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Performance of Four Rabbiteye Blueberry Cultivars Grown With or Without Drip Irrigation

DENNIS E. DEYTON[1] AND ROY THOMPSON[2]

Abstract

A blueberry cultivar trial was established in central Tennessee in 1977 and an irrigation study imposed on the planting in 1981. 'Tifblue' was more cold hardy, vigorous, and more productive than 'Southland,' 'Garden Blue,' or 'Delite.' Drip irrigation was very beneficial, resulting in larger plants that were 40% more productive than nonirrigated plants. 'Tifblue' was very responsive to irrigation.

Introduction

Interest has developed in recent years in commercial production of rabbiteye blueberries (*Vaccinium ashei* Reade) throughout the southeastern states. The Tennessee Valley usually has cooler winters than traditional rabbiteye blueberry production areas. 'Tifblue' has been found to be more productive than 'Homebell' or 'Woodward' on the Cumberland Plateau (6). Winter injury was evident in one of six years of production. Cultivars have been shown to differ in tolerance to freeze injury (2).

Young rabbiteye blueberry plants are shallow rooted and sensitive to moisture stress. Cultivars differ in sensitivity to moisture stress (3) and vary in response to irrigation (1).

The objectives of this study were: (1) to characterize plant growth and yield of 4 rabbiteye blueberry cultivars grown in the Tennessee Valley, and (2) to determine whether addition of irrigation to previously established plants would be beneficial under Tennessee conditions.

Materials and Methods

An initial planting of 4 rabbiteye blueberry cultivars was established in 1977 at the Middle Tennessee Experiment Station, Spring Hill, TN. Bare-rooted, 2-year-old plants were set on a Maury silt loam soil (fine, mixed, mesic Typic Palendalfs), with soil pH adjusted with sulfur to and kept between 5.0 and 5.5. Plants were established 1.5 m apart within rows and 3.0 m between rows. Plants were mulched annually with approximately 2.5 m of hardwood sawdust. First harvest was made in 1979.

In the spring of 1981, an irrigation study was imposed on the planting. The experimental design was a randomized complete block with 4 replications and a split plot array of treatments with main plot being cultivar and subplot being irrigation. Each subplot consisted of 2 plants. Plots within a row were separated by border plants. Irrigation was supplied with a drip system having two emitters placed on either side of a plant .3 m from the base of each plant. The amount of water to be applied weekly was determined by a formula (4) based on plant size and pan evaporation:

$$LP = \frac{PE \times 42000\ 1/\text{hectare} \times .75R \times GS}{\text{Plants/hectare}}$$

Where: LP = Liters of water to apply per plant
PE = Pan evaporation
R = Replacement factor
GS = Percent ground surface that plants occupy.

The estimate of ground coverage ranged from 30% in 1981 to 60% in 1984. The mean pan evaporation, rainfall, and irrigation rates from May through August for 1981 to 1984 are shown in Table 1. The irrigation was

[1]Associate Professor, Department of Plant and Soil Science, U.T., Knoxville.
[2]Senior Research Assistant, MTES, Spring Hill, TN.

inadvertently left operating several times in 1982, 1983 and 1984 resulting in application of more water than predicted by the formula.

Vegetative growth measurements were made by photographing the plants after leaf abscission using a 1.2 m by 2.4 m background that was divided into a 15 cm by 15 cm grid system. Plant height and side view surface area were determined from the photographs. First bloom and harvest dates were recorded each year. Fruit was hand harvested each year. Random samples of berries were collected on August 22 in 1981 and July 17 in 1982 and frozen for later analyses. Percent soluble solids of screened juice was determined by a refractometer, scale 0-30. An aliquot of juice was mixed with an equal amount of distilled water and then acidity determined by titrating with 0.1 N, NaOH to 8.1 pH.

Results

Cultivars exhibited different growth characteristics. The data shown in Table 2 are for plants receiving irrigation from 1981 to 1984. 'Tifblue' was a vigorous cultivar that was the tallest and had the greatest sideview plant area prior to irrigation (1980) and throughout the 1981-1984 period (Table 2). 'Garden Blue' was almost as vigorous as 'Tifblue.' 'Southland' and 'Delite' were less vigorous.

