# METHODS FOR THE SUCCESSFUL ESTABLISHMENT OF BLACK CHERRY PLANTATIONS IN SOUTHERN ONTARIO

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Frontispiece. Mature black cherry of excellent form.

## ABSTRACT

Seedlings and transplants of black cherry (*Prunus serotina* Ehrh.), black walnut (*Juglans nigra* L.) and white ash (*Fraxinus americana* L.) were planted in a fertile former agricultural field near Parkhill, Ontario to determine the effects of planting stock age, stem clipping and fertilization on tree survival and early height growth. A severe frost in early June of the fourth growing season killed all of the current and previous year's growth of black walnut and white ash seedlings and transplants. Black cherry was not affected by the frost. Age of planting stock had little effect on the survival of all three species or on the height growth of black walnut. Height growth of black cherry seedlings was significantly better than transplant growth. Height growth of white ash transplants was significantly better than seedling growth. Stem clipping had no effect on the survival of all three species but increased height growth sufficiently to compensate, within 3 to 5 years, for the height lost in clipping. Fertilization had no effect on the survival or height growth of the three species. Recommendations are made for the successful establishment of black cherry plantations in southern Ontario.

## RÉSUMÉ

Des semis et plants repiqués de Cerisier tardif (*Prunus serotina* Ehrh.), Noyer noir d'Amérique (*Juglans nigra* L.) et Frêne d'Amérique (*Fraxinus americana* L.) ont été plantés dans un champ fertile précédemment cultivé près de Parkhill, Ontario, pour déterminer les effets de l'âge du matériel planté, du recépage des tiges et de la fertilisation sur la survie et la croissance en hauteur initiale des arbres. Une forte gelée au début du mois de juin de la quatrième année de croissance a tué tous les semis et plants repiqués de Noyer noir d'Amérique et de Frêne d'Amérique mis en terre cette année et la précédente. Le Cerisier tardif n'a pas été affecté par la gelée. L'âge du matériel planté avait peu d'effets sur la survie de toutes les trois essences ou sur la croissance en hauteur du Noyer noir d'Amérique. La croissance en hauteur des semis de Cerisier tardif était significativement meilleure que celle des plants repiqués. La croissance en hauteur des plants repiqués de Frêne d'Amérique était significativement supérieure à celle des semis. Le recépage des tiges n'avait pas d'effets sur la survie de toutes les trois essences, mais il améliorait la croissance en hauteur suffisamment pour compenser en 3 à 5 ans la hauteur perdue par recépage. La fertilisation n'avait aucun effet sur la survie ou la croissance en hauteur des trois espèces. Il est recommandé d'établir des plantations de Cerisier tardif dans le sud de l'Ontario.

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## INTRODUCTION

Black cherry (*Prunus serotina* Ehrh.), black walnut (*Juglans nigra* L.) and white ash (*Fraxinus americana* L.) are three of the most valuable timber species of southern Ontario. While black walnut and white ash are commonly used in the afforestation of abandoned farmland, black cherry has been planted only sparingly because little is known about its growth requirements and suitable planting methods. In general, the few cherry plantations which were established in southern Ontario have shown poor growth (von Althen 1965). Nonetheless, black cherry appeared to have plantation potential because successful plantations have been established in the United States (Haasis 1930, Wallihan 1949, Chapman and Lane 1951). More recently black cherry has been included in the Tennessee Valley Authority hardwood tree improvement program which is aimed at making available the best possible seedlings for planting (Taft 1965).

To develop a suitable planting method black cherry was planted in mixture with black walnut and white ash, and various treatments were applied. The 5-year results for black cherry and 3-year results for black walnut and white ash are reported here.

## EXPERIMENTAL AREA

The study was carried out in a former agricultural field situated on the flood plain of the Ausable River near Parkhill, Ontario. The soil was a deep, uniform, well-drained, alluvial silty clay, and the pH of the plow layer was 7.6. The field is subject to short periods of flooding during spring runoff. The ground vegetation consisted of very vigorous quack grass (*Agropyron repens* [L.] Beauv.), teasel (*Dipsacus sylvestris* Huds.) and goldenrod (*Solidago* spp.).

