Effects of Potassium and Phosphorous Fertilization on Quality of Sweet Potatoes

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Abstract. Potassium applications from 0 to 140 kg/ha at 4 locations had more influence on quality of sweet potatoes than P applications of 0 to 73.9 kg/ha as an average of years and locations. As the rate of K but not P applications increased, percent dry matter decreased. K and P applications reduced protein content and firmness of canned roots. K slightly increased the crude fiber content (dry wt basis) of the roots, whereas P applications had no affect on fiber content. K and P fertilization had no influence on carotenoid content (fresh or processed), percent splitting of canned roots, or crude fiber content (fresh weight basis). Year and location effects were noted for some of the quality variables studied. Most of the differences observed were of low magnitude, thus had little effect on the overall quality of sweet potatoes. The most outstanding effect was the reduction in dry matter content due to K applications.

Materials and Methods
Sweet potatoes were grown at the Sweet Potato Research Center at Chase and a private farm at Gilbert in the northern part of the state, at the Idlewild Experiment Station at Clinton, and the main station at Baton Rouge from 1968 to 1975. One or 2 locations were used each year, chosen because of their varying levels of HC1-NH4F extractable P and HC1 extractable soil K. The Chase and Gilbert locations were considered relatively high in K and P contents, whereas the Baton Rouge and Clinton locations were relatively low in extractable K and P contents. Soil types at all locations were similar and were classified as silt loam soils, but the soil at Clinton was considered poor in inherent soil fertility, as was the Baton Rouge soil. Sweet potatoes were grown at Clinton for 6 years, at Chase for 5 years and 1 year at Baton Rouge and Gilbert.

A Latin Square design was utilized comparing 6 rates of K and P fertilization with 6 replications, with all squares being randomized identically at all locations for each year. Analyses of variance were calculated for each experiment and across squares for K and P, respectively. Means were compared using orthogonal comparisons. Rates of K fertilization utilized were 0, 28, 56, 84, 112 and 140 kg/ha, whereas rates of P varied from 0, 14.8, 29.6, 44.4, 59.1 and 73.9 kg/ha. The K plots also received 33.6 kg N/ha and 44.4 kg P/ha, whereas the P plots received 33.6 kg N/ha and 56 kg K/ha. The fertilizers were hand mixed and applied by hand to insure even distribution within the plot.

Results and Discussion
Varying rates of K fertilization from 0 to 140 kg/ha had a significant influence on some of the quality variables of sweet potatoes (Table 1). Dry matter content as an average of all tests was reduced by the application of K fertilizer. As K rates increased there was a reduction in % dry matter of the roots. The highest rate (140 kg/ha) on the average reduced dry matter content by 1.8% as compared to the control. On an individual experiment basis dry matter content was significantly altered in 11 out of 13 tests, usually in a linear decrease as the K rate increased. There were year differences. For example, 1968 and 1974 at Chase showed about a 4.5% difference in average dry matter content. As an average for locations, there was a 2.8% difference in dry matter at Chase and Clinton locations. Both of these locations resulted in higher dry matter content than at the Baton Rouge or Gilbert locations.

For individual experiments K applications had little influence on firmness of syrup-packed roots (Table 1). In only 1 out of 12 tests were significant differences in firmness noted, which occurred at the Clinton location where a linear reduction in
f firmness occurred due to increasing K rates. However, when analyzed across squares as an average there was a significant reduction in firmness due to K fertilization (Table 1). The differences were significant but of low magnitude.

As an average of all tests K application had no influence on carotenoid content of fresh or processed roots (Table 1). Significant differences were noted in 2 out of 12 tests for carotenoid content of fresh roots and 1 out of 11 tests for processed roots.

Protein content (dry and fresh wt basis) was slightly lowered by K applications (Table 1). On a dry wt basis, protein content was lowered in 5 out of 9 experiments and on a fresh wt basis protein content was lowered in 8 out of 9 experiments.

Fiber content (dry wt basis) was influenced by K fertilization in 3 out of 11 tests, but on a fresh wt basis significant differences were noted in 2 out of 11 tests without a set pattern of affect. As an average of all tests, K fertilizer increased fiber content (dry wt basis), whereas on a fresh wt basis it was not significantly influenced.

Splitting or cracking of canned roots was not influenced by K fertilization (Table 1). There were large variations among replications for splitting of canned roots as evident by the large coefficients of variation.

Varying rates of P applications from 0 to 73.9 kg/ha had an influence on dry matter content of sweet potatoes grown at Clinton but not at other locations. Analysis showed significant differences in dry matter content in 3 out of 6 years at Clinton, 1 out of 5 years at Chase, and no effect at Gilbert and Baton Rouge. In the 4 years where significance occurred, no set pattern appeared, thus the potatoes grown on the control plots and the plots receiving 73.9 kg/P/ha had about the same dry matter content. As an average of all years and locations, P application did not affect dry matter content of sweet potatoes (Table 2). The average dry matter content of potatoes grown at Clinton was about 4% higher than those grown at Chase. During 1973, there was a 5% difference in dry matter content at Chase and Clinton. Yearly variations occurred at both locations.

