HortScience 21(4):997–998. 1986.

Split-root Water Application to Highbush Blueberry Plants

John D. Abbott[1] and R.E. Gough[2]
Department of Plant Science, University of Rhode Island, Kingston, RI 02881

Additional index words. *Vaccinium corymbosum*, irrigation, cultural practices

Abstract. **Watered split-root portions of 2-year-old plants of 'Bluecrop' blueberry (*Vaccinium corymbosum* L.) exhibited significantly greater shoot dry weight, shoot thickness, shoot length, mean number of shoots, and leaf dry weight than nonwatered portions. Watered portions blossomed, produced fruit, and set new flower buds while existing flower buds died and no new flower buds formed on the nonwatered portions.**

Irrigating fruit plants is becoming increasingly important in modern production practices (3). Although traditional methods have included basin, furrow (5), and sprinkler irrigation, growers are turning to the use of trickle irrigation for water conservation and improved profits (3). Improper use of trickle irrigation may lead to uneven watering of the plants, which may result in uneven growth. Auchter (1) reported that water may move laterally in some trees when one side of the root system is removed. This report was substantiated later by Furr and Taylor (4). However, Chandler (2) suggested that lateral transfer of nutrients and water may not occur in mature apple trees. He advised against fertilizing only one side of a fruit tree, stating that applying fertilizer to one side improved growth only on that side. Gough (6) has reported similar findings for the highbush blueberry plant.

This study was undertaken to determine if one-sided watering of highbush blueberry plants could be done without detriment to the plant.

Ten 2-year-old 'Bluecrop' plants were selected for uniformity of vigor and size in Oct. 1984. The root ball and the basal 5 cm of the main stem of each plant were slit lengthwise into equal portions with a grafting knife and seated in specially constructed containers (Fig. 1). Each container consisted of an 8.8-liter plastic pot with a 2-mm thick, white plastic partition centered in the pot, extending the length of the pot. The junction of the partition and the pot walls was sealed with butyl caulking to prevent flow of water from one side of the pot to the other. Each pot was then filled with a mixture of 1 peat : 1 perlite : 1 sand (by volume). The plants were placed one to a pot so that about half of the root ball was positioned on each side of the partition. The split-stem of the plant was seated firmly on the partition. Tree wound dressing sprayed over the outside cut surface of the stem made a tight seal. The root ball of a few additional plants was slit without splitting the stem and about half of the root ball was positioned on each side of the partition. Plants were placed in refrigerated storage at 0°C until Jan. 1985 to satisfy their rest requirement and then placed in the greenhouse in a completely randomized design under a 16-hr day/8-hr night regime. The plants were not fertilized. One half of each plant received 300 ml of water daily while the other half received no water. Growth and development were monitored by weekly inspection for 8 months.

One day prior to harvesting the vegetative portions of the plants, the main stem on the watered side of each plant was injected near its base with a 1% aqueous solution of acid fuschin as an aid in determining lateral transport within the plant. Shoots were separated into treatments as determined by the acid-fuschin test and then measured and harvested accordingly. Plants were harvested, and the shoot dry weight, shoot thickness, shoot length, mean number of shoots per plant, and leaf dry weight were determined and the data analyzed by analysis of variance.

Root balls were carefully removed from the pots and separated into treatments. Root balls were allowed to air-dry completely for 1 week and then were examined visually for density and cohesiveness.

Within 1 week after the start of the experiment, the watered side of each plant began to grow. Such growth appeared dark green for about 2 months, after which reddening of the foliage occurred. By this time, several new canes were produced on many of the watered sides of the plants (Fig. 2). These new canes appeared dark green and sustained continued growth throughout the experiment. In contrast, shoots on the nonwatered side began to grow as those on the watered side, but grew neither as fast nor as long. The nonwatered side exhibited chlorosis and some reddening of the foliage within 1 month from the start of the experiment and produced no new canes.

The watered portions of the plants bloomed and set fruit that matured to full size. Harvested fruit had a mean soluble solids of 7.8%, as determined using a hand refractometer, which was substantially lower than typical 'Bluecrop' fruit (about 10–11%). All of the flower buds on the nonwatered portions died before opening.

Vegetative growth on the watered sides of the plant was, in every instance, significantly greater than that on the nonwatered (Table 1). A similar trend was seen in those plants in which only the root ball was slit up to the base of the stem (unpublished data). This would indicate that splitting the stem and interrupting the ''transition zone'' did

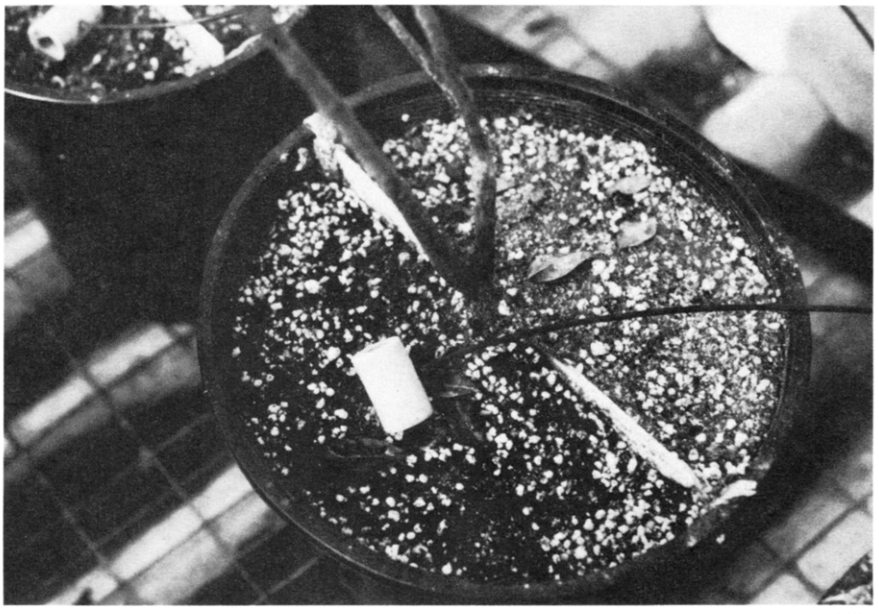

Fig. 1. Two-year-old potted 'Bluecrop' blueberry plant with split-root system and stem straddling plastic partition. Watered portion with drip emitter (foreground); nonwatered (background).

