

Chlorine in Relation to Ring-Neck in Avocado Fruits

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This disease¹ usually occurs on the fruit stem or pedicel and consists of dry areas that more or less separate from the living tissue and leave a scar. Figure 1 illustrates ring-neck disease in fruit of the Itzamna variety and shows a complete ring of surface tissue that has died and separated from the pedicel. The cause of the dying of the tissue is very puzzling¹ and at present no suggestions regarding control are available.

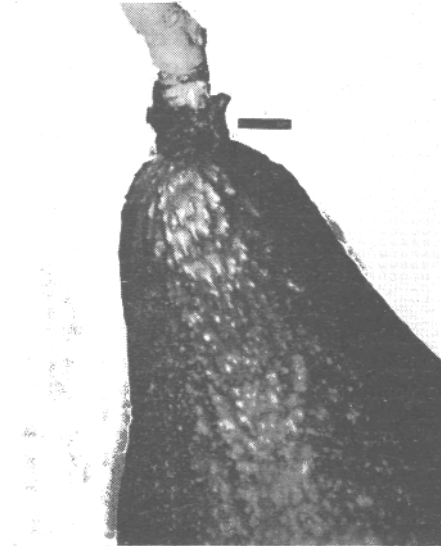


Fig. 1—Fruit of Itzamna variety affected with ring-neck disease. Note the dry ring of tissue (designated by black line) that has separated from the thickened segment of the pedicel next to the fruit. (Retouched print, made from original plate kindly furnished by Dr. Ira Ayer, Carlsbad, California.)

In the course of chemical studies in avocado fruits², data were secured that may be of interest in relation to ring-neck and other diseases. It was found that chlorine is not uniformly distributed in the dry matter of the skin or pulp of avocado fruits.

In this study the total chlorine was determined by weighing it as silver chloride. The dried fruit material was treated with sodium carbonate and repeatedly ashed, followed in each case by thorough leaching with hot distilled water and finally with nitric acid. The samples in each case usually consisted of 6 or more fruits but ranged from 1 to 20, depending on size, availability and other factors.

TABLE I

Total Chlorine as a Per Cent in the Dry Matter of Various Portions of the Pulp and Skin in Avocado Fruits

*Inner and outer portions combined.

Fruit half		Portion used	Fuerte	Anaheim (lot 1)	Anaheim (lot 2)	Dickinson	Itzamna
Pulp	Skin						
Stem	.....	Inner	0.084	0.260	0.220	0.140	0.073 *
Stem	.....	Outer	.060	.200	.170	.100	
Tip	.....	Inner	.049	.180	.160	.100	.064 *
Tip	.....	Outer	.037	.170	.150	.080	
.....	Stem	All	.780	.380	.360	.330	.400
.....	Tip	All	0.770	0.240	0.270	0.270	0.350

In table 1 it is seen that the stem half of the pulp or skin contains a greater percentage of total chlorine than the tip half, and that the inner portion of the pulp is richer in chlorine than the outer portion.

Tables 2 and 3 present evidence that indicate a relation between the chlorine content in the irrigation water, the condition of the trees and the chlorine content of the pulp and skin in the fruit. The Fuerte variety contained high percentages of chlorine in the pulp and skin. Over one per cent of chlorine was found in the dry matter of the skin of fruits of the Fuerte variety grown on trees in soils containing extremely high chlorine concentrations. Severe leaf tip-burn and defoliation accompanied such high chlorine conditions. It is possible that such fruits differ in many ways from those grown on healthy trees.

The fact that high chlorine is associated with leaf tip-burn suggested the possibility that chlorine may also be associated with injuries or physiological diseases in the fruits since fruits originate from modified leaves. Accordingly in connection with ring-neck disease in which tissue is killed, it was considered possible that in some cases at least, high concentrations of chlorine may be associated with the occurrence of the disease.

