MECHANICAL HARVESTING SYSTEM AND CMNP EFFECTS ON DEBRIS ACCUMULATION IN LOADS OF CITRUS FRUIT

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Objective(s) Pursued (Priority Topics):

1. Determine the total quantity of debris (primarily stems and leaves) that accumulates in a standard load of harvested fruit for each different mechanical harvesting system and hand harvesting.

2. Characterize the debris accumulated to determine what proportion is leaves, small diameter stems and large diameter stems to aid in the development of debris removal systems.

3. Determine if the abscission compound CMNP can reduce the amount of debris accumulated by different harvest methods.

Detailed Accomplishments in 2008-09:

Debris accumulation studies: Three different harvest methods (hand, Oxbo 3210, and Oxbo 3220) were evaluated for their effects on debris accumulation. These data show approximately a 2-3 fold increase in the total amount of debris accumulated in mechanically harvested loads compared to hand harvested loads. The bulk of these differences are from small and large stems.

For purposes of statistical analysis, the 15 subsamples from the three separate samplings of each harvest method were pooled. For all categories, leaves, small stems and large stems, the Oxbo 3210 had significantly greater debris compared to the other harvest methods. In general, there were no statistical differences in debris between hand harvested fruit and fruit harvested with the Oxbo 3220.

Of greatest importance to growers and processors is the total amount of debris per harvested load of fruit. An estimate of this figure was calculated for each harvest method. This value was calculated on a fresh weight (FW) basis; however, because each sample can vary in its moisture content due to irrigation, rainfall, humidity, etc. there is a lot of variation in the FW data that obscures statistical significance. That said, in all cases hand harvested loads had the least debris, with as little as 30 lbs to as much as 150 lbs less debris than the mechanically harvested loads.

CMNP ‘Valencia’ rate trials: For CMNP trials the same three categories of debris were evaluated; leaves, small stems and large stems; however, since CMNP allows for better separation of stems from the fruit the debris was subdivided into loose debris and adhering debris. For all categories of debris, all rates of CMNP numerically reduced the
amount of debris relative to the untreated controls. Loose leaves were numerically reduced at all rates of CMNP, but there were no significant differences for this category of debris. Loose small stems were significantly reduced at all rates of CMNP relative to the control, but there were no differences among rates of CMNP. Both adhering leaves and small stems were significantly reduced at the 200 and 300 gal/A rates compared with controls and were more effective than the 100 gal/A rate. Total adhering debris and overall total debris followed a similar pattern, 200 and 300 gal/A was significantly less compared with controls but only numerically lower compared to the 100 gal/A rate. Overall, the 200 and 300 gal/A rates reduced the total debris in a load by about 65%.

CMNP 'Hamlin' rate × shaker frequency trials: Data were collected from three Hamlin trials conducted during the 2008-09 season. With only minor exceptions the results of these three trials were similar. In all three trials there was no effect of shaker frequency on any of the measured variables; however, CMNP rate was significant in all three trials. There were no differences in any category of loose debris among CMNP treatments for any of the trials. However, CMNP application significantly reduced all categories of adhering debris in each trial. With only a few minor exceptions there was little difference in CMNP effect at 200 or 300 ppm and the use of CMNP reduced the total amount of debris estimated per load by at least 50%.

Areas where progress exceeded expectations:
The tremendous benefit of CMNP at reducing debris in mechanically harvested loads was a nice surprise. Prior to this result the benefits of CMNP for late season harvesting of ‘Valencia’ was seen as the primary benefit of this compound. However, now it is known that CMNP will have significant benefits to mechanical harvesting during all parts of the harvest season.

Areas where progress didn’t meet expectations:
Sand proved to be a very difficult variable to estimate because each time the fruit is handled some of the sand is lost. Thus, we believe that the data we have been able to collect for sand are low estimates at best. Due to the variation in the sand data, partly as a result of sample handling, there were no significant differences detected. Because of the difficulty in accurately measuring this variable no additional data were collected for ‘Hamlin’ during the 2008-09 season.

Impact of accomplishments towards overall goals of funding:
Mechanical harvesting increases the amount of debris in loads of harvested oranges by 2-3 times. However, it is still unclear exactly what other factors may contribute to debris accumulation, but they clearly exist as evidenced by the variation from sample to sample within a machine type. The use of CMNP can effectively reduce the amount of debris to levels equivalent to hand harvesting and 200 gal/A at 250 ppm is sufficient to achieve this reduction assuming environmental conditions for maximum efficacy are present.

Presentations associated with 2008-09 efforts:


Publications from 2008-09 efforts:

Refereed:


Non-refereed:


Next steps:

None – this project is complete.