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Vaccinium Membranaceum Berry Production Seven Years After Treatment to Reduce Overstory Tree Canopies[1]

Abstract

Five overstory treatments were applied to a berry field near Mount Hood, Oregon, that was shaded by conifer forest. Big huckleberry (*V. membranaceum*) berry production was highest where 2,4-D applied to stem incisions (frills) reduced the overstory canopy without disturbing *vaccinium* shrubs in the understory. Production was lower where both overstory and understory were disturbed by cutting and burning or where the overstory canopy was not reduced.

Introduction

Big huckleberry (*Vaccinium membranaceum* Dougl. ex. Hook.) bears palatable berries that are extensively harvested by berry pickers in the Cascade Range of Oregon and Washington. Most of the berries are produced in sparsely forested subalpine areas where wildfires created favorable environmental conditions. Berry production declines when open-grown *V. membranaceum* shrubs become heavily shaded by closed forest canopies, however, and dense subalpine forests have seriously reduced huckleberry production in several heavily-used berryfields. In the absence of wildfire, silvicultural treatments to reduce or eliminate the forest overstory are necessary if former levels of berry production are to be restored.

Five overstory treatments were applied in 1974 to a berryfield shaded by dense young conifer forest, and subsequent berry production was compared to determine which was most effective. Treatment results after three years were published previously (Minore *et al.* 1979). Seven-year results are presented here.

Study Area

The study area was 11 km southwest of Mount Hood in Oregon on a gently sloping western aspect at an elevation of 1463 m in the Pacific silver fir (*Abies amabilis*) Forest Zone (Franklin and Dyrness 1973). Abundant *V. membranaceum* shrubs that covered about 45 percent of the area were overtopped by a conifer overstory of about 14,000 conifer trees per hectare that had an average canopy density of about 55 percent. Lodgepole pine (*Pinus contorta* Dougl. ex Loud.) was the dominant species in this overstory; but Douglas-fir (*Pseudotsuga mensiesii* (Mirb.) Franco), noble fir (*Abies procera* Rehder), subalpine fir *A. lasiocarpa* (Hook.) Nutt.), grand fir (*A. grandis* (Dougl. ex D. Don) Lindl.), mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.), western hemlock (*T. heterophylla* (Raf.) Sarg.), Western white pine *Pinus monticola* Dougl.

[1]This paper reports research involving an herbicide. It does not contain recommendations for its use nor does it imply that the uses discussed here have been registered. All herbicides must be registered by appropriate state and/or federal agencies before they can be used.

ex. D. Don), Englemann spruce (*Picea engelmannii* Parry ex Engelm.), and Western red cedar (*Thuja plicata* Donn.) were also present above the *Vaccinium* shrubs. Beargrass (*Xerophyllum tenax* (Pursh) Nutt.) was dominant below the shrubs, but the herb stratum was also characterized by dwarf bramble (*Rubus lasiococcus* Gray), pearly everlasting (*Anaphalis margaritacea* (L.) B. & H.), and coiled pedicularis (*Pedicularis contorta* Benth.). The soil was coarse-textured, shallow, rocky, and low in nutrients.

Methods

The study consisted of a completely random experimental design, with five treatments replicated four times (Table 1). Square 0.14 hectare plots surrounded by 3 m buffer strips were arranged in a 4 x 5 plot grid. In the first treatment, all trees were cut on four randomly selected plots in 1973, and the resulting slash was broadcast-burned in late August 1974. The slash fire did not consume the blackened *Vaccinium* shoots, but it severely disturbed all understory vegetation.

A one-to-one mixture of 2,4-D amine and water was applied to stem incisions (frills) cut around the circumference of every tree larger than 5-cm d.b.h. on four other plots in early July 1974, when the last remnants of a heavy winter snow pack were melting and *Vaccinium* shrubs were just beginning to produce leaves. The frills were spaced 3.8 cm apart. About 50 percent of the 14,000 trees/hectare were large enough to treat. The overstory was severely disturbed, but the understory was undisturbed in this second treatment.

