THE EFFECTS OF VARIOUS POTASSIUM (K.) LEVELS ON CHANDLER WALNUT TREES, YIELD, AND NUT QUALITY

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ABSTRACT:

In general trees with a history of K. deficiency, adequacy, or luxury continued in this mode in 1991. Positive correlations appeared between July 1991 leaf K. levels and:tree size(TCSA), visual K. status, % husk K., yield/tree,and yield/ TCSA. These positive correlations appear to flatten out at about July leaf K. levels of 1.4-1.5 %, which is higher than those currently considered adequate (1.2 %). No correlation appeared between July 1991 leaf K. levels and: % shell K., % kernel K., nut size, nut weight, % light kernels, % edible kernels, % kernel yield, % shrivel, or % broken shells. Trees with high leaf K. levels (1.5 + %) produced approximately 80 lbs./tree more than trees with low leaf K. levels (1.0 - %).

OBJECTIVE:

Determine if leaf K. level differences have any affect on tree growth, yield or nut quality in a Chandler walnut orchard which has trees with a long history of K. deficiency, adequacy, or luxury as a result of previous research and/or location.

Comparisons will be made through correlation analysis between July leaf K. levels and various tree growth, yield, and quality parameters.

PROCEDURES:

1) Identify trees with histories of various leaf K. levels, measure tree trunks one meter above ground on these trees and eliminate any non-typical or diseased trees or any trees not on paradox rootstock.
2) Collect July leaf samples for K. analysis and compare these levels with the historic levels for each tree. Using as wide a range of current and historic leaf K. levels, possible and also considering trunk measurements (tree size), and observations of tree uniformity select as many trees as can be hand harvested in one day for this trial (48).
3) Rate trees for visual K. status in July and October.

4) At harvest collect 10 harvested nuts/tree for husk, shell, and kernel K. analysis.
5) Measure yield for each tree.
6) Have a 1000 gram sample/tree analyzed for various nut quality attributes.
7) Determine shell strength and shell mass.
8) Analyze data collected through correlations between July 1991 leaf K. levels and the various parameters being measured.

RESULTS:

In general trees continued to have similar July leaf K. levels than those in previous years. An example of this, for 11 test trees, is found on table 1.

Parameters that indicated a positive correlation with July 1991 leaf K. levels included:

1.) Tree size as determined by trunk cross sectional area (TCSA). Fig. 1.
2.) July visual K. status rating. Fig. 2.
3.) October visual K. status rating. Fig. 3.
4.) Percent husk K. Fig. 4.
5.) Pounds yield per tree. Fig. 5.
6.) Pounds yield per TCSA. Fig. 6.

Parameters not indicating a correlation with July 1991 leaf K. levels included:
1.) Percent shell K. Fig. 7.
2.) Percent kernel K. Fig. 8.
3.) Nut size measured as: kg/100 nuts, percent large nuts, or grams/nut.
4.) Percent light kernels.
5.) Percent edible kernels.
6.) Percent kernel yield.
7.) Percent shriveled kernels.
8.) Percent broken shells.

Additional shell size, shell strength, and shell mass measurements are yet to be taken.

DISCUSSION:

Although it might be suggested that the difference in tree size is a result of something other than leaf K. status, the long history of the various levels of leaf K. status for different trees helps support the positive correlation found between leaf K. levels and tree size (TCSA).

Although the actual regression line still needs to be calculated for this and other correlations it appears that the correlation between July leaf K. and TCSA flattens out around 1.4 % leaf K.

In July very slight visual symptoms of K. deficiency were present on trees with July leaf K. levels below 1.1 percent. In October other trees showed visual symptoms of K. deficiency which had July leaf K. level of near 1.4 percent.

Percent K. in the husk was positively correlated with July leaf K. levels. The correlation appears to flatten out at about 1.35 % leaf K.

It is not surprising that yield/tree is positively correlated with July leaf K. levels since leaf K. levels were positively correlated with tree size (TCSA) and large trees generally have larger yields.

What is surprising is that there appears to be a slight positive correlation between July leaf K. levels and yield/TCSA. The relationship appears to flatten out at about July leaf K. levels of 1.4-1.5 percent.

Most trees with low July leaf K. levels (below 1.0 %) produced about 120 pounds per tree while trees with K. levels of 1.5 % produced about 200 pounds per tree. Fig. 5.

