DEVELOPMENT OF NUTRIENT MANAGEMENT TOOLS FOR PRUNES

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OBJECTIVES

To produce accurate and user-friendly guidelines and to develop NutManPro for prunes in California and to collect the additional data needed to support these objectives.

1. Determinate the influence of plant nitrogen status and fruit size on nitrogen removal by prune fruits.
2. Develop early-season leaf sampling protocols and interpretation.
3. Implement the Nutrient Management Program (NutManPro-Prune) and disseminate information regarding the program

During 2014, the research was focused on objective 1.

PROCEDURE

In order to represent the different levels of farming of the prune industry, 10 orchards were selected in the area of Yuba City, Sutter County. Details about the orchards can be observed on figure 1 and table 1.

Figure 1. Level of farming of sampled orchards. 1) High farming; 2) Medium farming; 3) Low farming or abandoned.

The orchards were sampled to assess their mineral status and to study its relationship to mineral content and removal in fruits.

At harvest, 500 fruits were randomly collected from each orchard and sorted by fresh weight in: small fruits (<17 g per fruit), medium (between 17 and 25 g per fruit), and large (> 17 g per fruit). In order to assess the influence of fruit size on mineral concentrations, three subsamples were taken into each range of weight and refrigerated for mineral analysis. In addition, three subsamples were selected to determine dry away ratio. The samples selected for mineral analysis were dried to constant weight and grinded to analytical determination of total nitrogen (%).

		Size distribution		
Orchard	Level of farming	Small (< 17 g)	Medium (17 g - 25 g)	Large (> 25 g)
1	MEDIUM	65%	35%	0%
2	HIGH	4%	57%	39%
3	HIGH	0%	25%	74%
4	HIGH	16%	83%	1%
5	MEDIUM	27%	58%	14%
6	MEDIUM	24%	62%	14%
7	LOW	41%	55%	4%
8	MEDIUM	39%	58%	3%
9	LOW	7%	56%	37%
10	HIGH	49%	40%	11%

Table 1. General characterization of the studied orchards.

The study had an unbalanced randomized block design and the results were examined by linear regression and analysis of variance (ANOVA).

RESULTS AND CONCLUSION.

Nitrogen status and N fruit removal.

Nitrogen levels range between 2.04 % and 2.41% (Figure 2). These results represent the variability on nitrogen status between the different orchards studied.

