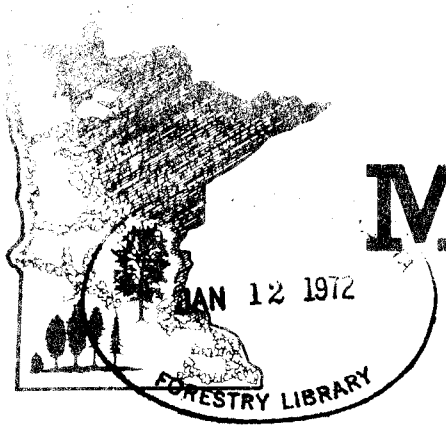

Minnesota Forestry Research Notes

No. 231
October 15, 1971

CONTROL OF YOUNG HAZEL UNDERGROWTH BY LIGHT APPLICATIONS OF 2, 4-D

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Studies of the control of dense hazel (Corylus cornuta) undergrowths have indicated that intensive or often repeated treatments are necessary. For example, Buckman (1964) found that four annual summer burns reduced the aerial stems to less than half the preburn number (20,000 per acre). Spring burns resulted in an increase in aerial stems. Roe and Buchman (1963), working with dense mil-acre plots (average of 66,000 stems per acre), tested the effects of 1/2, 1 and 2 pounds per acre of 2, 4-D applied at various times throughout the summer. They recommended a minimum of 2 pounds per acre applied about mid-July when shoot growth was complete. The recovery in terms of the number of resprouts the year after spraying averaged 18% (range 3% to 38%) of the original aerial stems. Average recovery for 1/2 and 1 pound per acre at this foliar stage was 62% and 55% respectively. Recovery was greater for earlier and later treatments.

The studies cited above were conducted in dense undergrowths where hazel was well established. Recent work indicates that prior to forming these dense undergrowths, beaked hazel goes through a seedling and young clone stage (Tappeiner, 1971). This stage is often found in red pine stands, 40 to 60 years old. It can be recognized by the scattered groups of hazel 10 to 40 feet in diameter with aerial stems 4 to 10 feet tall. Often the hazel is spreading into the area adjoining these groups. This occurs by seeding and is a slow process. Hazel in these stands remains in the seedling stage (3 to 15 inches tall) for about 12 years until underground stems are formed. Then a small clone (<0.2 feet in diameter) with one to three aerial stems 15 to 30 inches tall is formed. Even at 20 to 30 years of age clones are usually less than 2 feet in diameter with three to 10 aerial stems. The information reported here is the result 1 year after spraying to determine if young hazel can be controlled with light applications of 2, 4-D: 1/2 or 1 pound per acre.

Methods

Plots (.10 acre) were located in young red pine stands so that from 80 to 100 seedlings and small clones, and from 30 to 60 large clones (0.2 to 4.0 feet in diameter) were included on each plot (Table 1). Before spraying occurred, seedlings and clones were aged and numbered, and the length and number of aerial stems determined. Other vegetation on the plots included: bush honeysuckle (Diervilla lonicera), big leaf aster (Aster macrophyllus), false lily of the

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Published by the College of Forestry, University of Minnesota, St. Paul, Minnesota 55101

valley (Maianthemum canadense), bracken fern (Pteridium aquilimum,) juneberry (Amelanchier sp.), and paper birch seedlings (Betula papyrifera)

On June 15, July 13 and August 3, 1970, two plots each were sprayed at the rate of 1 pound of 2, 4-D per acre. On August 3 an additional two plots were sprayed with 1/2 pound per acre. Spraying was done from 0800 to 0900 hours using a hand sprayer with a fine mist. Each plot was sprayed evenly throughout, and herbicide was not concentrated on the hazel stems. The condition of hazel after treatment was observed throughout the summer of 1970, and on August 1, 1971, the number and length of live aerial stems of remaining clones and seedlings were recorded.

Results and Discussion

Mortality of large clones ranged from 49% to 98%, seedlings and small clones from 75% to 100% (Table 2). On control plots natural mortality of seedlings and small clones was less than 5%, of large clones less than 1%. On large clones the number of aerial stems was reduced by 49% to 98% and total length of live aerial stem by 66% to 100%. The survival of the seedlings can probably best be explained by their being protected by taller vegetation such as bracken fern. For example, on plot 2, survival of a protected rodent cache of eight seedlings accounts for over half the survival of seedlings on that plot. Aerial stems of large clones that survived were generally those that were missed on the edge of the plot or the taller ones not reached by the spray. The greater mortality on the plots sprayed with 1 pound per acre in either July or August is consistent with the results of Roe and Buchman (1963) who achieved best control with mid-July or "shoot growth complete" treatments compared to earlier or later applications. The 1/2 pound per acre treatment was nearly as effective as 1 pound per acre in reducing number and length of aerial stems but not as effective in killing clones and seedlings. Observations indicated that bush honeysuckle was damaged and birch seedlings were killed, but other than an initial leaf damage, other vegetation was not noticeably affected.

