Table 2. Response of container grown highbush blueberries to hexazione.

| Hexazinone (kg/ha) | Method of application | Foliar injury (%) | |
|---|---|---|---|
| | | Berkeley | Bluecrop |
| 1.0 | soil | 6 | trace |
| 2.0 | soil | 57 | 5 |
| 3.0 | soil | 96 | 37 |
| 2.0 | foliar | 100 | 100 |

some cases. With time, symptom development progressed at the highest rate of herbicide resulting in successive defoliations which eventually killed 'Berkeley'. Injury on 'Bluecrop' with 2 and 3 kg/ha was variable across the replications ranging from almost no effect to complete kill. The unexpected levels of injury from these treatments was attributed, in part, to confinement of the roots and herbicide within the container. In the field trials, replacement plants set out 1 and 2 years before treatment were not affected by 2 kg/ha hexazinone.

Foliarly applied hexazinone resulted in complete defoliation of both cultivars. However, new leaves emerged on 'Bluecrop' and despite being severely stunted all plants survived.

Differential tolerance between blueberries and many common perennial weed species to 1 and 2 kg/ha hexazinone was expressed under field conditions. The margin of crop safety should be greater on medium textured soils, and the herbicide should be applied before emergence of the foliage to decrease risk of drift injury. The herbicidal activity of hexazinone complements that of some presently used residual soil-applied herbicides. For example, hexazinone is active against Compositae species (Table 1) that are not controlled by terbacil. Furthermore, in lowbush blueberries excellent control of many Rosaceae species, including woody *Rosa* and *Rubus* spp., has been obtained with hexazinone (Jensen, unpublished data). Its initial control of perennial weeds coupled with its short-term persistence suggests tankmix combinations with simazine or other residual herbicides. Hexazinone has a potential use in highbush blueberries, and possibly other commerical *Vaccinium* species.

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# Field Chilling vs. Cold Storage of Highbush Blueberry Cuttings[1]

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***Abstract.*** **Hardwood cuttings from canes of highbush blueberry (*Vaccinium corymbosum* L.) collected in early dormancy and stored at 2°C until spring rooted better than cuttings collected in the latter part of the winter. Cuttings placed immediately in a greenhouse propagation structure rooted and grew poorly when collected before mid-December but if collected after mid-December produced plants up to two-fold larger than spring-rooted plants after 1 growing season due to the extended growing period.**

Highbush blueberries are commonly propagated from hardwood cuttings in outside propagation structures (7). After 1 growing season in the rooting bed, rooted cuttings are normally moved to a field nursery and grown an additional year. They are then sold as 2-year old plants for commercial field planting.

Cuttings are usually taken from the field just prior to insertion in propagation beds in early spring. Johnston (5), however, advised collecting canes in early winter and storing to avoid winter injury. Results of storing blueberry cuttings have been contradictory (3, 6, 8, 10).

Coville (1) early noted the effect of cold temperatures in stimulating blueberry plant growth. Darrow (2) determined the cold requirement for breaking rest in highbush blueberry cultivars to range from 800 to 1000 hours below 7.2°C. Following fulfillment of the cold requirement, highbush blueberries produce better vegetative growth under long photoperiods (4, 9).

This experiment was conducted to evaluate the effects of cold storage of blueberry hardwood cuttings and to compare winter rooting of cuttings in a greenhouse with traditional spring rooting in outdoor structures.

Canes from the previous season's growth were collected from 'Blueray' and 'Collins' plants from the Arkansas Agricultural Experiment Station, Fayetteville, at bi-weekly intervals from November 2, 1976 until February 22, 1977. Half the canes at each collection date were sealed in moistened polyethylene bags and stored at 2°C until March 28, 1977 at which time cuttings were made and placed in an outside propagation frame. The remaining half of the canes were immediately made into cuttings on each collection date and inserted into a greenhouse propagation bed. All cuttings were made from basal and intermediate portions of canes and were cut to a length of 10 cm (8). Cuttings were placed in a medium of 1 sphagnum peat:1 washed sand (v/v), leaving only the top bud exposed. Intermittent mist was adjusted to maintain a moist, not wet, medium. The experimental design was a randomized block with 4 replications and 12 cuttings per replicate. Air temperature was maintained at ca. 21°C and daylength was extended to 16 hr by timed incandescent lights above the propagation area. The portable frames containing the cuttings were moved from the greenhouse in May and placed alongside the cuttings inserted in March in the outside propagation area.

On March 28, 1977 the stored canes were made into cuttings as described above and inserted into an outside propagation bed in a medium of 1 sphagnum peat:1 washed sand (v/v) under intermittent mist. The same experimental design was used as in the greenhouse experiment.

After rooting was indicated by a second flush of growth the propagation beds were fertilized every 2 weeks until late August with a soluble complete fertilizer (Peter's Peat-lite Special 20N-19P-18K at 30 ppm). The cuttings were removed from the propagation beds after the onset of dormancy, the medium carefully rinsed from the roots, and each plant was evaluated for extent of rooting on a scale of 1-5 (1=no roots or callus; 2=callus, but no root; 3=callus with small root system; 4=average marketable root system; 5=extensive root system). Total stem growth was determined for each plant.