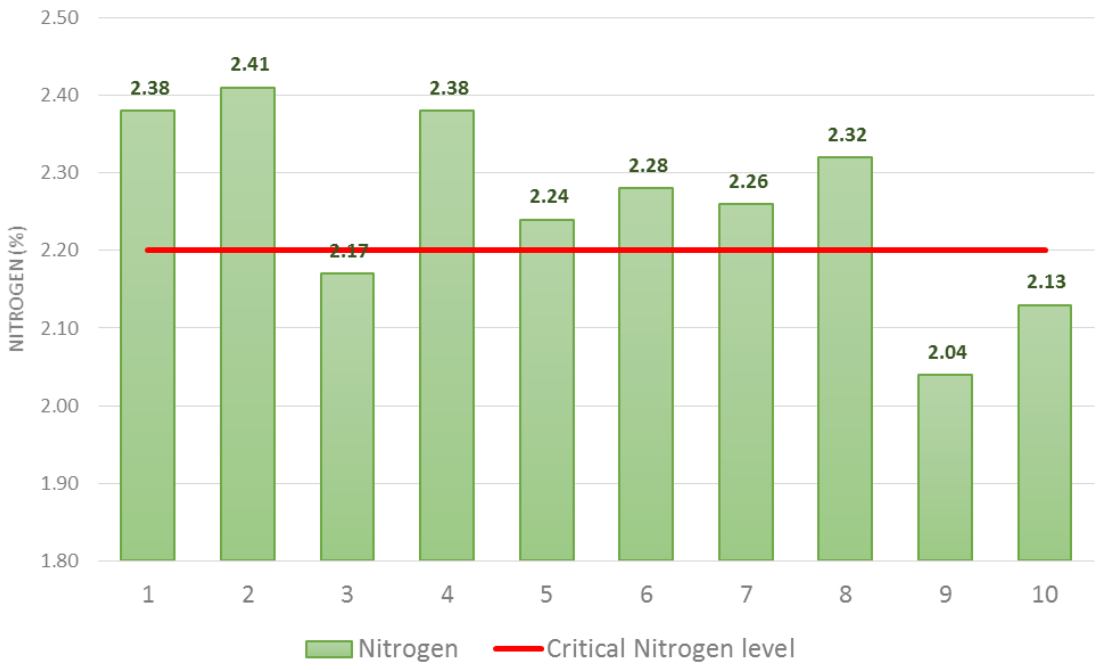

Figure 2. Leaf analysis. Nitrogen levels before harvest. Yuba City area, July 2014.

With the exception of orchard 3, 9, and 10, orchards showed optimum nitrogen levels (Upper 2.2%) (Niederholzer, 2014).Leaf nitrogen status of the trees partially explains the variability observed in the nitrogen concentration of nitrogen of fruits (Figure 2)

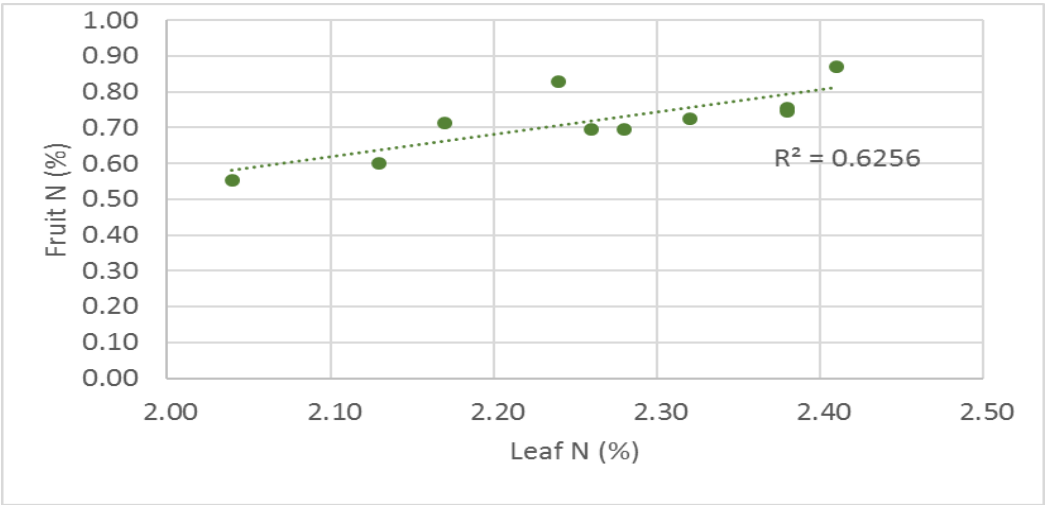

Figure 2. Nitrogen leaf status and its influence on nitrogen fruit concentrations. Ten orchards, Yuba City area, July – August 2014. * Significant at $P < 0.05$ according to F – test.

Fruits are substantial sinks of nitrogen and compete for limited resources. Weinbaum et al. (1994), reported that 36 % of the prune tree's nitrogen is concentrated in fruits. Saa and Brown (2014), studying the influence of fruit on leaf activity, demonstrated that there are negative effects of fruit presence on leaf N% on the surrounding fruiting spurs. On the other hand, Weinbaum et al. (1994), showed that heavy cropping trees have higher levels of leaf nitrogen. It is important to analyze the influence of crop load and its interaction to leaf and fruit nitrogen concentration in prunes.

Fruit size and N fruit removal.

There is a significant influence of fruit size on nitrogen concentration (Figure 3), showing small fruits have higher nitrogen concentrations. Haynes and Goh (1980) reported that large fruit remove more nitrogen (quantity of nutrients) just by increasing dry weight. However, the same authors observed a tendency (non - statistical differences) of lower nitrogen concentration (%) as the fruit increase in size.

