California Avocado Society 1949 Yearbook 34: 166-171

EFFECT OF THE APPLICATION OF COMPLETE FERTILIZERS ON THE COMPOSITION OF FUERTE AVOCADO FRUIT

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It was pointed out in a previous report (1) that the inorganic composition of the pulp of Fuerte avocado fruit varies according to the availability of fertilizer elements in orchard soils. Fullmer (2) has shown for these same orchards that the petioles (leaf stalks) and leaf blades from trees in orchards that have received fertilizers containing phosphorus and potassium tended to contain higher concentrations of these elements than those from trees in orchards fertilized chiefly with nitrogen. According to the revised avocado bulletin (3) an average of about one-third of an avocado fruit is refuse, the actual range extending from 13.60 to 47.00 per cent. Most of the waste consists of the seed whereas the highly important protective coverings such as the skin and the seed coat are also included. Weatherby and Sorber (4) have reported the percentage content of many of the organic constituents of the seed whereas scant, if any, data, are available regarding the inorganic composition of the avocado seed and skin. The present data show the relationship of the inorganic composition of the skin, seed coat, and seed to that of pulp which was shown (1) to be related to leaf composition and soil fertilization (2).

RESULTS

The skin, seed coat and seed (without the seed coat) were obtained from the same fruit for which the pulp data were previously reported (1) and the fruit were obtained from the orchards investigated by Fullmer (2).

In table I it is shown that the total phosphorus content in the skins of Fuerte avocado fruit varies greatly, dependent upon the orchard from which they were obtained. The data for the total phosphorus content in the dry matter of the skins are arranged in descending order. It will be noted that the three lowest phosphorus values for the skin are associated with the three lowest values for total phosphorus, both in the seed (without the seed coat) and in the pulp. Even the phosphorus content of the seed coat is low in fruits from orchards D and F.

The fact that avocado fruit skins contain considerable total phosphorus, the content of which may vary with the fruit variety, is suggested by the data in table II. To these data might be added that for the whole skin of Mexicola fruits obtained at Riverside and in which the dry matter of the skin contained 1366 p.p.m. of total phosphorus. In the dry matter of the skin of Fuerte avocado fruit obtained at Carpinteria, a content of 1115 p.p.m. total phosphorus was found.

The relatively low calcium and magnesium content in the dry matter of Fuerte avocado

seed is seen in the data given in table III which also shows the very high content of potassium.

TABLE I

Phosphorus Content of Various Portions of Fuerte Avocado Fruit

(collected April 19, 1946, in the Vista-Escondido area)

Orchard*	No. of fruit	Fresh weight of whole fruit (grams)	Skin (fresh weight as a per cent of fresh weight of whole fruit)	Seed coat (fresh weight as a per cent of fresh weight of whole fruit)	Seed without coat (as a per cent of fresh weight of whole fruit)	Total phosphorus (P) (p.p.m.) In dry matter: Fruit skin	Seed coat	Seed (without seed coat)	In fresh weight*: Pulp
E1 (old trees)	4	1040.2	3.83	0.48	13.79	1920	340	1980	1122
E1 (young trees)	4	1204.0	3.48	0.47	12.58	1890	298	1630	883
C1	5	1353.8	2.94	0.59	15.14	1800	300	1850	855
A	5	1111.6	3.51	0.50	14.46	1660	260	1670	1060
									1007
D (young trees)	6	1304.8	5.05	0.60	18.79	1640	340	1770	——
C2	5	1200.7	3.09	0.54	5.95	1560	260	1580	883
X2	4	998.3	3.70	0.67	17.03	1480	380	1950	863
X1	3	742.0	4.00	0.54	18.52	1440	200	1820	981
B	5	1134.0	5.85	0.62	16.09	1400	320	1250	768
D (old trees)	5	1178.4	3.27	0.56	12.74	1180	160	815	753
F	5	1051.0	4.08	0.63	13.41	1120	200	1330	509

* *Same as in table 2 (Haas, A.R.C. Nitrogen, potassium, and phosphorus content of Fuerte avocado fruits from different orchards. Calif. Avocado Soc. Yearbook 1945:101-104.*

TABLE II

Phosphorus Content of the Skin of Avocado Fruit Collected at the Citrus Experiment Station at Riverside