## METHOD

The experimental area was plowed and disked in the summer and disked again in the autumn before spring planting. In the spring of 1969, 15 seedlings or transplants of either black cherry, black walnut or white ash (Table 1) were planted with a 6-inch (15.24-cm)-diameter soil auger in randomly assigned rows of one species and age class per row. Spacing was 5 feet (152.4 cm) between rows and 4 feet (121.92 cm) within rows. Three pounds per acre (3.36 kg/ha) of active Princep® were broadcast over the total experimental area shortly after planting. The soil between the rows of trees was rototilled in July of the first growing season and in May and July of the second growing season.

Table 1. Size of planting stock

| Species | Age class | Mean length of stem (in.)[a] | Mean stem diam. at 1 in.[a] above root collar (in.)[a] | Mean top-to-root ratio (oven-dry weight) |
|---|---|---|---|---|
| Black cherry | 1+0 | 8 | .20 | 1:1.5 |
| Black cherry | 1+2 | 38 | .38 | 1:0.9 |
| Black walnut | 1+0 | 11 | .26 | 1:2.2 |
| Black walnut | 1+1 | 14 | .34 | 1:3.8 |
| Black walnut | 1+2 | 28 | .38 | 1:1.7 |
| White ash | 2+0 | 13 | .30 | 1:2.0 |
| White ash | 2+2 | 33 | .43 | 1:1.1 |

[a] 1 in. = 2.54 cm.

Treatments consisted of:

A. Planting trees of various ages (Table 1).

B. Stem clipping.
   1. Control, no stems cut.
   2. Stems of seedlings and transplants cut at ground line shortly after planting.

C. Fertilization.
   1. Control, no fertilization.
   2. One 9-g (.27-oz.) tablet of 22-8-2 fertilizer placed at the bottom of the planting hole.
   3. Two 9-g (.27-oz.) tablets of 22-8-2 fertilizer placed at the bottom of the planting hole.

The stem-clipping treatment was included because it had been noticed for several years that seedlings browsed to the ground line early in the growing season produced vigorous, well-formed shoots which grew as well as or better than the nonbrowsed seedlings.

The experiment was laid out in a factorial arrangement (Table 2). Seedling and transplant survival and height were recorded after the first, third and fifth growing seasons. Since black walnut and white ash sustained severe frost damage in June of the fourth growing season their 3-year survival and height data were subjected to analyses of

variance and Duncan's multiple range test (Steel and Torrie 1960). The 5-year data of black cherry, which was not affected by the frost, were subjected to the same analyses.

Table 2. Factorial design of experiment

| Species | No. of treatments: Stock age | Stem clipping | Fertilization | No. of replications | Total no. of plots | No. of trees per plot | Total no. of trees planted |
|---|---|---|---|---|---|---|---|
| Cherry | 2 | 2 | 3 | 3 | 36 | 15 | 540 |
| Walnut | 3 | 2 | 3 | 3 | 54 | 15 | 810 |
| Ash | 2 | 2 | 3 | 3 | 36 | 15 | 540 |

## RESULTS

1. Black walnut and white ash sustained severe frost damage in June of the fourth growing season (Fig. 1). Black cherry was not affected by the frost.

2. Age of planting stock had little effect on the survival of all three species or on the height growth of black walnut. However, height growth of the black cherry seedlings was significantly better at the 5 percent level than that of the transplants while height growth of the white ash transplants was significantly better than that of the seedlings (Table 3).

3. Stem clipping resulted in vigorous sprouting. More than one sprout emerged from one third of the stumps, necessitating a second pruning to reduce the sprouts to one per stump. While stem clipping reduced survival by two to four per cut for all age classes and species except black cherry seedlings, it significantly increased the growth of seedlings and transplants of all three species (Table 4). Table 5 shows the effect of stem clipping on total height and mean annual height growth of black cherry seedlings and transplants after one, three and five growing seasons. Total height at the end of the fifth growing season was the same for the clipped and control trees.

4. Fertilization had no effect on the survival or height growth of any of the three species (Table 6).

Figure 1. White ash crown distorted by late spring frost.

5. Weed growth is especially difficult to control in black cherry and white ash plantations by chemical means because both species have a low resistance to Princep and can be damaged by dosages necessary for effective weed control. The 3 pounds of active Princep per acre (3.36 kg/ha) applied shortly after planting controlled weed growth only during the early part of the summer. When rapid growth of quack grass threatened to smother the smaller trees we rototilled between the rows in July of the first year and in May and July of the second growing season. This controlled weed growth sufficiently to allow the trees to outgrow the weed competition.

