactory. However, in some nonirrigated orchards, the symptoms are not completely eliminated the year after boron is applied to the soil. In this situation, a spray application should always be the first treatment.

Boron deficiency symptoms in the almonds are of three types and may sometimes occur on a single tree. In the first type, new shoots fail to develop from the buds near the extremity of the branch. These portions of the branch may die within a few months, but lateral shoots farther down may grow giving a brushy appearance. This symptom is not found as often as the other two, but when present, a large part of the tree may be killed. The second symptom consists of brown gummy areas in the nuts. Usually the affected area is limited to the shell (endocarp) area but in some cases, gum may be extruded to the surface. The embryos in these injured nuts usually abort. Most of these nuts drop in May or June, sometimes resulting in loss of the entire crop. The third symptom consists of leaf scorch and drop from watersprouts and other vigorous shoots. The tips of the scorched leaves usually curl up, and the tips of the injured shoots die back.

This is the first report of boron deficiency in the almond, but excess symptoms have been observed for many years in California. It is important, therefore, not to add boron unless a definite deficiency exists. Some materials are stronger and some weaker than borax—read labels carefully before deciding how much to use.

Percentage of gummy almonds found in samples collected in 1960 and 1961 from individual trees.

Untreated trees		Boron treated trees*	
1960	1961	1960	1961
88	40	0	0
88	24	0	0
36	92	0	0
56	84	0	0
76	4	0	0
80	68	4	0
24	12	0	0
96	96	0	0

* 100 pounds of borax per acre June 18, 1959.

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Boron-deficient almond shoots showing leaf scorch and dieback on current season's growth. This type of injury is found on watersprouts and other vigorous shoots in late spring or early summer.

SAFFLOWER OIL MUTANT TYPES UNDER STUDY

TYPES OF SAFFLOWER from India which produce an oil with low iodine value (80–90) differ by a single gene from those grown commercially, where the iodine value is about 140. The oil with low iodine value actually resembles olive oil, and would be unsuitable in the manufacture of paints and other coatings. Also, for present uses of safflower in food products, the iodine value should be high.

A second type from Iran produces oil intermediate between the above, and one gene seems to be responsible for its difference from commercial types. Though these mutant types are at present of no value commercially, they may be useful in studies of the synthesis of oil in safflower. The relative amounts of the fatty acids, linoleic and oleic, determine the differences in iodine value obtained in safflower oils.—*P. F. Knowles, Department of Agronomy, University of California, Davis.*