Since no significant cultivar interactions occurred in this experiment, data from the 2 cultivars were pooled.

Cuttings from canes collected in early winter and stored at 2°C until spring produced higher percent rooting and better root grade than cuttings collected from

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the field after mid-winter (Table 1). Weather data for this period show mild temperatures in November and December, followed by severe winter weather in January and February with temperatures as low as —25°C on several occasions. Winds during this period may have resulted in some desiccation of canes. Canes collected after the onset of low temperatures may have been weakened by winter injury (5). Successful cane storage is dependent on proper storage conditions and previous reports (3, 6, 10) of adverse effects of storing blueberry propagation wood may have resulted from improper storage temperatures or packaging conditions (8).

Cuttings from the canes collected before mid-December, and inserted immediately in a greenhouse mist bed rooted very poorly (Table 2). The best results were obtained from cuttings collected during the latter half of December. Cuttings collected later in the winter showed decreasing rooting ability.

The chilling requirement for highbush blueberries of a minimum of 800 hours below 7.2°C (2) was not reached until the December 14 collection date (Table 2). The poor rooting and vegetative vigor of cuttings forced in November is likely an expression of insufficient chilling to satisfy the rest requirements. Bud break on these cuttings was delayed, and some breaking of rest may have occurred as a result of the greenhouse temperatures and extended daylength. Cuttings taken on these early dates and cool-stored rooted and grew well (Table 1), showing that cool storage of detached canes is effective in satisfying the rest requirement. The reduction in percent rooting and percent marketable plants from cuttings taken in January and February may have been due to wood injury resulting from low winter temperatures experienced during that period.

No appreciable differences were found in rooting percentage of cuttings inserted immediately in a greenhouse or stored until spring when the cuttings were collected after mid-December (Table 1, 2). However, greenhouse-rooted cuttings, grown under extended daylength, were up to 2 times larger by the end of one growing season when the cuttings were inserted soon after rest cessation. In fact, the greenhouse-propagated plants, after 1 growing season, were equal in size to 2-year-old field-grown plants. In order to maintain a better balance between root and shoot growth, cuttings forced early in a greenhouse should be spaced at least 7.5 cm apart in the propagation bed, or transplanted to containers after rooting for production of the best grade of plants.

Greenhouse propagation of highbush blueberries, although requiring high energy inputs, may be advantageous where time is critical as in the rapid propagation of newly-released cultivars.

Table 1. Effect of date of cane collection and storage on propagation of the highbush blueberry. (All cuttings placed in outside propagation frame March 28, 1977.)

| Date collected | Rooted (%) | Mean stem growth (cm) | Mean root grade[z] | Marketable[y] (%) |
|---|---|---|---|---|
| Nov. 2 | 84ab[x] | 35ab | 3.3abc | 52ab |
| Nov. 16 | 95a | 46a | 3.6a | 58ab |
| Nov. 30 | 85ab | 46a | 3.5a | 60a |
| Dec. 14 | 76bc | 36ab | 3.0bcde | 42ab |
| Dec. 28 | 95a | 40a | 3.4ab | 51ab |
| Jan. 11 | 76bc | 37ab | 3.1abcd | 46ab |
| Jan. 25 | 70bcd | 34ab | 2.9cde | 46ab |
| Feb. 8 | 60d | 26b | 2.6e | 39b |
| Feb. 22 | 70bcd | 40a | 3.0bcde | 48ab |

[z]Scale of 1 (none) — 5 (extensive).
[y]Plants with root grades 4 and 5.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 2. Effect of date of cane collection and greenhouse forcing on rooting and growth of hardwood highbush blueberry cuttings.

| Date collected and inserted | Acculumated chilling hours[z] | Rooted (%) | Mean stem growth (cm) | Mean root grade[y] | Marketable[x] (%) |
|---|---|---|---|---|---|
| Nov. 2 | 293 | 19d[w] | 21e | 1.5d | 10g |
| Nov. 16 | 516 | 44c | 42e | 2.3c | 29ef |
| Nov. 30 | 736 | 41c | 52cd | 2.3c | 25f |
| Dec. 14 | 998 | 73ab | 83ab | 3.3ab | 56ab |
| Dec. 28 | 1220 | 81a | 97a | 3.4a | 59a |
| Jan. 11 | 1556 | 54bc | 80abc | 2.7bc | 47abc |
| Jan. 25 | 1892 | 57bc | 79abc | 2.8bc | 40cde |
| Feb. 8 | 2195 | 55bc | 76abc | 2.8bc | 44bcd |
| Feb. 22 | 2419 | 40c | 55bcd | 2.3c | 31def |

[z]Accumulated hours at or below 7.2°C.
[y]Scale of 1 (none) — (extensive).
[x]Plants with root grades 4 and 5.
[w]Mean separation in columns by Duncan's multiple range test, 5% level.

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