Table 3. Effect of age of planting stock on 5-year survival and height growth of black cherry seedlings and transplants and 3-year survival and height growth of black walnut and white ash seedlings and transplants

| Species and age class | Mean survival (%) | Mean height growth (ft)[a] |
|---|---|---|
| Black cherry | | |
| 1+0 | 78 | 15.0 |
| 1+2 | 82 | 14.2 |
| Black walnut | | |
| 1+0 | 99 | 5.5 |
| 1+1 | 96 | 5.6 |
| 1+2 | 98 | 5.5 |
| White ash | | |
| 2+0 | 96 | 5.8 |
| 2+2 | 99 | 6.4 |

[a] 1 ft = 30.48 cm.

Note: Lines connect means that are significantly different at the 5% level.

Table 4. Effect of stem clipping on 5-year survival and height growth of black cherry seedlings and transplants and 3-year survival and height growth of black walnut and white ash seedlings and transplants

| Species and age class | Mean survival (%)[a] | | Mean height growth (ft)[a] | |
|---|---|---|---|---|
| | Control | Stems cut | Control | Stems cut |
| Black cherry | | | | |
| 1+0 | 75 | 81 | 14.6 | 15.3 |
| 1+2 | 84 | 80 | 12.5 | 15.8 |
| Black walnut | | | | |
| 1+0 | 100 | 97 | 5.3 | 5.7 |
| 1+1 | 98 | 94 | 5.2 | 5.9 |
| 1+2 | 99 | 96 | 5.1 | 5.9 |
| White ash | | | | |
| 2+0 | 98 | 94 | 5.6 | 6.0 |
| 2+2 | 100 | 98 | 5.7 | 6.6 |

[a] 1 ft = 30.48 cm.

Note: Lines connect means that are significantly different at the 5% level.

Table 5. Effect of stem clipping on total height and mean annual height growth of black cherry seedlings and transplants

| Time of measurement | 1+0 | | | | 1+2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Control (ft)[a] | Mean annual ht growth (ft)[a] | Stem cut (ft)[a] | Mean annual ht growth (ft)[a] | Control (ft)[a] | Mean annual ht growth (ft)[a] | Stem cut (ft)[a] | Mean annual ht growth (ft)[a] |
| Planting | 0.7 | - | 0.0 | - | 3.2 | - | 0.0 | - |
| | | 1.5 | | 2.0 | | 1.1 | | 2.6 |
| End of 1st growing season | 2.2 | | 2.0 | | 4.3 | | 2.6 | |
| | | 3.0 | | 3.0 | | 2.4 | | 3.4 |
| End of 3rd growing season | 9.8 | | 9.1 | | 10.4 | | 10.3 | |
| | | 2.9 | | 3.1 | | 2.5 | | 3.2 |
| End of 5th growing season | 15.3 | | 15.3 | | 15.7 | | 15.8 | |

[a] 1 ft = 30.48 cm.

Table 6. Effect of fertilization on 5-year survival and height growth of black cherry and 3-year survival and height growth of black walnut and white ash seedlings and transplants

| Species and age class | Mean survival (%) | | | Mean height growth (ft)[a] | | |
|---|---|---|---|---|---|---|
| | Control | One tablet | Two tablets | Control | One tablet | Two tablets |
| Black cherry | | | | | | |
| 1+0 | 74 | 83 | 75 | 15.2 | 15.3 | 14.6 |
| 1+2 | 87 | 78 | 82 | 14.3 | 13.9 | 14.3 |
| Black walnut | | | | | | |
| 1+0 | 99 | 99 | 98 | 5.5 | 5.5 | 5.5 |
| 1+1 | 93 | 97 | 98 | 5.4 | 5.6 | 5.7 |
| 1+2 | 96 | 100 | 98 | 5.5 | 5.3 | 5.6 |
| White ash | | | | | | |
| 2+0 | 94 | 98 | 97 | 5.9 | 5.7 | 5.8 |
| 1+2 | 100 | 99 | 98 | 6.3 | 6.2 | 6.8 |

[a] 1 ft = 30.48 cm.

