

## **RED LEAF SPOTTING IN HOLLY MAY BE BORON DEFICIENCY**

English holly is a major item in the 'greenery' industry of the Pacific Northwest. A discerning market is demanding well-fruited sprays with dark green foliage free of blemishes caused by insects, diseases, or faulty nutrition. Insect and disease problems of English holly have been identified at various times by the departments of Entomology and Plant Pathology at Oregon State University. While several forms of leaf-spotting have been studied and control methods prescribed, leaf necroses have been described which were of unknown origin. One of these disorders, a red or purple-red leaf spotting has been found in recent studies to be one of the symptoms of boron deficiency.

Greenhouse sand cultures were used to develop boron deficiency symptoms in two commercial cultivars of *Ilex aquifolium*, Rederly and Curly.

Rederly cuttings, rooted in January 1959 and grown in cultures without boron from April 1. developed symptoms of deficiency early the following August. Similarly treated cuttings of the variety Curly developed symptoms somewhat more slowly. The symptoms (Fig.1) first appeared on mid-terminal leaves as irregularly-shaped, reddish or purplish spots on the upper surface; on the lower surface they were water-soaked in appearance. As the leaves aged, these spots progressively enlarged, developing a 'target-spot' bordered on the outside with yellow. Sometimes an enlargement of the veins and finally defoliation accompanied this spotting. Although less frequent than spotting, a pitting of the upper leaf surface (Fig. 2) apparently resulted from buckling or collapse of the mesophyll. Leaves appearing near the end of a growth flush were often misshapen and malformed.

### **Deficiency levels**

Mid-terminal leaves of the Rederly variety taken for leaf analysis at the first sign of boron deficiency from complete and minus-boron cultures contained 39.6 and 10.6 ppm (dry basis) boron, respectively. Similar samples taken from the variety Curly contained 25.3 and 6.1 ppm boron for complete and minus-boron cultures. Leaf samples taken from the Rederly plants in April of the second year before new growth started contained 26.4 and 15.1 ppm boron for complete and minus-boron cultures. Deficiency symptoms were present on leaves of the latter culture. Samples of mid-terminal leaves taken from these plants in July after completion of new growth contained 36.1 and 6.9 ppm boron for complete and minus-boron cultures. Leaves produced on the latter solution were showing signs of boron deficiency.

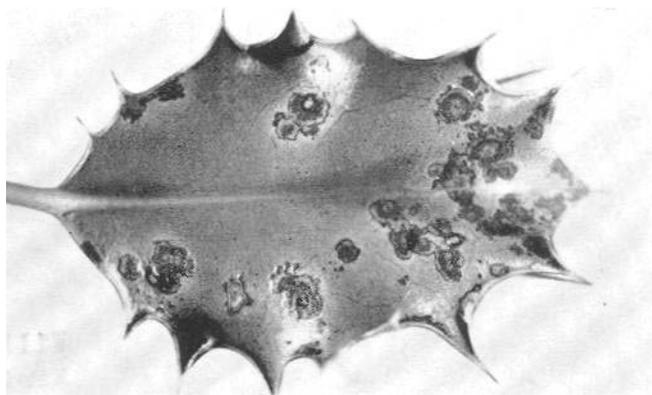
## Field survey results

A survey conducted in 1960 and 1961 on the status of nutrition in Oregon holly orchards afforded the opportunity of examining numerous commercial plantings for symptoms of boron deficiency and of estimating leaf deficiency level. County agents who assisted in this study were Robert Smith, Clackamas; Ray McNeilan, Multnomah; Lloyd Baron, Washington; Bob Marsh, Clatsop; and Scott Clevenger, Lincoln. Some of the survey data are given in Table 1.

**Table 1. Relationship between leaf boron content of English holly varieties in commercial orchards and boron deficiency symptoms**

Variety	Boron deficiency symptoms in leaves			
	Present		Absent	
	Orchard number	Boron (ppm)	Orchard number	Boron (ppm)
Rederly -----	70	11.9	2	21.3
	19	16.5	38	23.2
	4	20.8	56	33.1
	24	22.7	18	37.8
French-English -----	66	13.7	3	24.8
Green-stem(types)....	72	11.0	13	28.5
	40	15.6	27	33.9
	41	16.5	32	44.3
	71	23.2	65	45.7

These data indicate that incipient boron deficiency is possible in numerous commercial holly orchards in Oregon. The greenhouse trial and field survey showed that leaves containing 25 ppm boron or more were free of boron deficiency symptoms but that symptoms were always present when leaf boron was 20 ppm or less. Leaf boron levels of 21 to 24 ppm were found on both normal and deficient trees.



These studies will be continued next year in orchards deficient in boron to determine tree response to applied boron and gather information needed in establishing critical levels.

**This type of red or purple-red leaf spotting is caused by boron deficiency.**

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