Proceedings 96th Arkansas State Hort Soc.Ann. Mtg. 1975, p. 59

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

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'Concord' grapes *(Vitis labrusca)* 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 through 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 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 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 have reported 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 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. Trickle irrigation was begun on July 12, 1975. Water was applied at various intervals until August 5, 1975. A total of 317,128 gallons of water per acre was applied to the irrigated plots. Each vine was supplied by two drip emitters. The emitters dripped at the rate of approximately one gallon of water per hour

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

Nitrogen. The two nitrogen levels were low and high. Vines in the low nitrogen plots received zero pounds of nitrogen. Vines in the high nitrogen plots received 213 pounds of actual nitrogen per acre. Ammonium nitrate (34-0-0)was applied on April 10, 1975. The fertilizer was broadcast around the vines and in the row.

Samples. Three representative samples of fruit were taken from each plot at approximately twelve-day intervals: before harvest (August 8), at harvest (August 21), and after harvest (September 2). Each sample was placed in a polyethylene bag and frozen for later qualitative analysis.

Yield. Yield was measured in pounds of fruit per vine. The measurements were rounded to the nearest quarter of a pound of fruit. The yield per vine per plot was determined by averaging the yields of the middle two vines of each plot.

Pruning. Dormant pruning was done during the week of November 3-7, 1975. Vines were pruned to their respective nodes/vine level, either 30+10 or 60+10 nodes/vine. All vines were pruned to six nodes/ spur.

Experimental design. The experiment was designed as a split, split plot design with the major split in the replications of nodes/vine. The replications were split again by irrigation with a sub-split of nitrogen.

All possible combinations of the three variables were 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 (20^{o}C) the night prior to analysis to facilitate thawing.

The thawed samples were blended for 1 5 seconds in an Osterizer. The blended samples were allowed to warm to 19^{o}C before the percent transmittance 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°C for one hour. When cool, the cooked samples were strained through two layers of cheesecloth (12x20) mesh. The remaining qualitative evaluations were made on the cooked and strained juice.

Color was determined by the amount of light that could 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 revolutions 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. I

A 5 ml portion of the pure juice was diluted in 125 ml of distilled water. The pH and titratable acidity were determined on the diluted samples. The titratable acidity was measured in the ml of 0.1 N sodium hydroxide required to titrate the sample to pH 7.

Results and Discussion

Irrigated plots yielded 0.7 ton/acre more than the non-irrigated plots. The 60+10 nodes per vine pruning level resulted in an increase of 2.9 tons of fruit per acre over the 30+10 nodes/vine level. Nitrogen had little effect upon the yield of 'Concords' in this year's study (Table 1).

Irrigation increased the amount of wood produced by the vines as indicated by increased pruning weights in the irrigated plots. Nodes/vine and nitrogen had little effect upon wood production (Table 1).

Irrigation had an adverse effect on fruit quality, as indicated by a decrease in soluble solids and an increase in the percent transmittance, over the fruit of nonirrigated vines. Titratable acidity was not significantly affected by irrigation. Fruit from the 60+10 nodes/vine plots had significantly lower percent soluble solids and a higher percent transmittance at 520 nm than the 30+10 nodes/vine plots. Again, the amount of titratable acidity was not significantly affected by the treatment. The only effect nitrogen had on quality was that the high level of nitrogen fertilizer decreased the amount of titratable acidity. Abdalla and Sefick (1965) observed a similar decrease in the amount of titratable acidity at high levels of nitrogen fertilizer in the fruit of 'Concords' grown in South Carolina. As the sampling date was delayed, the percent soluble solids and the titratable acidity were inversely affected, soluble solids increased as titratable acidity decreased. Color improved as the sampling date was delayed (Table 2).

A significant interaction between irrigation and nodes/vine indicated that fruit from the 30+10, non-irrigated vines had significantly higher soluble solids and significantly better color than all other treatments. As shown in Figure 1 , the percent soluble solids of the fruit from the 30+10, nonirrigated vines was significantly higher than the other treatments. The fruit from 60+10, irrigated vines was significantly lower in soluble solids than the other treatments. There was no significant difference between the percent soluble solids of the 30+10 irrigated and 60+10, nonirrigated treatments.

Despite significant differences between the treatments due to the interactive effects of irrigation and nodes/vine, the percent of soluble solids of all treatments was at an acceptable level by September 2. Only the 30+10, nonirrigated fruit differed greatly from other treatments (Figure 2).

Color was affected by the interaction of irrigation and nodes/vine. Again, the fruit from non-irrigated vines was of the best quality. There were no significant differences in the percent transmittance between the 30+1 O irrigated, the 60+10 nonirrigated and the 60+10 irrigated treatments (Figure 3).

Conclusions

Results indicated that yield could be increased by irrigation and by increasing nodes/vine from the 30+10 level to the 60+10 level. Both irrigation and higher nodes/vine delayed maturity as evidenced by decreases in the percent soluble solids and by increases in the percent transmittance. The soluble solids obtained from the 60+10 irrigated L plots did reach an acceptable level by the September 2 sampling date. Nitrogen had no significant effect upon yield, soluble solids, or color but did significantly decrease the titratable acidity. No recommendations can be made until the long-term effects of these treatments have been investigated.

Table 1. Yield and dormant pruning weights of 'Concord' grapes as affected by irrigation, nodes/vine and nitrogen, 1975.

Treatment	Yield Tons/Acre	Pruning Weight lbs/vine
Irrigation		
Irrigated	5.6	3.0
Not irrigated	4.9	2.2
Nodes/vine		
30+10	3.8	2.7
60+10	6.7	2.4
Nitrogen		
Low	5.1	2.6
High	5.4	2.7

Table 2. Quality of 'Concord' grapes as affected by irrigation, nodes/vine, nitrogen, and sampling date, 1975.