Variety	Total phosphorus (P) content (p.p.m.) in dry matter	
	Skin of stem half of fruit	Skin of tip half of fruit
Fuerte	1410	1410
Fuerte	1120	1320
Fuerte	1378	1410
Dorothea	1010	1110
Puebla	1270	1270
Dickinson	1360	2160
Anaheim	2580	3040
Linda	2920	2420
Ward	1820	1830

TABLE III

Calcium, Magnesium, and Potassium Content in the Dry Matter of Fuerte Avocado Seed (with seedcoat) Collected in the Vista-Escondido Area

Orchard	No. of Seed	Fresh Weight (grams)	Dry Matter (grams)	Dry Matter as a % of Fresh Weight	Percent in Dry Matter		
					Calcium	Magnesium	Potassium
E1 (old trees)	1	39.8	17.2	43.22	0.041	0.067	1.162
E1 (young trees)	1	47.4	23.9	50.42	0.048	0.065	0.982
C1	3	91.0	40.0	43.96	0.048	0.049	1.060
A (high producer)	2	88.2	41.5	47.05	0.029	0.057	1.231
A (low producer)	3	107.3	48.4	45.11	0.035	0.063	1.269
C2	2	74.2	32.2	43.40	0.041	0.056	1.109
X2	2	72.7	30.9	42.50	0.037	0.079	1.350
X1	2	58.5	26.4	45.13	0.043	0.110	1.334
B	2	73.1	34.1	46.65	0.042	0.044	0.915
D (old trees)	3	157.2	76.5	48.66	0.036	0.063	1.025
F	2	102.0	45.7	44.80	0.034	0.062	1.216

Tables IV and V indicate the large concentrations of phosphorus in avocado seed and in the fruit stalk (pedicel).

TABLE IV

Phosphorus Content of Avocado Seed (without seed coat) Collected at the Citrus Experiment Station at Riverside

Number of Seed.	Variety	Total Phosphorus (P) in Dry Matter (p.p.m.)
6	Fuerte	1680
8	Fuerte	1570
10	Fuerte	1680
16	Blake	1680
5	Blake	1800
4	Puebla seedling	2030
8	Puebla seedling	1860
5	Puebla	1850
5	Benik	1980

TABLE V

Phosphorus Content of Avocado Fruit Pedicels Collected at the Citrus Experiment Station at Riverside

Number of Pedicels (fruit stalks)	Variety	Total Phosphorus (P) in Dry Matter (p.p.m.)
16	Blake	1060
10	Benik	1560
16	Blake	940
17	Puebla	1380
10	Fuerte	1490

TABLE VI

Potassium in the Skin, Pulp, and Seed (with seed coat) of Fuerte Avocado Fruit Collected in the Vista-Escondido Area

Orchard	Potassium (per cent)		
	In fresh fruit pulp †	In dry matter of fruit skin	In dry matter of the seed (See last column in table III)
X1	0.71	3.942	1.334
X2	.67	4.013	1.350
A1 (high producer)	.67	4.078*	1.231
A2 (low producer)	.66	3.925	1.269
F	.65	4.479	1.216
E1 (old trees)	.60	3.805	1.162
D (old trees)	.52	2.549	1.025
C2	.51	3.815*	1.109
E1 (young trees)	.50	2.775	0.982
C1	.49	3.195	1.060
B	.44	2.633	0.915

* *Stem half only.*

† *From published results of Haas (see footnote in Table I).*

When the published results for the potassium content in the pulp of Fuerte avocado fruit (1) are arranged in descending order in table VI, and the values for potassium in the skin and seed of the same fruit are placed in the table, it is found that the high and low potassium values in the pulp are associated with corresponding high and low potassium values in the skin and seed.

SUMMARY

Fuerte avocado fruit were obtained in the Vista-Escondido area from trees the leaves of which showed higher concentrations of phosphorus and potassium when these fertilizer elements were added to the soil than when chiefly nitrogenous fertilizers were used. The pulp, fruit skin, and the seed also showed differences in their potassium and total phosphorus contents that paralleled the results previously found for these elements in the leaf petioles and blades. The use of phosphorus and potassium in addition to nitrogen in the fertilizer program has been accompanied by an increased absorption of these elements not only in the leaves but also in the skin, pulp and seed of avocado fruit. Whether these additional elements will be effective in increasing the keeping quality (vitality) of the fruit, or in improving the eating quality or the fruit production remains to be investigated.

LITERATURE CITED

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