Note: None of the means is significantly different at the 5% level.

## DISCUSSION

Damage from late spring frosts is one of the hazards of successful hardwood afforestation in southern Ontario. While temperatures frequently drop to below freezing in late May and early June, the 27°F (-2.7°C) recorded on 11 June, 1972 was the lowest temperature recorded in June of the last two decades. The frost killed the current black walnut and white ash shoots, which were from 6 to 14 inches (21.24 - 35.56 cm) long, and also killed the previous year's growth. Although all trees survived and began to sprout again within 2 weeks, new sprouts appeared at the base of the 1971 growth on 90 percent of the seedlings and transplants and at the root collar on the remaining 10 percent.

Black cherry which was almost fully leaved on 11 June sustained no frost damage and maintained its normal rate of growth (Fig. 2). Black cherry also proved to be more frost resistant than either basswood (*Tilia americana* L.), red oak (*Quercus rubra* L.), sugar maple (*Acer saccharum* Marsh.) or white spruce (*Picea glauca* [Moench] Voss) which grew in adjacent plantations. All of these species lost most of their current growth.

Figure 2. Comparative height of 5-year-old white ash, black walnut and black cherry (left to right).

While the frost resistance of black cherry may have been due, in part, to the advanced state of leaf growth, black cherry is also one of the earliest flushing species in Ontario. It therefore frequently encounters freezing temperatures during various stages of growth. However, in the few black cherry plantations we have established we have never encountered serious frost damage. This indicates that black cherry is more resistant to late spring frosts than most other hardwood species.

Black walnut and black cherry seedlings survived and grew as well as or better than the transplants. It is therefore recommended that only seedlings of these two species be planted. However, white ash transplants grew on an average 0.6 feet (18.29 cm) taller in 3 years than did the seedlings. While this extra growth was statistically significant, the extra costs of production, shipping and planting of the transplants must be weighed against the benefits of the extra height

growth. Therefore, under normal planting conditions it will no doubt be more economical to plant seedlings. However, on difficult sites or where rapid height growth is essential, the use of transplants may be well justified despite the higher costs of plantation establishment.

Stem clipping increased height growth of seedlings and transplants, but this increased growth was sufficient only to compensate for the initial loss of height. Since stem form of the clipped seedlings and transplants was no better than that of the control trees, the clipping treatment was of little practical value in improving plantation establishment.

Fertilization was included as a treatment to determine if Agriform® forest starter tablets could increase survival and early growth of seedlings and transplants of all three species. Promising results have been obtained with these tablets in reforestation experiments in the Pacific northwest (Austin and Strand 1960). Since our plantation soil was fertile, fertilization was not expected to increase long-term growth, but we hoped to increase growth during the initial establishment period. On fertile planting sites the first years after planting are the most critical years for successful plantation establishment because the newly planted trees must compete with fast-growing weeds. As long as the seedlings and transplants are small they are also highly susceptible to damage from browsing by rabbits and stem girdling by mice. If fertilization can increase growth, the period of time will be reduced during which the trees are vulnerable to such injuries. This in turn will increase the probability of successful establishment.

The absence of any growth response to fertilization in this experiment was probably due to the high fertility of the soil which assured good growth without fertilization.

The results of this experiment also correspond closely with those of previous studies which showed that too little is presently known to make recommendations for hardwood fertilization at time of planting (Ellis and von Althen 1973).

## CONCLUSION

On the basis of these results and other experimental plantings (von Althen, unpublished data) the following recommendations are made for the successful establishment of black cherry plantations in southern Ontario:

1. Select a fertile, well-drained planting site.

2. Plow and repeatedly disk the total planting area during the summer and autumn previous to spring planting until all weeds are destroyed. The better the site preparation the cheaper will be the post-planting weed control.

3. Plant 1+0 seedlings in early spring with a shovel or a planting machine at a spacing of 10 feet (304.8 cm) between rows and 5 feet (152.40 cm) within rows.

4. Apply 2 pounds per acre (2.24 km/ha) of active Princep immediately after planting.

5. When weeds are 6-8 inches (15.24-20.32 cm) high rototill or disk between the rows. Maintain weed control until the seedlings are 4-5 feet (121.92-152.4 cm) high.

6. Where necessary, control mouse populations by applications of poisoned bait during the first 5 years after planting.

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