CONCLUSION:

Tree size (TCSA), visual K. status, % K. in the husk, yield/tree, and yield/TCSA were positively correlated with July leaf K. levels.

Although regression lines still need to be developed it appears that most of the correlations flatten out at about 1.4-1.5 % July leaf K.levels. This is higher than the current 1.2 % July leaf K. which have been recommended as being adequate.

The incentive to maintain good leaf and visual K. status is clear based on the yield data. Trees with higher leaf K. status produced approximately 80 pounds /tree more than trees with low leaf K. status. This is an additional 3840 pounds/acre at the tree density in the test orchard. At a conservative value of 50 cents/pound for Chandler walnuts this production benefit would equal 1920 dollars/acre.

Table 1. CURRENT AND HISTORICAL LEAF K. LEVELS FOR SELECTED TREES.

JULY LEAF K. LEVELS

ROW/TREE	1991	1990	1989	1988	1987	1986
15/8	0.6	0.8	1.2	0.8	0.9	0.8
30/3	0.7	0.8	0.9	0.9	0.9	0.9
15/2	0.7	0.9	1.2	1.0	0.9	0.8
30/11	1.0	0.8	1.1	0.9	1.1	1.2
9/24	1.3	1.4	1.3	1.3	1.1	1.1
9/6	1.3	1.5	1.3	1.3	1.1	1.0
9/8	1.5	1.8	1.6	1.5	1.1	1.2
9/14	1.5	1.9	1.6	1.5	1.5	1.3
18/21	1.7	1.5	1.5	1.0	1.1	1.1
14/19	1.7	2.0	1.7	1.4	1.1	1.1
9/12	2.0	2.0	1.7	1.8	1.5	1.4