The cultivars were exposed to low temperature stresses of -28°C on 17 Jan. 1982 and -31°C on 21 Jan. 1985. 'Tifblue' exhibited no shoot injury in 1982 and less injury than the other cultivars in 1985 (Table 3). The project was discontinued in 1985 due to severity of cold damage to other cultivars. Other reports (2, 5) have indicated that 'Tifblue' has a relatively high level of cold tolerance. 'Garden Blue' suffered more injury in 1982 than other cultivars and serious damage in 1985.

The date of first bloom was recorded. Date of first bloom varied from the 4th to 20th of April during the four year period but the mean date of first bloom for each cultivar was either 15 or 16 April. The similar bloom periods should facilitate cross pollination.

Table 1. Pan evaporation, rainfall, and amount of irrigated water on blueberries at Middle Tennessee Experiment Station, Spring Hill, Tenn., May-August, 1981-1984.

Year	Pan evaporation (cm)	Rain (cm)	Drip Irrigation l/day/plt)
1981	29.5	44.7	3.3
1982	39.1	28.5	7.4
1983	13.0	55.6	7.8
1984	22.6	68.1	9.7

'Tifblue' had the highest fruit yields before irrigation usage (1979, 1980) and with irrigation (1981-1984) (Table 4). The peak yield of 'Tifblue' was over 21,000 k/ha in the 6th year (1983) after planting. Yield of 'Tifblue' in 1982 was reduced by cold damage but not as severely as were the other cultivars. Although 'Southland' was less vigorous than 'Garden Blue' it consistently had higher yields. For the first 5 production years 'Delite' was less pro-

Table 2. Vegetative growth of irrigated rabbiteye blueberry cultivars at Spring Hill, Tenn.

Cultivar	1980	1981	1982	1983	1984
	Plant height (m)				
Tifblue	1.8	2.2	2.8	2.6	2.9
Southland	1.3	1.8	2.0	2.0	2.5
Garden Blue	1.6	2.1	2.5	2.5	2.8
Delite	1.5	1.8	2.0	2.2	2.6
F test	*	*	**	**	*
	Plant side view area (m^2)				
Tifblue	1.8	2.5	3.3	3.9	3.4
Southland	1.2	2.1	2.4	2.5	2.7
Garden Blue	1.7	2.2	2.9	3.6	3.0
Delite	1.0	1.7	2.6	2.3	2.8
F test	**	**	**	**	NS

NS, *, ** Nonsignificant or significant at P = 0.05 or 0.01, respectively.

Table 3. Cold injury ratings of stems of four rabbiteye blueberry cultivars at Spring Hill, Tenn.

Cultivar	Cold injury rating[z] 1982	1985
Tifblue	0.0	3.4
Southland	0.2	7.0
Garden Blue	2.5	5.8
Delite	0.2	6.7
F test	*	**

[z]Rating scale: 0 = none, 7 = severe, 10 = dead.
*, **, significant at P = 0.05 or 0.01, respectively.

ductive than the other 3 cultivars though it had acceptable yields in 1984.

The cultivars began ripening in mid-July each year and the duration of harvest period averaged 43 days for 'Tifblue,' 'Southland,' and 'Garden Blue' and 40 days for 'Delite.' The harvest interval of each cultivar is show in Fig. 1. The harvest season of all cultivars was very similar though 'Delite' has been reported to ripen slightly later (8). 'Garden Blue' tended to ripen slightly earlier.

'Delite' fruit samples had higher soluble solids in 1981 than other cultivars (Table 5), perhaps due to its lighter cropload. Soluble solids and acidity content were similar for all cultivars in 1982. 'Southland' fruit were slightly more acidic than fruit of other cultivars.