Received for publication 8 Nov. 1985. Paper No. 2303 of the Rhode Island Agricultural Experiment Station. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

[1]Graduate Student.

[2]Associate Professor.

Fig. 2. Two-year-old potted 'Bluecrop' blueberry plant showing new canes (arrow) produced on watered side.

Table 1. Mean shoot dry weight, shoot thickness, shoot length, leaf dry weight, and number of shoots per plant for watered and nonwatered portions of 2-year-old 'Bluecrop' blueberry plants.[z]

Treatment	Shoot dry wt (g)[y]	Shoot thickness (mm)[x]	Shoot length (mm)[y]	Leaf dry wt (g)[w]	No. shoots per plant[y]
Watered	148.2**	3.6**	9.0**	12.8**	16.5**
Nonwatered	23.0	1.2	3.0	4.5	6.0

[z]Means of 10 plants per treatment.
[y]Means of all shoots on all plants within treatments.
[x]Means of all shoots on all plants within treatment measured 1 cm above base.
[w]Means of 10 leaves per plant.
**Significantly different from nonwatered treatment by F test, 1% level.

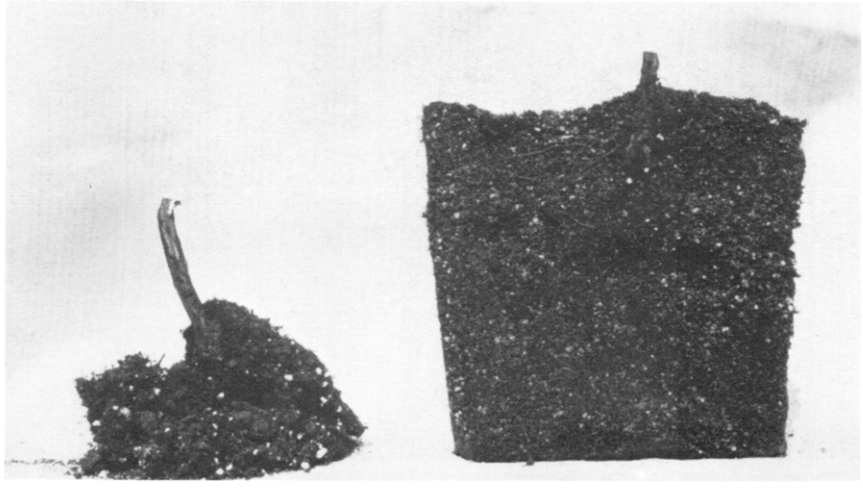

Fig. 3. Root ball from 2-year-old potted 'Bluecrop' blueberry plant. Dense, cohesive root system from watered portion of plant (right) compared to small, very loose root system from nonwatered portion (left).

not affect the lateral transport within the plants.

The increased shoot dry weight on the watered side was a function of the overall increase in shoot number and size (Table 1). The increased leaf dry weight (Table 1) was a function of generally larger leaves. In each case, the vascular system of the majority of the shoots, especially of those vigorous and productive, were stained by acid fuschin, while weak, unproductive shoots were not. This staining indicates that water, necessary for plant growth, is not transported laterally, resulting in uneven growth when water is applied to roots of one side of the plant.

The root balls on the watered side of the plants were much more dense than those in the nonwatered side and were easily removed from the pots. They maintained their integrity even when air-dried. The root balls from the nonwatered portion readily crumbled during removal from the pot, were difficult to handle, and were much smaller in size and less dense (Fig. 3) than those from the watered portion.

The results of this study are consistent with those of a previous study (6), which indicated that the cultivated highbush blueberry plant has minimal lateral transport. Providing irrigation to only one side of the plant (as with drip irrigation) could result in extreme differential growth and disrupted fruit production, ultimately leading to the death of portions of the plant, which occurred in one instance in this study. Extreme care should be taken to ensure that irrigation lines operate properly and remain close to the central portion of the blueberry bush to provide even distribution of water for plant use.

Literature Cited

1. Auchter, E.C. 1923. Is there normally a cross transfer of foods, water and mineral nutrients in woody plants? Univ. of Md. Agr. Expt. Sta. Bul. 257.
2. Chandler, W.H. 1957. Deciduous orchards. Lea & Febiger, Philadelphia.
3. Childers, N.F. 1983. Modern fruit science. Hort. Publ., Rutgers Univ., New Brunswick, N.J.
4. Furr, J.R. and C.A. Taylor. 1933. The cross-transfer of water in lemon trees. Proc. Amer. Soc. Hort. Sci. 30:45–51
5. Gardner, V.R., F.C. Bradford, and H.D. Hooker. 1927. Orcharding. McGraw-Hill, New York.
6. Gough, R.E. 1984. Split-root fertilizer application to highbush blueberry plants. HortScience 19:415–16.