Treatment	% Sol. Sol.[z]	Tit. Acid[zy]	% T 520nm[z]
Irrigation			
Irrigated	15.2	5.8	57.5
Not irrigated	16.2	5.7	50.6
L.S.D. .05	0.3	NS	2.5
Nodes/Vine			
30+10	16.3	5.7	51.0
60+10	15.1	5.8	57.1
L.S.D. .05	0.3	NS	2.5
Nitrogen			
Low	15.7	5.9	54.2
High	15.8	5.7	53.9
L.S.D. .05	NS	0.1	NS
Samp. Date			
Aug. 8	13.2	7.5	64.7
Aug. 21	15.9	5.2	53.2
Sept. 2	18.0	4.6	44.2
L.S.D. .05	0.4	0.2	3.1

[z]Average of the three sampling dates.

[y]Reported as mls of 0.1 N NaOH required to titrate to pH7.

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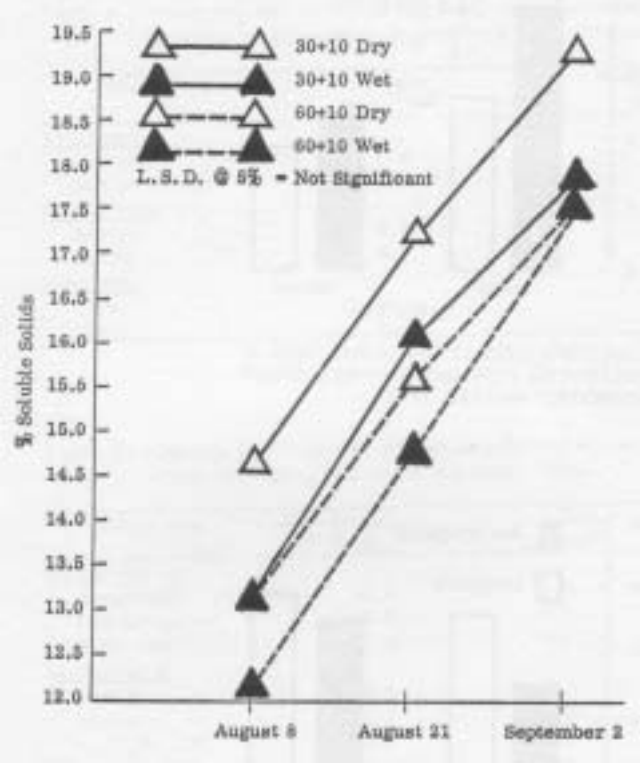
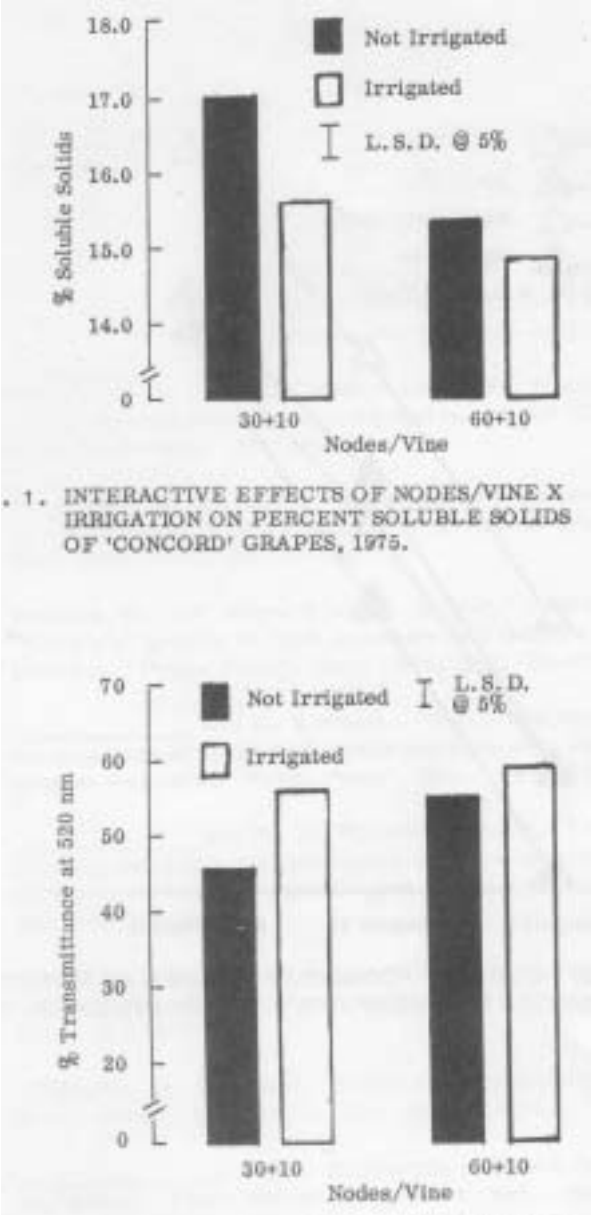


Fig. 2. Soluble solids of 'Concord' grapes as affected by irrigation x nodes x sampling date, 1975



. 1. INTERACTIVE EFFECTS OF NODES/VINE X IRRIGATION ON PERCENT SOLUBLE SOLIDS OF 'CONCORD' GRAPES, 1975.

Fig. 3 Interactive effects of nodes/vine x irrigation on percent transmittance (520nm) on 'Concord' Grapes, 1975