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TWO YEARS' RESULTS WITH DRIP IRRIGATION ON YIELD AND QUALITY OF 'CONCORD' GRAPES

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'Concord' grapes constitute the majority of the grape acreage in Northwest Arkansas. Research has been geared toward finding the optimum cultural factors for producing maximum yields of good quality under the existing environmental conditions.

Yields of 'Concord' grapes have been increased in New York by the use of the Geneva Double Curtain (GDC) training system (5). The GDC training system is now being studied under Arkansas conditions. Cultural factors such as irrigation, nodes/vine, and fertilization levels must be investigated as related to the GDC system.

If irrigation proves to be beneficial, trickle irrigation would be the most practical method of water application since water is more efficiently distributed by this method. In addition, grape producers in Northwest Arkansas have a limited supply of irrigation water.

Presently, the 30+10 nodes/vine pruning level is recommended for Arkansas-grown 'Concords'. This pruning level was found to be the best for 'Concord' grapes grown under New York conditions(7). Recent studies (2 ,3) indicate that higher bud loads may be a feasible alternative under Arkansas conditions.

However, higher bud loads may tend to weaken the vines. Therefore, vine vigor can become a limiting factor. Nitrogen fertilization is a major factor contributing to vine vigor, (6,10). There have been conflicting reports on nitrogen's effect on fruit quality. Some researchers indicate that nitrogen decreases quality and delays maturity as indicated by low soluble solids, high titratable acidity, and poor color development, (4,9). Other researchers indicate that nitrogen applications either significantly increased soluble solids (8), or had no effect on the soluble solids (1).

Materials and Methods

This study was established on an eight-year-old 'Concord' vineyard at the Main Experiment Station, Fayetteville. This vineyard was fairly uniform in vigor and all vines were propagated from the same mother plant. This plant was selected because of its good vigor and tendency to produce fruit that ripened uniformly with a high percent of soluble solids.

Experimental variables consisted of two levels of irrigation, two levels of nodes/vine, and two levels of nitrogen fertilizer. All vines were pruned to six nodes/spur. Current season's growth was positioned vertically toward the ground.

Irrigation. Plots were either irrigated or not irrigated. In 1975, irrigation was begun on July 12 and applied at various intervals as needed until August 5. Approximately, 11.7 acre-inches (317,128 gallons/acre) were applied to the irrigated plots. Rainfall from 50$ bloom to the final sampling date was 17.3 inches.

In 1976, irrigation was begun on June 8 and ended on August 23. Approximately, 13.7 acre-inches (369,550 gallons/acre) of water were applied. Rainfall from 50$ bloom to the final sampling date for 1976 was 9.52 inches.

Timing of irrigation was based on soil moisture as measured by an irrometer. Field capacity (10-20 on the guage) was maintained.

In both years, each vine was supplied by 2 drip emitters. The emitters dripped at the rate of about 1 gal of water per hour.

Nodes/vine. Vines were pruned to either 30+10 or 60+10 nodes/vine. Thirty and sixty indicating the number of nodes left on the vine for the first pound of dormant prunings. Ten indicates that ten nodes were left for each pound of dormant prunings above one pound.

Nitrogen. The two nitrogen levels were low and high. Vines in the low plots received zero pounds of nitrogen.

In 1975, vines in the high nitrogen plots received 4001bs NH4N03 per acre and in 1976 they received 6001bs/acre. Fertilizer was applied on April 10 in 1975 and on March 18 in 1976. The fertilizer was broadcast around the vines and in the row.

Samples. Three representative samples of basal clusters from each plot were taken at approximately 2 week intervals. Samples were taken early in the ripening phase, at mid-ripening phase, and at the time of commercial harvest in the Fayetteville area. Each sample was placed in a polyethylene bag and frozen for later qualitative analysis.

Experimental design. The experiment was a factorial design with all possible combinations of the three variables replicated six times within the vineyard. Each plot within a replication consisted of four vines.

Laboratory analysis. Enough samples for a day's analysis were placed in a cold storage room (2 ^{o}C) the night prior to analysis to facilitate thawing.

The thawed samples were blended for 15 seconds in an Osterizer. The blended samples were allowed to warm to 20 ^{o}C before the percent soluble solids was measured on a Bausch and Lomb Abbe refractometer.

After the soluble solids were measured, the samples were covered with watch glasses and cooked in a water bath at 85 ^{o}C for one hour. When cool, the cooked samples were strained through two layers of cheesecloth (grade 50). The remaining qualitative evaluations were made on the cooked juice.

Color was determined by the amount of light that would pass through a sample at 520 nanometers. In order to determine the percent transmittance of a sample, a 5 ml portion of the juice was diluted with 100 mls of distilled water. Samples were then centrifuged at 4,000 rev per minute for thirty minutes. After the samples had been centrifuged and decanted, the percent transmittance at 520 nm was measured on a Bausch and Lomb 340 Spectrophotometer that had been standardized with distilled water.

A 5 ml portion of the pure juice was diluted in 125-150 mls of distilled water. The pH and titratable acidity (mls of 0.1 NaOH required to titrate the sample to pH 7) were determined.

All data were subjected to analysis of variance and "F-tests." L.S.D. was used to separate means.

Results and Discussion

Two years' results with drip irrigation showed that irrigation significantly increased yield by one ton per acre (Table 1). Irrigation delayed maturity as indicated by significantly lower soluble solids, higher titratable acidity, and poorer color (the higher the value the poorer the color).

Fruit load had a significant effect on yield and quality (Table 1). By leaving 60+10 nodes/vine, yield was increased by over two tons per acre above the 30+10 level. Soluble solids were significantly higher and color significantly better for the 30+10 treatments. Acidity was not affected by the fruit load.

Nitrogen had no significant effect on yield and the only quality factor significantly affected was titratable acidity (Table 1). Abdalla and Sefick (1965) observed a similar decrease in titratable acidity at high levels of nitrogen fertilizer in the fruit of 'Concords' grown in South Carolina.

As the season progressed soluble solids increased, acidity decreased, and color improved (Table 1). Vine vigor as indicated by pruning weights, was significantly affected by irrigation, but not by nodes/vine or nitrogen (Table1).

The interaction between nodes/vine and irrigation (Figure 1) was significant both years for soluble solids and color, but not acidity. In both years the 30+10 dry treatments had the highest percent soluble solids than other treatments and the best color. In 1975, 60+10 irrigated plots had significantly lower solids than other treatments, but in 1976 there was no difference in the percent solids of the irrigated plots. Irrigated treatments did not differ significantly in color either year. Quality was affected by the treatments in a similar manner both years; however, yield was lower by 1 ton per acre in 1976 than in 1975.

Despite significant differences between the treatments due to the interactive effects of irrigation and nodes/vine (Figure 2) the percent soluble solids on all treatments was at an acceptable level by the last sampling date. Higher fruit load and irrigation tended to delay maturity by about one week. Color improvement was similarly affected. Acidity decreased with advancing maturity.

Conclusion

After two years study with drip irrigation, results indicate that yield can be increased with irrigation by 1 ton per acre. Yield can be increased by 2 tons by increasing the number of nodes/vine from 30+10 to 60+10. Both of these factors tend to delay maturity, as indicated by lower percent soluble solids, by approximately one week. Nitrogen had no significant effect on yield, soluble solids or color, but did significantly reduce titratable acidity. This study wilt be continued to evaluate the long-term effects of these treatments on yield and quality.

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