On a third series of plots, all vegetation below a height of 3 m was sprayed with a low volatile ester of 2,4-D in late July 1974 to dry the vegetation for subsequent burning. Burning was unsuccessful, however, and this became a 2,4-D spray treatment that slightly disturbed the overstory and moderately disturbed the understory. Cooperating pathologists inoculated the fourth series of plots with *Phellinus weirii* (Murr.) Gilbertson at this time by placing *P. weirii* cultures in contact with the roots of 25 well-spaced trees on each plot. Little or no overstory disturbance occurred on the *Phellinus* plots. The four control plots were not disturbed in any way. Beginning in 1975, berry pro-

TABLE 1. Treatments and their effects on overstory and understory vegetation.

Treatment	Overstory	Understory
Cut and burn	Destroyed	Crowns killed
2,4-D frill	>5-cm DBH killed	Undisturbed
2,4-D spray	Foliage below 3 m killed	Foliage killed
Phellinus weirii inoculation	Undisturbed	Undisturbed
Control	Undisturbed	Undisturbed

duction was sampled every other year on every treatment by picking and weighing all the berries on 16 systematically spaced .004-ha subplots on each of the 20 plots. *Vaccinium membranaceum* berries ripened irregularly on individual shrubs, and ripeness varied among treatments, so picked weights were converted to ripe weights:

$$\text{Ripe weight} = \frac{(\text{Picked weight})\ (\text{Average weight of a ripe berry})}{(\text{Average weight of a picked berry})}$$

The ripe weights were subjected to analyses of variance. Where significant differ-

ences among treatments occurred, Scheffe' (1959) multiple comparison tests were used to compare individual treatment means. Sample years were not compared statistically.

Results and Discussion

Meteorological influences are very important in determining annual huckleberry production (Minore and Dubrasich 1978), and the weather was more favorable for berry production in 1979 than it was in 1981 (Fig. 1). Nevertheless, the 2,4-D frill treatment

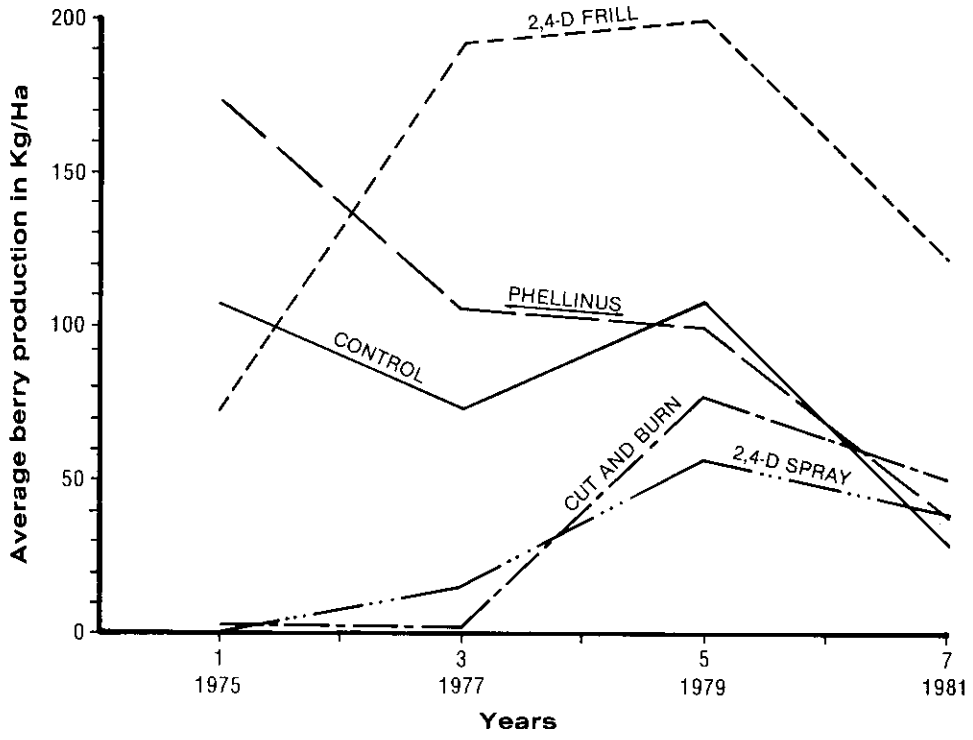

Figure 1. Average berry production trends during the 7 years after treatments were applied. Weather was unfavorable for berry production in 1981. The 1975 and 1977 data are from Minore, Smart and Dubrasich (1979).

