Plum Nutrition Studies

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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.

Also, in 1999 an adjacent block of Royal Diamond plums trained and pruned as described above became available for additional study. The trees in this block had not been fertilized for four years. This opportunity allowed us to perform a discrete experiment on plum response to applied nitrogen. These trees were fertilized on March 16, 1999 at a rate of 300 pounds nitrogen per acre.

Results and Discussion

Blackamber Trial

The primary focus in 1999 was to establish the treatments and determine a baseline of performance for the orchard. In subsequent years the long-term fertility status of the treatments is expected to become evident.

The Blackamber trees were harvested three times (July 6, 9, and 13). At each harvest the fruit was weighed and counted and representative sub-samples collected for fruit quality analysis. There were no significant effects on yield or other fruit performance attributes (table 1). There were however, significant differences in leaf nitrogen percentage, and it will be interesting to note if this has any cumulative effect in subsequent years. There were no differences between fruit quality attributes such as soluble solids, acidity, or pH (data not presented).

Table 1. Effect of N fertilization on yield and leaf nitrogen response of Blackamber plum.

N Rate (lbs/acre)	Yield (tons/acre)	Crop Load (fruit/tree)	Fruit Size (grams/fruit)	Leaf Nitrogen (%)
0	17.39 [ns]	483 [ns]	82.6 [ns]	2.28 [a]
125	19.55	525	84.1	2.54 [b]
250	17.54	495	80.8	2.62 [c]

Despite these differences in leaf N concentrations, there were no differences in fruit yield or size. This may be because much of the growth potential of the fruit is determined in the year prior to harvest. Such responses will be monitored in 2000. Also, prior work by R. Scott Johnson with peaches and nectarines suggest that there may be a lag phase between the cessation of N application and reduced productivity.

In October 1999 a permanent covercrop of dwarf perennial rye and fescue was planted throughout the orchard to help further separate 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, and also 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. As a consequence, in subsequent years we will be able to incorporate studies on both potassium and nitrogen nutrition.

Royal Diamond Trial

Fertilized trees had greater yield, larger fruit, and greater leaf nitrogen concentrations (table 2). The greatest response was seen as a 10% increase in leaf N%, and an 11% increase in fruit size. While 300 pounds on actual N is a very high rate of application, it is surprising that such a rate did not increase leaf N even more.

Given that the current UC recommendation for plum leaf N concentration is 2.3% to 2.8%, and since both treatments fall within this range, these results indicate the need for further research on plum nutrition.

Table 2. The effect of applied nitrogen on yield and leaf nitrogen response of Royal Diamond plum.

	Yield (tons/acre)	**Crop Load (fruit/tree)**	**Fruit Size (grams/fruit)**	**Leaf Nitrogen (%)**
Unfertilized (0 lbs N/AC	27.1	794	77.0	2.34
Fertilized 300 lbs N/AC	28.9	767	85.8	2.58

Abstract

Plum nutrition studies were initiated in 1999 on Blackamber and Royal Diamond plums. A rate comparison trial (0, 125, and 250 pounds N/acre/year) was begun in the Blackamber block. There was no significant effect on tree or fruit performance in the first year other than an increase in leaf N concentrations. A single year trial on Royal Diamond trees that had been unfertilized for four years showed that a single mid-March application of 300 pounds N per acre increased leaf N concentration by 10% and fruit size by 11% even though leaf concentrations of both treatments fell within current UC recommendations.