Irrigation had a significant effect on growth and yield of the blueberries. Prior to installation of irrigation, plant height, plant area, and yield were not different between those plants chosen to receive irrigation and those not. Irrigated blueberry plants were taller (Figure 2) and had greater sideview

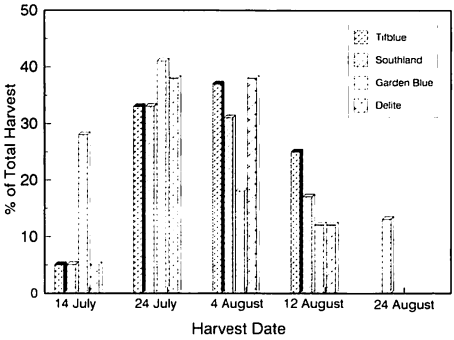

Figure 1. Yield distribution of four rabbiteye blueberry cultivars at Spring Hill, Tenn., 1981.

are (Figure 3 (P = 0.01) than the controls at the end of the first irrigated growing season (1981) and in the following years. 'Delite,' a somewhat slower cultivar to establish, had the greatest initial response to irrigation with plants having 77 and 100% more plant area than the controls by the end

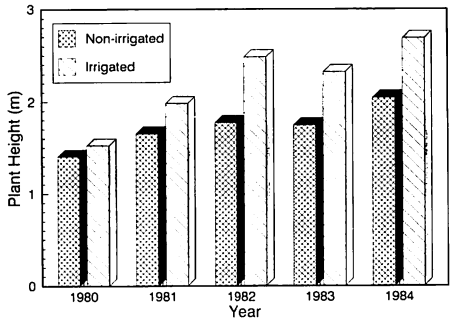

Figure 2. Plant heights of four rabbiteye cultivars ('Tifblue,' 'Garden Blue,' 'Southland,' 'Delite') from irrigated and non-irrigated plots. Plants were first irrigated in 1980. Plants heights were not different in 1980 but irrigated plants were taller (P = 0.01) in 1981-1984.

Table 4. Yield of rabbiteye blueberry cultivars at Spring Hill, Tenn.

Cultivar	Cold injury rating[z] 1979	1980	1981	1982	1983	1984	Total
Tifblue	4.49	5.13	11.73	5.95	21.6	13.50	62.36
Southland	3.56	2.36	7.15	1.01	17.9	8.21	40.14
Garden Blue	1.00	2.74	5.87	.00	11.6	8.88	30.03
Delite	1.60	0.47	2.92	0.45	4.2	9.20	20.07
F test	NS	**	**	**	**	**	**

NS, *, **, Nonsignificant or significant at P = 0.05 or 0.01, respectively.

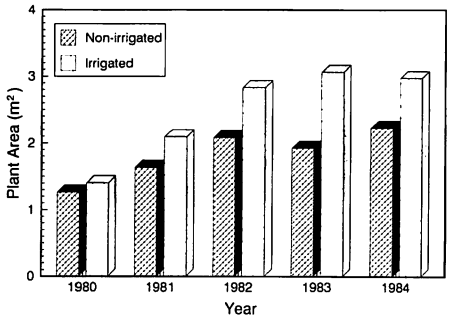

Figure 3. Plant plant area (side view) of four rabbiteye blueberry cultivars ('Tifblue,' 'Garden Blue,' 'Southland,' 'Delite') from irrigate and non-irrigated plots. Plants were first irrigated in 1980. Plants areas were not different in 1980 but irrigated plants were taller (P = 0.01) in 1981-1984.

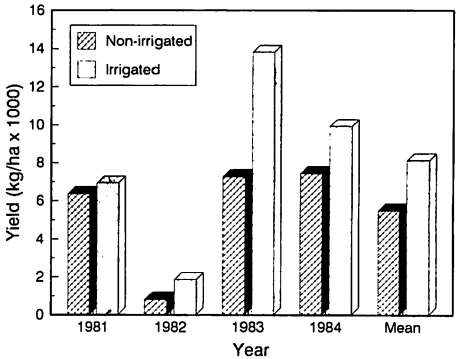

Figure 4. Yield of irrigated and non-irrigated rabbiteye blueberry plants. yields were not significantly different in 1981 but were different (P = 0.01) in the following years.

of 1981 and 1982. By 1983, the plants required pruning to restrict size, thus limiting response by the end of 1984. Irrigated plants of 'Delite,' 'Tifblue,' 'Garden Blue,' and 'Southland,' still had 25, 36, 37 and 38%, respectively more plant area than the controls.