produced more berries than other treatments in both years (Table 2). Indeed, the superiority of 2,4-D frilling became more evident each year. Scheffe' tests indicate that 2,4-D frill was significantly better than the average of all other treatments, but not significantly different than any single treatment at $P < 0.05$ in 1979. In 1981, berry

production of the 2,4-D frill treatment was significantly higher ($P < 0.05$) than all other treatments; the 2,4-D frill treatment was significantly higher than both *Phellinus* and control treatments at $P < 0.01$.

The increase in berry production on the 2,4-D frill plots occurred when treated overstory trees died; most of the overstory shade was eliminated without disturbing the understory *Vaccinium* shrubs. Similar results probably could be obtained by girdling the overstory trees. After either treatment, the dead trees remain standing for a long time. Only a few fell over during the seven years after 2,4-D treatment, and they have not limited access or created safety hazards. The overstory trees treated in this study were short, however, with diameters of less than 36 cm (14 in.). Leaving large dead trees on the stump would probably be hazardous.

TABLE 2. Average berry production, by treatment and year.[2]

Treatment	1979[3]	1981[4]
	Kg/ha	
2,4-D frill	200.1	122.6_a
Cut and burn	76.7	51.7_{ab}
2,4-D spray	57.2	38.5_{ab}
Phellinus inoculation	99.2	37.0_b
Control	108.0	29.9_b

[2]Each average is based on 4 replicates, with 16 subplot samples per replicate.

[3]Scheffe' tests showed the production on 2,4-D frill plots to be significantly higher ($P < 0.05$) than that of all other treatments in the frill vs. others comparison, but differences among individual treatments were not statistically significant.

[4]Averages within the bracket were not significantly different at $P < 0.05$ when compared with Scheffe' tests. Those followed by the same letter were not significantly different at $P < 0.01$.

None of the overstory died as a result of *Phellinus weirii* inoculations, and the *Phellinus* plots were indistinguishable from untreated control plots seven years after treatment. Inoculation failure or a prolonged delay in the expression of disease symptoms may be responsible.

The 2,4-D spray treatment, originally intended to facilitate overstory removal through subsequent burning, failed to affect overstory density significantly when the burning failed. *Vaccinium* shrubs were normal in appearance five years after being damaged by 2,4-D. Seven years after treatment, their berry production was similar to that of other *Vaccinium* shrubs shaded by a dense overstory.

Vaccinium shoots were killed by fire on the cut and burn plots in 1974. Although they resprouted vigorously, the *Vaccinium* shrubs had not completely recovered from this disturbance after seven years.

The failure of fire to improve *Vaccinium membranaceum* berry production in seven years is surprising, for most huckleberry fields seem to have become established after wildfires, and periodic fires probably eliminated the forest overstories that shaded huckleberry shrubs in the past. Huckleberry recovery from fire (Miller 1977, 1978) varies both with fire intensity, fuel condition, soil moisture, burning season, and *Vaccinium* species, however. Postburn recovery of *V. globulare* can be exceedingly slow in Western Montana (Stickney 1981).

Past increases in *Vaccinium membranaceum* berry production associated with the burning of overstory trees and huckleberry shrubs in the Cascade Range must have been delayed until long after the fires. Reestablishment of overstories also occurred long after the fires when uncontrolled fildfires swept over large areas, however; and the delay probably was not particularly important when burns of all ages were readily available to the huckleberry pickers of former years. The delay may be important now. If the results obtained on the study site are applicable elsewhere in the Pacific silver fir zone, the elimination of forest overstories by girdling or herbicide-frill treatments that do not disturb the *Vaccinium* understories may be the most feasible way to increase huckleberry production rapidly in heavily used berry fields recently overgrown by subalpine forest.

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