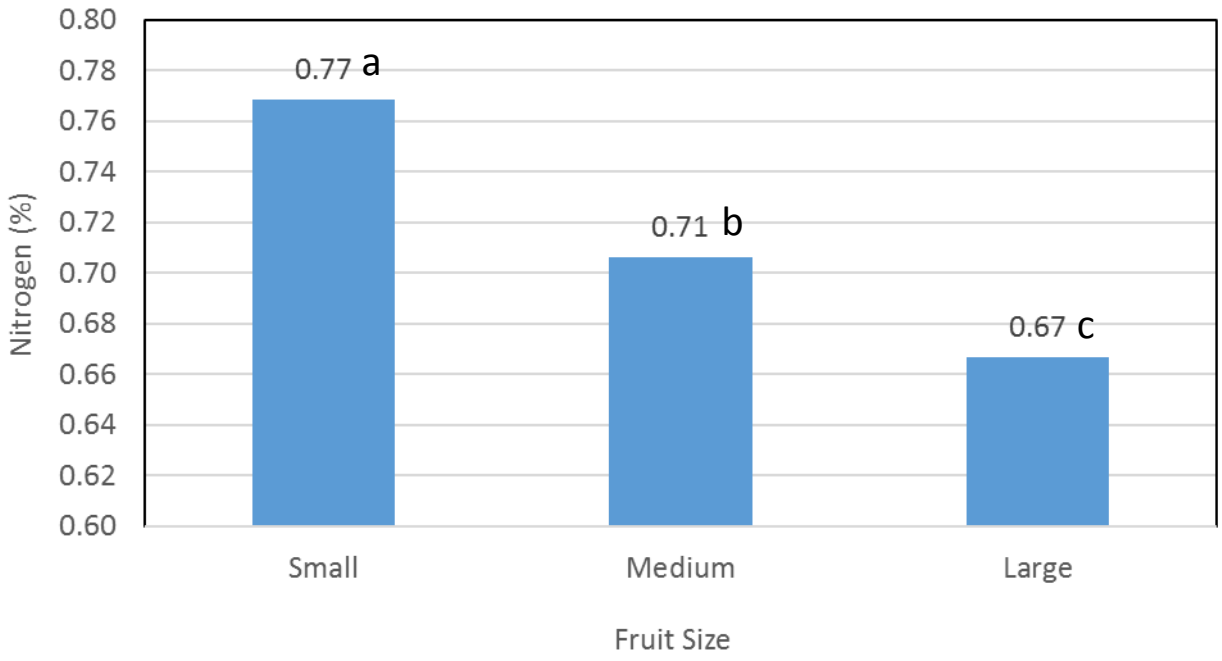

Figure 4. Fruit size influence on nitrogen concentration in fruits. Yuba City area, August, 2014. Different letters between fruit sizes denote significant differences on mean nitrogen concentration of fruits. (Scheffe test, $P<0.05$)

Consequently, an important consideration is the size proportion of the orchard in order to obtain a more accurate estimation of the nitrogen removal in fruits.

Mineral removal from the orchard

After factoring the differences observed in nitrogen content between fruit sizes and including the size distribution registered in each orchard (Data not shown), the total mineral removal is observed on Figure 5.

	Removal lb/ton		
Orchard	N	P	K
1	12.4	1.8	18.9
2	13.8	2.2	21.9
3	10.9	2.2	19.5
4	11.8	2.1	18.6
5	13.4	2.3	20.9
6	11.6	2.0	18.8
7	11.7	2.0	18.9
8	11.6	2.0	18.8
9	9.6	1.7	16.3
10	8.9	1.7	16.3
Average	10.7	1.9	17.8
Confidence interval for removal (*P<0.05)*	10.7 - 12.5	1.9 - 2.1	17.9 - 19.9

Figure 5. Nitrogen (N), phosphorus (P) and potassium (K) removal in fruits. Yuba City area, August, 2014.

The data partially agree with previous information that reported nitrogen removals between 12 – 18 lb N / dry ton (Niederholzer, 2014). However, our data coincide with data extrapolated from Weinbaum et al. (1994).

In conclusion, small prune fruits have a higher concentration of nitrogen than larger fruits, which demonstrated the importance of considering fruit size on calculating mineral removal from orchards. Nitrogen removal from prune orchards in the study ranges between 10.7 to 12.5 lb / dry ton). These values are in the lower limit of the previously informed range (12 – 18 lb / dry ton). Therefore, more empirical evidence is needed to confirm these results and analyze how yield and nitrogen status of the tree could influence nitrogen removal.

Literature cited

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