PLUM NUTRITION STUDIES

Project Leaders: Kevin R. Day
Cooperators: R. Scott Johnson, Carlos Crisosto, Ted DeJong, Kevin Klassen, and Gerardo Banuelos

ABSTRACT

After four years of studying fertilization rates of 0, 125, and 250 pounds nitrogen (N) per acre in Blackamber plum, we have only observed consistent differences in tree vigor and light penetration. Annual K supplementation (2000 lbs/acre potassium sulfate) was practiced on one-half of the block for the past four of those seasons. Trees receiving no nitrogen fertilizer had reduced fruit size and yield potential compared to those receiving Nitrogen fertilizer. In the 2001 and 2002 seasons, yields were slightly improved by a combination of both high N and K. Tree nutrition status had no effect on fruit color or firmness at harvest or after 30 days in cold storage in any of the years studied.

INTRODUCTION

Detailed studies outlining the effect of tree nutrition have been performed on peaches and nectarines. Research on peaches and nectarines shows that high rates of nitrogen have the potential to delay maturity, reduce fruit quality (poorer color, lower soluble solids concentration), and reduce fruit size. Little if any such work has been done on Japanese plum, and virtually none in California.

Observations by experienced observers, including growers, pest control advisors, and university researchers, suggest that plums may not be as dramatically affected as peach and nectarine by high nitrogen rates. There is an additional school of thought that promotes the use of nitrogen to improve fruit size and/or tree cropping ability, since most plums by nature do no tend to grow in as shaded or vigorous a growth habit as peach. Compounding these opinions is the effect that nitrogen status may have on subsequent spur and flower development. Furthermore, there is no data regarding the effect of nitrogen status on fruit quality or potential storage life.

To answer these and other questions, and provide sound empirical evidence of plum response to nitrogen fertilization, the following experiment was begun in the spring of 1999.

METHODS

A mature block of Blackamber plums growing at the Kearney Agricultural Center was used in this study. The trees are spaced 6'x18' and are trained to a two leader perpendicular Kearney "V" conformation. The trees received routine horticultural care including pruning, thinning, irrigation, and pest control.

Three rates of nitrogen fertilization were applied: 1) unfertilized control, 2) 125 pounds of nitrogen per acre, and 3) 250 pounds of nitrogen per acre. Nitrogen was applied as split applications with one-half applied in early spring (mid-March) and the other half in late September. A randomized block design with four replicates, each consisting of two 13-tree long rows was used.

In October 1999 a permanent covercrop of dwarf perennial rye and fescue was planted throughout the orchard to help further increase the differences between the N treatments. In this instance it is assumed that the covercrop will act as a trap crop and help reduce the vigor of the unfertilized trees. Additionally, in October 1999 the block was split and one-half of the trees were fertilized with a 2000-pound per acre rate of potassium sulfate (1080 pounds K_2O).

Trees received standard horticultural care for the variety. However, in the 2002 season only, trees were differentially thinned (light, standard, and heavy crop loads) to help better determine tree nutrient status on potential productivity vs. potential fruit size.

RESULTS AND DISCUSSION

Field Measurements

The trees were harvested on June 24 and July 1, 2002. Trees receiving the 0 N treatment tended to have lower yields and smaller fruit size than those receiving some N (figure 1). There was no difference in fruit size or yield between trees receiving 125 or 250 #N/acre.