Rates of P application significantly altered the firmness of canned roots in 2 out of 13 experiments, both years at the Clinton location. As an average, P treatments slightly reduced firmness. (Table 2). There were large yearly variations such as during 1970 and 1973 at Chase.

Carotenoid content of fresh or processed roots was not influenced by P applications. Significant differences were shown in 1 out of 12 experiments for fresh roots and only 1 out of 11 for processed roots. As an average P had no influence on carotenoid content (Table 2). The carotenoid content at Baton Rouge was much lower than at the other locations. Protein content was lowered in all cases at the Clinton location, but was not altered at the 3 other locations. In most cases increasing P application resulted in lowered protein content when com-

### Table 1. Effects of K fertilization on quality of sweet potatoes, 1968-1975.

<table>
<thead>
<tr>
<th>K (kg/ha)</th>
<th>Protein (%)</th>
<th>Crude fiber (%)</th>
<th>Splits (%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Dry wt</td>
<td>Fresh wt</td>
<td>Dry wt</td>
</tr>
<tr>
<td>0</td>
<td>6.7</td>
<td>1.9</td>
<td>2.95</td>
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<tr>
<td>28</td>
<td>6.4</td>
<td>1.8</td>
<td>2.96</td>
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<tr>
<td>56</td>
<td>6.2</td>
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<tr>
<td>84</td>
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<tr>
<td>112</td>
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<td>3.08</td>
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<td>140</td>
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**Significancex**

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<thead>
<tr>
<th>C.V. (%)</th>
<th>L**, Q*</th>
<th>L** c*</th>
<th>NS</th>
<th>NS</th>
<th>NS</th>
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### Table 2. Effects of P fertilization on quality of sweet potatoes, average of all experiments, 1968-1975.

<table>
<thead>
<tr>
<th>P (kg/ha)</th>
<th>Dry matter (%)</th>
<th>Firmness2</th>
<th>Carotenoids (mg/100 g)</th>
<th>Protein (%)</th>
<th>Crude fiber (%)</th>
<th>Splits (%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fresh</td>
<td>Processed</td>
<td>Dry wt</td>
<td>Fresh wt</td>
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<td>1.9</td>
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<tr>
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<td>28.1</td>
<td>4.00</td>
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<td>NS</td>
<td>NS</td>
<td>L** Q**, C* L**, Q**</td>
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<td>7.6</td>
<td>7.9</td>
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</table>

**Significancex**

| 2P. S. I. required to shear a 200-g sample of canned sweet potato with shear press. |
| YRoots that have split or cracked in the can. Severe splits are roots that have been judged to have fallen apart during transit. |
| X L = linear; Q = quadratic; C = cubic. |
| **NS**Significant at 5%(*) and 1%(**) level; NS = not significant. |
Chemical Thinning: Ethylene and Pre-treatment Fruit Size
Influence Enlargement, Auxin Transport, and Apparent Sink Strength of French Prune and ‘Andross’ Peach

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Abstract. Ethephon applied to peach (Prunus persica L., cv. Andross) and French prune (Prunus domestica L., cv. Agen) at fruit developmental stages sensitive to ethylene-induced abscission reduced peach enlargement and the 14C-IAA transport capacities of excised peach pedicel segments. Sensitivity to (2-chloroethyl)phosphonic acid (ethephon) was inversely related to peach size prior to treatment. Triliodobenzoic acid (TIBA) increased abscission of control and ethephon-treated prunes.

Accumulation of label by fruit tissues of ethylene pretreated prune explants following xylem transport of 14C-sugar was reduced despite the absence of competing sinks and continued availability of sugar. These results provide evidence of a direct effect of ethylene on fruit tissues.

Thinning of immature fruit post-bloom enhances fruit size, promotes regular cropping, and minimizes mechanical tree damage. Apple fruits are chemically thinned successfully, and this success is based, at least in part, on the pronounced variability among developing fruits occupying different positions on a single bearing spur (7). That is, there is a visible basis for chemical selectivity. Comparable variation is not apparent within stone fruit inflorescences, and thinning agents, including ethephon, have performed less reliably within these species (10, 20). Also, if the number of developing ovules influences chemical selectivity, then stone fruit populations (one developing ovule per ovary) offer considerably less heterogeneity (e.g., vs. apple) for selective fruit removal.

The basis for chemical selectivity within stone fruits remains obscure. Our objective was to investigate the fruit-ethylene interaction in 2 Prunus species and quantify differences in ethylene response within a peach fruit population. We asked ourselves whether ethylene affects persistent fruit or are the measurable effects restricted to fruit predisposed to abscission. An attempt was made to discern whether reduced sugar accumulation by ethethylene-treated prune fruit tissue was a cause or a consequence of ethylene-mediated fruit senescence and ab-


Literry Cited