Fig. 1

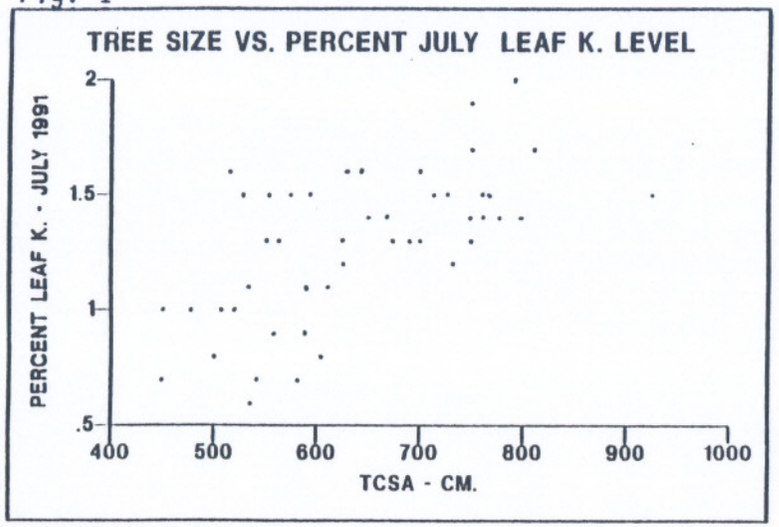

Fig. 2

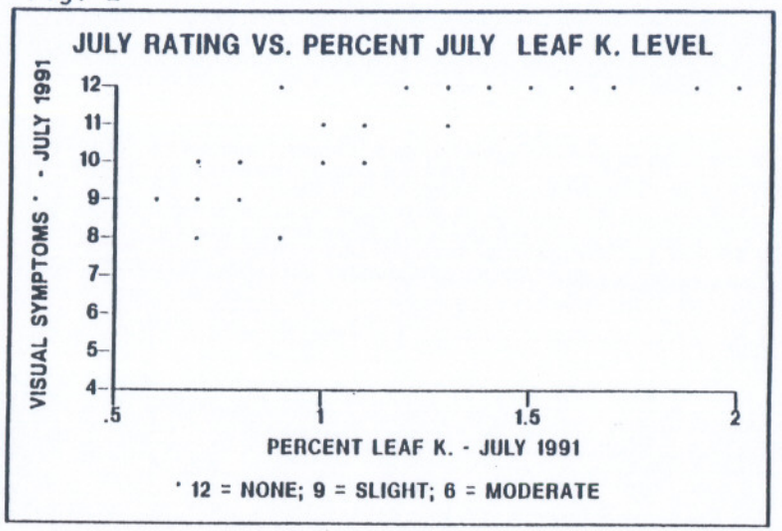

Fig. 3

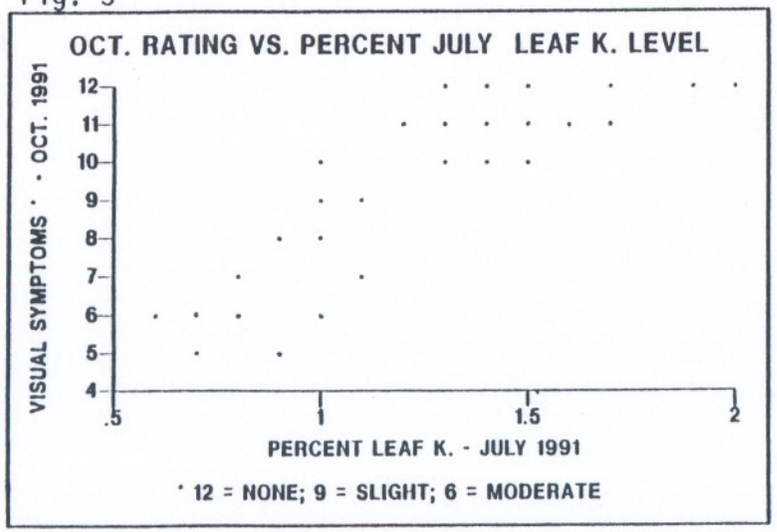

Fig. 4

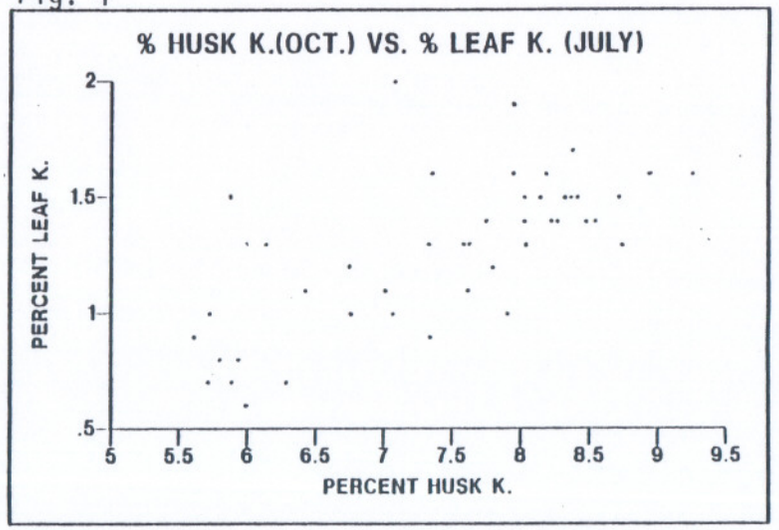