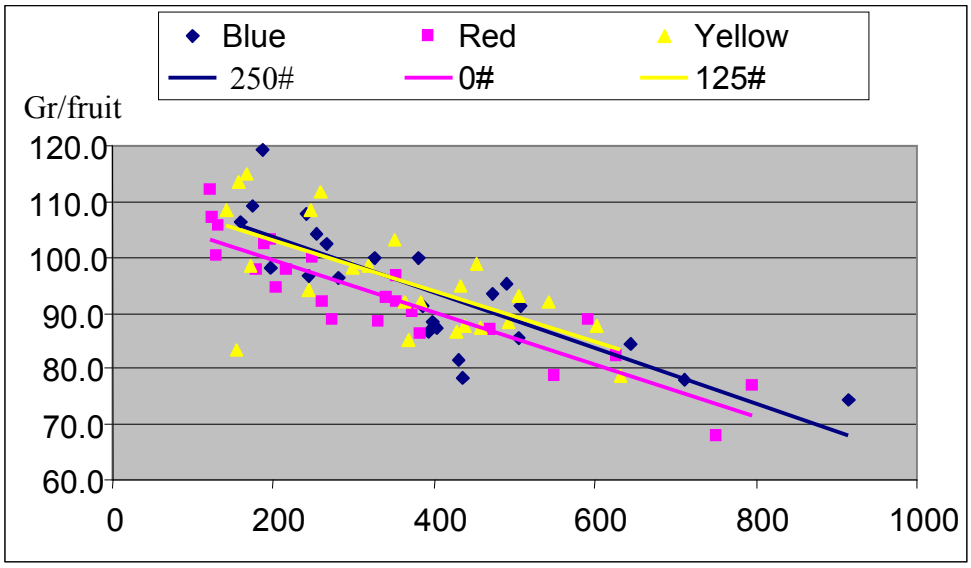

Figure 1. The relationship between fruit size (grams) and crop load (fruit/tree) for Blackamber plum fertilized at 0, 125, and 250 pounds N/Ac/Year (Red, Yellow, Blue lines respectively).

The annual addition of potassium at 2000 pounds per acre of potassium sulfate (1080 pounds K_2O) was in general of no benefit. However, potassium augmentation was of benefit only when combined with high rates of N fertilizer (figure 2).

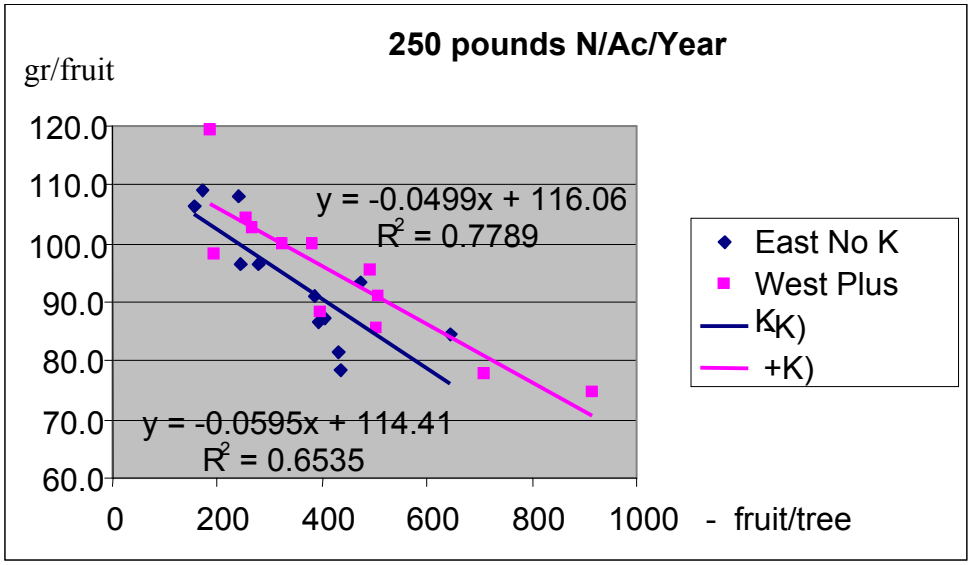

Figure 2. The relationship between fruit size (grams) and crop load (fruit/tree) for Blackamber plum fertilized at 250 pounds N/Ac/Year combined with either no annual potassium (Blue line) or 1080 pounds K_2O annually (red line).

Postharvest Measurements

At harvest at 50-fruit sub-sample was collected from each replicate and subjected to fruit quality analysis, including fruit color, size, firmness, and soluble solids concentration. There were no consistent differences between these parameters at harvest or after 30 days in cold storage (data not presented).

CONCLUSIONS

- There was no practical improvement in tree productivity or fruit size from high N rates.
- There was an interaction between N and K at the greatest rates. That is, the addition of some N improves fruit size, but the addition of more N only improves fruit size if K is added with it. However, this was of no practical benefit since the per unit return on investment was exceeded by the cost of the additional fertilizer.
- Surprisingly, tree N or K status had no effect on fruit postharvest quality.