

PROGRESS REPORT FOR PROJECT TOTAL VINEYARD MECHANIZATION TO OPTIMIZE YIELD AND QUALITY OF CONCORD, *Vitis labruscana*, GRAPE PRODUCTION

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RESULTS OF ARKANSAS EXPERIMENTS:

The objective of the Arkansas research is to examine carryover effects and establish if year to year variations in yield and quality can be minimized in a total vineyard mechanization system.

The Finger Lakes Vineyard Notes Newsletter 9 reports prices paid by New York wineries for Concord in 2000. The price range for machine harvested Concord was \$245 to \$315 a ton. The mean of the values listed is \$285.50. This value is also consistent with prices paid in Arkansas. At this price, total vineyard mechanization is an economic imperative. The Morris-Oldridge total vineyard mechanization system for Concords greatly reduces hand labor in the vineyard. The system involves four steps 1) machine pruning, 2) mechanical fruit thinning at green pea stage if necessary, 3) shoot positioning and center breaking for GDC and 4) machine harvesting. Fruit thinning controls crop load and the high bud number after pruning allows a crop during years with late spring frosts.

Arkansas climatic conditions have been diverse during testing of the Morris-Oldridge system. In 1995, the season prior to treatment establishment, there was a devastating hailstorm that left many vines without early season shoots. In the conversion year of 1996, there were warm days and cool nights (ideal) but we over-cropped the machine-pruned vines. In 1997, a late spring frost greatly reduced yields and no fruit thinning was required. In 1998, we had the hottest summer on record with a great deal of uneven ripening. In 1999 and 2000, the weather was wet until July and then hot, dry conditions until after harvest. This diversity of growing conditions is making an excellent test for our grape mechanization efforts and its affect on final grape quality. We are very pleased with the consistency of the results over a wide range of climatic conditions. However, additional time is needed to examine long-term effects on vine vigor and final product quality.

Grapevines at the University of Arkansas, Fayetteville were mechanically pruned and shoot positioned using modules from the Morris-Oldridge totally mechanized vineyard system for the fifth year. System components were designed and built by Oldridge Vineyards of Lowell, AR, in cooperation with the University of Arkansas. The University of Arkansas has pending U.S. and International patents on this system.

Experiment 1 was applied in the spring of 1996 to mature single and double curtain Concord vines trained on a 1.8m high cordon. The vines are established on a 3 x 2.5m spacing with drip irrigation. Half of the vines received hand adjustment to the best 100 nodes after mechanical pruning using the Morris-Oldridge system. Fruit load was adjusted 30 days post-bloom on the machine-pruned vines to approximate the fruit load of the hand-adjusted vines. All vines were mechanically shoot positioned, and vines trained on the double curtain system had the centers mechanically separated 2 to 3 times during the growing season. Vines were skirted at 60 cm above the vineyard floor before mechanical harvest.

In Experiment 2, vines were minimal pruned. The vineyard is a mature double curtain vineyard established on the same spacing as Experiment 1. Minimal pruning has been used on this vineyard since 1994. Minimal pruning consists of maintaining open centers between vertical curtains using mechanical methods and skirting the canopy bottoms at 60 cm during the growing season to prepare for mechanical harvest. Data collected from this vineyard was compared to data from an adjacent double curtain vineyard that was either hand or machine pruned.

Tables 1 and 2 give an overview of Experiment 1. The hot growing season of 2000 was slightly warmer than 1999 but color was excellent with good yields and soluble solids. We had expected uneven ripening to be a problem due to the heat but nighttime temperatures were low enough to allow color development. Yields have been consistent over the years. This is something that we strive for by adjusting fruit load. With the exception of the heavy frost year of 1997 yield has been above 6 tons per acre. The yield in 1999 was much higher than usual even with fruit removal. Prior to fruit removal were estimating over 20 tons per acre on the machine-pruned vines and even the hand-pruned vines had to have fruit removed. This was the best fruit set in recent years and many shoots had 4 clusters. This is not normally seen in Arkansas.

Over all years the hand-pruned fruit had slightly larger berries and more berries per cluster than machine pruned fruit. This may explain why color remained comparable between hand- and machine-pruned treatments even though machine-pruned treatments have a yield advantage.

Color measurements were made in a manner similar to what would be seen if a glass of juice was held up to a light to observe the color. The CIE L value indicates how light or dark the juice is with 0 being black and 100 being white. Hue angle is a system describing color in angles from 0 to 360°, 0 is red, 90° is yellow, 180° is green, 270° is blue and 360° is back to red. In the case of Concord grape juice, a hue angle near zero is best. Chroma is the aspect of color by which a sample appears to differ from gray of the same lightness and corresponds to intensity of the perceived color. Absorbance units at 520 nm are another indication of the red color present. Higher values indicate more red color.

Training system normally has a great effect on fruit quality due to light exposure, differences in fruiting area and fruit load. This was more evident prior to the introduction of the year 2000 data. Data from double curtain and single curtain training systems are presented separately in Tables 3-6. This is statistically a more accurate representation of the data than that found in Table 1 and 2, since training system is not a confounding factor.

Tables 3 and 4 show data for vines pruned to a single curtain training system. Differences in soluble solids between hand- and machine-pruned vines were only observed in two out of five years. Yield was greater on the machine-pruned vines than the hand-pruned vines. Color was comparable between the hand- and machine-pruned vines as indicated by hue angle and total red pigment. The color of the machine-pruned vines in 1996 was much lighter than the hand-pruned vines. This was a conversion year and a learning year. Had the machine-pruned fruit been allowed to ripen further in this year the color might have equated.

Tables 5 and 6 show data for the double curtain training system. Yield and quality data follow the same basic trends as in the single curtain trained vines. Soluble solids were comparable between hand- and machine-pruned vines for all years except 1996. Yields are higher on machine-pruned vines and berry weight was lower in all but two years. Color quality was generally better on hand pruned vines as indicated by lower hue angle values and higher total red pigment.

Tables 7 and 8 are much like the double curtain values of tables 5 and 6 but the minimal pruning treatments (Experiment 2) have been included. There are no differences between the hand-and minimal-pruned vines for soluble solids or yield and color was comparable in most years.

We have collected five years of data on this project and each year has been climatologically different. This has proven to be a benefit as we learn to adapt machinery and techniques to varying croploads. Although there were environmental differences during the study, and perhaps because of the differences, the totally mechanized vines have had yields that are more consistent than hand-pruned vines over the years with a quality similar to hand-pruned vines. We feel that we need at least 5 or 6 years of good data before publishing the results of this study. Since 1996 was a conversion year and 1997 was a year with frost damage, we feel that an additional years of data should be collected followed by postmortem examination of the vines.

NOTE FROM PROGRAM MANAGER: Extensive data substantiating the narrative report were submitted to the Viticulture Consortium-East- in a total of 8 tables.. These are available upon request from the Commodity Grants Manager –
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