Reasons for the high mortality of the young, developing hazel undergrowth with relatively light applications of 2, 4-D include:

1. Seedlings and small clones do not have large underground stems with the capacity for vigorous resprouting. Underground stems of clones are from 0.10 to 1.0 inches in diameter and occupy an area of only 1 to 4 square feet. In dense, old undergrowths they may be 2.0 to 3.0 inches in diameter and form a rather dense mat under the litter.
2. Treatment was done in young, relatively dense stands where there is considerable shade and competition for soil moisture from the overstory and other shrubs and herbs.

Also, it must be pointed out that precipitation for June, July and August 1970 was 5.7 inches below normal, and this might partially account for the high mortality. Studies are being continued to determine possible variation due to weather.

Silvicultural Implications

The results of this study suggest that controlling hazel at the "seedling or young clone stage" may have definite silvicultural advantages. Control of undergrowth at this stage prevents the development of dense hazel with capacity for vigorous resprouting after disturbance by logging or treatment by fire or herbicide.

Also, high mortality of seedlings and young clones was obtained with 1/2 and 1 pound of 2, 4-D per acre. In practice on dense undergrowths 2 pounds or more per acre are used and only temporary control is achieved because of numerous sprouts.

Treatment of young undergrowths can be timed to coincide with the development of the invading hazel. After initial treatment, reinvasion will occur by seeding. Even 15 to 20 years after germination, hazel is still in the young clone stage and susceptible to the type of treatment reported here. Therefore, a light application of herbicide every 10 to 20 years should be sufficient to maintain a sparse hazel undergrowth. More frequent treatments or a combination of fire and herbicide may be necessary for initial control of undergrowth denser than those in this study. It is stressed that the treatment reported here was not designed to eliminate hazel from conifer stands, only to control it. The large scattered groups mentioned above will not be eliminated; rather, the invasion into unoccupied area will be prevented or retarded by mortality of seedlings and small clones.

An important benefit of controlling hazel throughout the life of the stand would be the ease of site preparation during the regeneration phase. Without a dense undergrowth there would be less need for intensive site preparation (shearing, discing, or scarifying) and for spraying to release seedlings after planting. As a result, the soil disturbance and erosion as well as the costs of intensive site preparation would be avoided. Other benefits might include: 1) keeping the stand open for recreation and stand management during its life, 2) possible reduction in use of soil moisture by shrubs and increased productivity of the overstory, and 3) increase in preferred browse species (Krefting and Hansen, 1969).

Table 1. Description of overstory and hazel undergrowth on study plots

Plot	Overstory Species	Age Years	Basal Area Square Feet	Trees	Small Clones and Seedlings	Larger Clones		
						No.	Aerial Stems	Length of Live Aerial Stems (feet)
			(per acre)					
1	Red pine	37	149	596	967	586	1667	407
2	Red pine	30	236	1400	1297	500	1122	324
3	Red pine	37	109	424	955	565	1711	785
4	White pine	40	134	565	790	568	1990	566
5	White pine	40	141	540	789	595	2582	1001
6	Red pine	55	179	782	1953	976	2812	423
7	Red pine	50	189	665	2103	800	2840	527
8	Red pine	55	226	605	2128	860	1784	204

Table 2. Effect of 1 and 1/2 pound per acre of 2, 4-D on hazel undergrowth (Treatment evaluated August 2, 1971)

Plot	Treatment Date (1970)	Pounds Per Acre 2, 4-D	Small Clones and Seedlings Killed	Large Clones Killed	Decrease of Aerial Stems of Large Clones	Decrease of Aerial Stem Length of Large Clones
			(per cent)			
1	6/25	1	75	49	-49	-66
2	6/29	1	86	72	-79	-89
3	7/13	1	92	84	-93	-96
4	7/13	1	100	98	-99	-99
5	8/3	1	97	90	-92	-96
6	8/3	1	97	98	-98	-99
7	8/3	1/2	90	76	-90	-97
8	8/3	1/2	79	75	-81	-90
Average			90	80	85	92

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Published as Sci. Jour. Ser. Paper No. 7815 of the Univ. of Minn. Agr. Expt. Sta.