Fig. 5

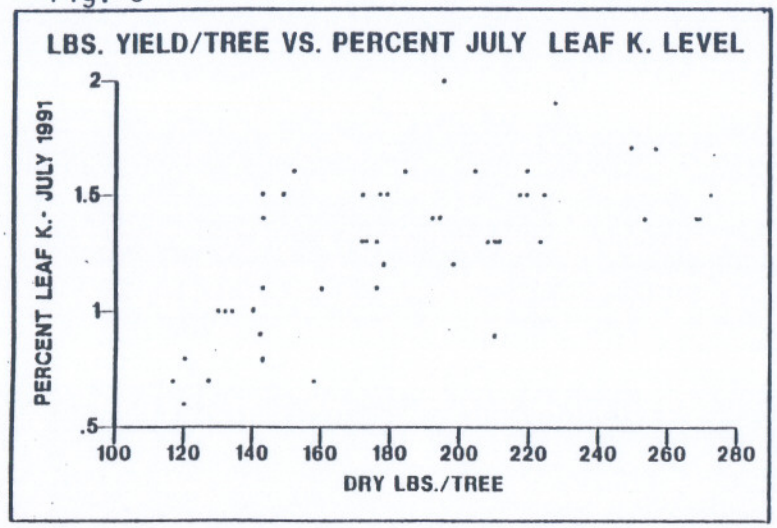

Fig. 6

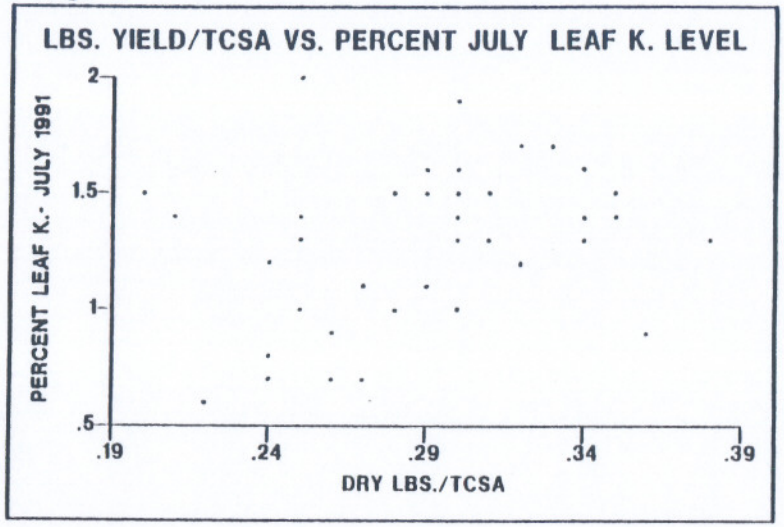

Fig. 7

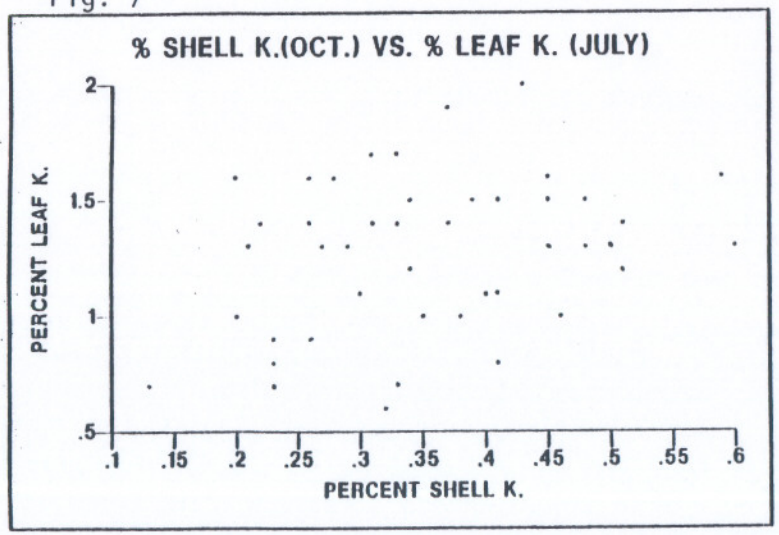
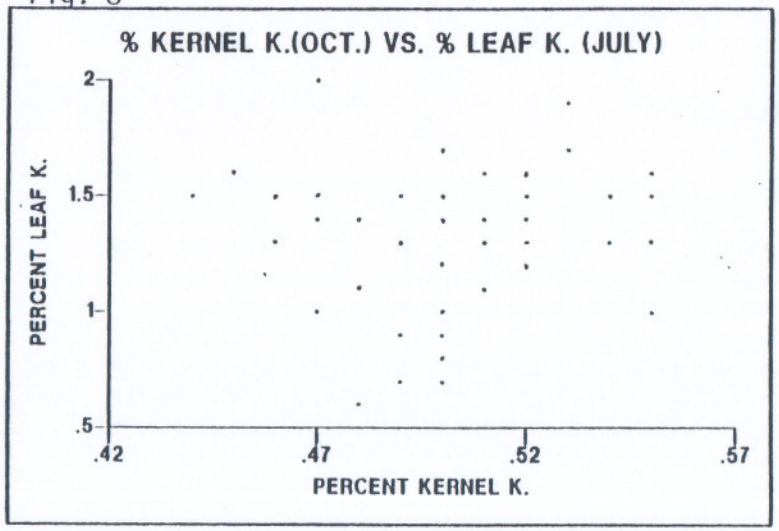
Fig. 8