Pedicels of Itzamna fruit were obtained from orchards in which ring-neck disease was absent and from those in which the disease was present. The thickened segments next to the fruit contained 0.435 per cent of total chlorine in the dry matter in the case of healthy fruit while those in diseased fruits contained 0.481 per cent. The remainder of the fruit pedicel contained 0.481 per cent in the healthy fruits and 0.931 per cent in the diseased. Horne (1) has indicated that ring-neck may occur not only on the thickened segment of the pedicel next to the fruit but may also be found on the remaining portion of the pedicel. In the data just presented, the chlorine percentages differed considerably in the upper portion of the pedicels and only slightly in the thickened basal segment next to the fruit.

TABLE 2
Total Chlorine in the Pulp of Avocado Fruits in Relation to the Chlorine in the
Irrigation Water and the Condition of the Trees

Variety	Collected	Chlorine in irrigation water	Condition of trees	Total Chlorine in dry matter	
				Stem half per cent	Tip half per cent
Puebla	Riverside	Low	Healthy	0.044	0.041
Benik	Riverside	Low	Healthy	.014	.013
Fuerte	Riverside	Low	Healthy	.033	.028
Fuerte	Carlsbad	Moderate	Fair health	.090	.060
Fuerte	Encinitas	Moderate	Fair health	.063	.045
Fuerte	Encinitas	High	Bad leaf tip-burn and defoliation	.102	.097
Fuerte	Encinitas	High	Bad leaf tip-burn and defoliation	.301	.267
Fuerte	Fallbrook	High	Bad leaf tip-burn and defoliation	0.148	0.127

Through the kindness of Mr. Dean P. Palmer, a collection was made of a large number of ring-neck pedicels of affected fruits of the Itzamna variety. The entire fruit pedicels were tested for total chlorine. The pedicels of healthy fruit collected at Fallbrook contained 0.41 per cent of total chlorine in the dry matter; those of one sample of ring-neck affected fruit collected at Carlsbad contained 0.77 per cent and those of a second sample of severely diseased fruit collected from a different location at Carlsbad contained 1.42 per cent.

There is some reason, therefore, in assuming that possibly chlorine or other salts are factors associated with ring-neck disease. Conditions such as scant irrigation water, deficient nitrogen fertilization and other factors may contribute directly to the severity of the disease or indirectly because of their relation to the absorption of chlorine and its effectiveness in plant tissues.

TABLE 3
Total Chlorine in the Skin of Avocado Fruits in Relation to the Chlorine in the
Irrigation Water and the Condition of the Trees

Variety	Collected	Chlorine in irrigation water	Condition of trees	Total Chlorine in dry matter	
				Stem half per cent	Tip half per cent
Guatemalan seedling	Riverside	Low	Healthy	0.031	0.024
Mayapan	Riverside	Low	Healthy	.022	.029
Anaheim	Fallbrook	Moderate	Fair health	.150	.060
Lyon seedling	Fallbrook	Moderate	Fair health	.130	.090
Premier	Fallbrook	Moderate	Fair health	.190	.110
Thompson	Fallbrook	Moderate	Fair health	.135	.096
Challenge	Tustin	Moderate	Fair health	.052	.039
Challenge	Tustin	High	Leaf tip-burn	.127	.096
Challenge	Santa Ana	Extremely high	Leaf tip-burn*	.178	.144
Challenge	Tustin	Extremely high	Leaf tip-burn*	.160	.120
Fuerte	Encinitas	Moderate	Leaf tip-burn	.780	.770
Fuerte	Fallbrook	Extremely high	Leaf tip-burn*	1.020	.940
Fuerte	Encinitas	Extremely high	Leaf tip-burn*	1.170	.970
Fuerte	Encinitas	Extremely high	Leaf tip-burn*	1.280	1.000

*Severe defoliation.

¹Horne, W. T., Avocado diseases in California. Univ. of Calif. Agr. Exp. Sta. Bul. 585, pp 72, 1934 (see pp 49-51).

²Haas, A. R. C. Chemical distribution in avocado fruits. (In course of preparation for publication.)