Without experimentation it is difficult to assess properly the part played by wetting the bolts with an atomizer. However, we have observed that production of beetles diminished during and after periods when water was not applied so assiduously as described. The adults of many wood- and bark-infesting beetles drink water copiously, and it is possible that this also applies to *H. rufipes*.—L.M. Gardiner and D.B. Roden, Great Lakes Forest Research Centre, Sault Ste. Marie, Ont.

Comparison of Germinability of Seed from Insect-infested and Uninfested Cones.—Germination tests were conducted to determine if seeds from infested cones suffered decreased germinability because of insect damage to conductive tissues in the cone.

Seeds from mature cones, collected in late August and early September from Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco), Engelmann spruce (*Picea engelmannii* Parry), and ponderosa pine (*Pinus ponderosa* Laws.), were extracted on an individual-cone basis from infested and uninfested cones. Both infested and uninfested cones for each test were taken from the same tree, to eliminate intratree variability. The insects involved were *Barbara colfaxiana* (Kft.), in Douglas-fir; *Laspeyresia youngana* (Kft.) and *Lasiomma (Hylemya) anthracina* (Cz.), in Engelmann spruce; and *Laspeyresia piperana* (Kft.), in ponderosa pine. Cones infested by insects other than the foregoing were discarded.

After extraction, the seeds were X-rayed to facilitate separation of filled and hollow seeds. On completion of tests, all seeds that failed to germinate were dissected. Those previously classified incorrectly as "filled" were deleted; thus the reason for totals of fewer than 500 seeds in some tests.

Five replications, each of 100 seeds, were stratified for 3 weeks at 1°C on moist filter paper in petri dishes. Germination tests were conducted at day-night temperatures of 27°C (8 h) and 20°C (16 h). A modified Jacobsen germinator (Edwards and Olsen, Can. J. Forest Res. 3(1):146-148, 1973) was used in conducting the tests. Seed germination commenced within 5 or 6 days and was completed in 10 or 11 days, except in one replication that required 13 days for completion. Seeds were classified as germinated when the radicle length was four times the seed length.

Table 1 shows that more than 90% of seed in all lots except ponderosa pine germinated, with no appreciable difference between seed from infested cones and seed from uninfested cones. This percentage indicated that seed in infested cones does not suffer damage indirectly because of feeding by these insects.—A.F. Hedlin and D.S. Ruth, Pacific Forest Research Centre, Victoria, B.C.

TABLE 1

Germinability of seeds from insect-infested and uninfested Douglas-fir, Engelmann spruce, and ponderosa pine cones

Host	Source of cones *	Insect	Seeds tested: Total of 5 reps.	Germinants: No.	Germinants: %
Douglas-fir	Falkland	*Barbara colfaxiana*	491	450	92.6
		Uninfested	487	462	94.9
	Riske Creek	*B. colfaxiana*	491	451	91.9
		Uninfested	487	454	93.2
Engelmann spruce	Bolean Lake	*Laspeyresia youngana*	502	475	94.6
		Uninfested	489	477	97.5
	Manning Park	*L. youngana*	454	410	90.3
		Uninfested	480	435	90.6
	Little Fort	*Lasiomma (Hylemya) anthracina*	432	426	98.6
		Uninfested	458	449	98.0
	Bolean Lake	*L. anthracina*	470	458	97.4
		Uninfested	489	477	97.5
Ponderosa pine	Lytton	*Laspeyresia piperana*	500	412	82.4
		Uninfested	490	364	74.3

*All cones from each location were obtained from a single tree.

SILVICULTURE

Height and Diameter Growth Response of 10-year-old Jack Pine to Thinning and Fertilization. — Thinning has been used successfully to improve individual tree growth rates and reduce rotation ages of several tree species (Dosen et al., J. For. 55:201-204, 1957; Cayford, Can. Dep. For., For. Res. Branch Publ. 1077, 1964; Berry, Bi-mon. Res. Notes 25:37, 1969; Bella and DeFranceschi, Can. Dep. Fish. For., Inf. Rep. A-X-40, 1971; Bella, Environ. Can., For. Serv. Inf. Rep. NOR-X-102, 1974). Fertilization is also being examined, alone and in combination with thinning, as a tool to stimulate growth and induce self-thinning of young trees of various species, but the author is not aware of any published reports on the effects of combined treatments on juvenile jack pine (*Pinus banksiana* Lamb.).

In 1971 an experiment was established to determine the effect of thinning and fertilization, alone and in combination, on the growth, survival, and development of 10-year-old jack pine in northeastern Ontario. The following is a report on the results obtained after four growing seasons.

The experimental area is in Benneweis Township, Gogama District, Ont. (lat. 47° 31′ N, long. 81° 49′ W), approximately 35 km south of the town of Gogama, within the Missinaibi-Cabonga Section (B.7) of the Boreal Forest Region (Rowe, Environ. Can., For. Serv. Publ. 1300, 1972). The general climate is modified continental, and the area is within the Height of Land Climatic Region (Chapman and Thomas, Can. Dep. Transp., Meteorol. Branch, Climatol. Study 6, 1968). Mean total precipitation, as measured at the nearest weather station (Ruel, Ont.), is approximately 84 cm annually (Anon., Environ. Can., Atmos. Environ. Serv., Can. Norm. 2, Precipitation 1941-1971, 1973).

The experiment was carried out in a dense 10-year-old jack pine stand on a sandy humo-ferric podzol (Anon., Can. Dep. Agric., Publ. 1455, 1974) described by Riley (Environ. Can., For. Serv. Inf. Rep. 0-X-180, 1973) as Site Class 2 (Plonski, Ont. Minist. Nat. Resour., Div. For., Norm. Yield Tables [Metric], 1974) for jack pine. The stand originated from site preparation, followed by aerial seeding, at a rate of 99,000 seeds/ha, in 1960. Sampling by Riley (1973) showed the stand to be 88% stocked (on a mil-acre quadrat basis) with 13,000 trees/ha and an average height of 1.8 m in 1970. Portions of the stand were thinned in 1970 to achieve approximately 1.8 m x 1.8 m spacing between trees, and this resulted in 4,135 stems/ha (Riley 1973).

In May 1971, two areas within the stand, one thinned and one unthinned, were arbitrarily selected to receive fertilizer treatments. Each area was divided into 12 plots (0.04 ha each) for fertilizer treatment. Four fertilizer levels were chosen: T_1 = 0 (control), T_2 = N 56 kg/ha, T_3 = N 168 kg/ha, T_4 = N 168 kg/ha + P 112 kg/ha. N was supplied as urea (46% N) and P as triple superphosphate (45% P_2O_5). Each treatment was replicated three times, and all treatments were randomly assigned to a plot in each experimental area.

All plots contained 0.02-ha interior measurement plots. All trees in the measurement plots were numbered with aluminum tags and measured for total height, and all trees greater than 3.8 cm dbh were measured for diameter. Fertilizer was spread by hand in appropriate quantities for the respective treatments of each area.

All plots were remeasured in June 1975, i.e. 4 years after establishment. Height growth measurements were subjected to analysis of variance, and Duncan's Multiple Range Test was used to assess treatment differences.