Yields of irrigated plants were similar to those of the nonirrigated plants the first season (1981) (Figure 4). However, yields of irrigated plants were higher (P = 0.01) than the controls in the following years (1982-1984). Irrigated plants yielded 43% more fruit than non-irrigated for the four year period. 'Tifblue' had the greatest yield response to irrigation in each year from 1982 to 1984. 'Tifblue' has been reported in Arkansas to be somewhat drought sensitive (5) and in Florida to be more responsive to irrigation than several other cultivars (3). It appeared to have more yield potential since

Table 5. Fruit quality of four rabbiteye blueberry cultivars from irrigated plants, Spring Hill, TN.

	1981			1982		
Treatment	Soluble[z] solids %	pH[z]	Titratable acidity[z] (ml)	Soluble[y] solids %	pH[y]	Titratable[y] Acidity (ml)
Cultivars						
Tifblue	13.7	3.14	24.8	11.9	3.25	20.7
Southland	13.3	3.09	31.3	10.7	3.20	21.3
Garden Blue	11.5	3.29	21.2	11.0	3.20	21.3
Delite	16.5	3.14	25.2	11.6	3.16	22.7
F test	*	*	*	NS	NS	NS
Irrigation						
Drip	13.9	3.17	24.8	10.4	3.14	22.8
None	14.7	3.18	26.5	12.5	3.27	20.1
F test	*	NS	NS	NS	NS	NS

[z]Mean of eight samples
[y]Mean of four samples
NS, *, Nonsignificant, significant at P = 0.05 or 0.01, respectively.

yields were higher than yields of other cultivars when not irrigated and also responded more to irrigation. Yield increases of 57, 50, 30 and 19% over the 4 year period were found for 'Tifblue,' 'Southland,' 'Garden Blue,' and 'Delite,' respectively. Fruit from irrigated plants tended to have lower soluble solids than controls in 1981 and 1982 (Table 5).

Thus, rabbiteye blueberries can be very productive in the Tennessee Valley, though cold weather may periodically damage plants and reduce yield. Irrigation was very beneficial, resulting in over 40% more yield. 'Tifblue' was best adapted of the cultivars tested.

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Evaluation of Advanced Strawberry Selections in Quebec[1]

SHAHROKH KHANIZADEH,[2] MICHEL LAREAU,[3] AND DEBORAH BUSZARD[4]

Abstract

Promising strawberry selections have been evaluated from 1983 to 1990. Out of more than 5000 seedlings from crosses made in 1983 and 1984 seven were selected. Final evaluation of these seven advanced selections at three locations resulted in the naming of SJ84187-3 and SJ83184-3 as 'Chambly' and 'Oka' respectively. The other five selections will be kept and used as parents for future crosses.

Additional index words. yield, fruit size, Sensory evaluation, breeding, *Fragaria x ananassa* Duch.

Introduction

The objectives of the Quebec strawberry breeding program are the development of high yielding cultivars suitable for mechanical harvesting (concentrating ripening, reflexed calyx, raised neck, firmness) and processing (colour, low juice loss and structural integrity after thawing, flavour), adapted to local growing conditions and environmental stresses such as

[1]Agriculture Canada, St-Jean-sur-Richelieu, Contribution No. 335/91.06.01R
[2]Research Scientist, formula developer, Agriculture Canada, Research Station, 430 Boul. Gouin, St-Jean-sur-Richelieu, Quebec, Canada J3B 3E6
[3]Agriculture Canada, Research Station, 430 Boul. Gouin, St-Jean-sur-Richelieu, Quebec, Canada J3B 3E6.
[4]Department of Plant Science Macdonald College of McGill University, Ste-Anne-de-Bellevue, Quebec, Canada H9X 1C0.