BILL FLEMER: Would the maturity of a crabapple seedling be hastened by taking the leader and training it over into a horizontal position?

DICK ZIMMERMAN: No, we find that the best thing to do to hasten the flowering of seedlings is to get it to grow as rapidly as you can, as long as you can. Any procedure which checks the growth of the seedling will, in turn, delay the flowering of the seedling.

MODERATOR PINNEY: U.S.D.A. has certainly been a big help to us in our birch program and if any of you ever get to Beltsville, Maryland, you should certainly make it a point to stop in and see some of the interesting things they have going there.

Our next paper is a substitute for the paper listed on your program since the gentleman who was to present that paper has hurt his leg and will not be with us. The paper which will be given is by W. G. Ronald and W. A. Cumming. The work to be reported was done while Mr. Ronald was at the research station in Morden, Manitoba though, more recently, he has been spending some time at the University of Minnesota. The paper will be read by Mr. Herman Temmerman. under whose technical direction the experiments were carried out.

COMPATIBILITY AND GROWTH OF COLUMNAR EUROPEAN ASPEN ON POPLAR ROOTSTOCKS[1]

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Hardwood or softwood cuttings of most poplars root easily with the exception of white poplars and aspens which belong to one section of the genus *Populus*. White poplars generally propagate easily by softwood cuttings and with more difficulty by hardwood cuttings; both softwood and hardwood aspen cuttings generally root poorly. Under natural conditions the aspens regenerate quickly from root suckers and seed.

Columnar European aspen (*Populus tremula* L. 'Erecta') is a valuable columnar clone that has proven difficult to propagate. Many attempts, by the authors, to root softwood cuttings have resulted in

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less than 10% success. Despite its value as a hardy upright poplar for northern areas, propagation failures have prevented wide commercial acceptance of this clone.

Propagation failures have stimulated research into aspen clonal propagation by greenwood cuttings (1), adventitious etiolated cuttings from root cuttings (1, 3) and tissue culture (5, 6). While these techniques have been successful with some clones, most utilize facilities not readily available to commercial propagators. The use of budding or grafting has apparently been little used for aspen propagation. Nelson (4), in a recent rootstock survey, recorded four reports of poplar grafting. Three reports concerned white poplar and aspen propagation; none recorded the propagation of columnar European aspen. One report recorded the use of *P. nigra* L. 'Italica' as a rootstock for *P. alba* L. 'Pyramidalis'. The existence of a *P. tremula-P. trichocarpa* L. graft was also recorded by Bortitz (2). These two rootstock-scion combinations, between two sections of the genus, indicate that intersection compatibility exists.

A propagation method based on the use of clonal rootstocks has definite merit in aspen propagation. The use of rootstocks would avoid persistant suckering evident in plants on their own roots. The development of clonal rootstock recommendations could apply in forestry for perpetuating and testing superior aspen clones. The basic requirements for a clonal rootstock are easy rooting ability and compatibility with the grafted or budded selection. This paper reports on the use of 8 clonal rootstocks and 1 seedling rootstock for clonal propagation of columnar European aspen.

MATERIALS AND METHODS

Budding. The first propagation attempt was made in August, 1968, when 10 buds were placed on rooted cuttings of Brooks #6. Early evidence of bud-rootstock union suggested that further testing was merited, using a wider range of rootstocks. In 1969, hardwood cuttings were prepared of Brooks #4 and #6 hybrids, *P. canadensis* Moench. 'Serotina de Selys', *P. deltoides* Marsh. var. *occidentalis* Rydb. 'Dakotah', *P. nigra* L. 'Thevestina', *P. acuminata* Rydb. and Manchurian poplar (*P. songarica* unknown). Cuttings were planted in early May for subsequent use in August budding. Seedling rootstocks of native *P. tremuloides* Michx. were obtained and tested in 1969. In 1970 five rootstocks that rooted well in 1969, were retested. T-budding was done early (August 8-12) and late (August 20-25) to test for ideal budding date. Ten rootstocks were budded on each date in all clones showing a high rooting percentage.

Grafting. Whip and tongue grafts of 7 cm (3'') scions and 15 cm (6'') unrooted hardwood cuttings of Brooks #4 and #6 were tested. Ten grafts in 1970 and 40 grafts in 1971 were made with each rootstock.

Completed grafts were stored in peat moss at 2° C until planted in nursery rows. At the end of the growing season the whip height and diameter at 12'' above scion-rootstock union were recorded for both budding and grafting experiments.

RESULTS AND DISCUSSION

The combined results of rootstock rooting, bud take and bud growth in 1969 and 1970 are presented in Table 1.

Rooting of understocks. All clones rooted over 60% except 'Dakotah' which was tested only in 1969. This clone proved difficult to root in other trials carried out at Morden. The two Brooks clones rooted over 90% making them highly desirable as rootstocks.

Budding Date. The late August budding date produced superior stands. The later date appeared to produce better callusing around the inserted bud. Even with late August budding in 1969, a tendency was noted for some buds to commence fall growth.

Table 1. Results of two seasons of budding trials with columnar European aspen

		Percent Bud Take		Growth	
Rootstock	Percent Rooting	Early August Budding	Late August Budding	Height (meters)	Diameter (cm)
Brooks # 4	94 2	36	75	2 3	1 65
Brooks # 6	95 2	52	88	2 3	1 67
P canadensis 'Serotina de Selys'	63 3	20	79	Incom-patible	
P deltoides var *occidentalis* 'Dakotah'[y]	30 0	z	100	2 2	1 60
P songarica	76 6	None	None		
P nigra 'Thevestina'	76 6	15	40	1 2	81
P acuminata [y]	80 0	20	46	Incom-patible	
P tremuloides [y]	20	26	2 4	1 89	

[y]tested one year only

[z]not budded due to limited rootstock

Compatibility and Growth. Three clones proved unsuited as rootstocks. *P. acuminata* and 'Serotina de Selys' produced satisfac-

tory bud stands but all whips died after reaching about 1 m in height during the first growing season. Manchurian poplar did not produce a successful union in two years of testing. Brooks #4 and #6, 'Thevestina' and 'Dakotah' clones and seedling *P. tremuloides* proved compatible for two or more years. Due to poor rooting of 'Dakotah', testing of this clone was discontinued. Subsequent growth and compatibility indicate that further testing of related cottonwood clones is merited. 'Thevestina' rootstock has resulted in smaller whips than other compatible combinations which may be indicative of delayed incompatibility. *P. tremuloides* proved compatible and produced large whips. This species, closely allied to *P. tremula*, may have a limited use in propagation. However its tendency to sucker, seedling variation, and difficulty in obtaining rootstocks would appear to rule out its usefulness. Brooks #4 and #6 clones produced high bud stands and good growth. These rootstocks have not exhibited undesirable suckering tendencies. The whips from 1968 budding have continued to grow well for 3 years.

Grafting. The results of grafting scions to hardwood cuttings are presented in Table 2. This technique has merit as it may be a faster, less expensive operation. It is possible to produce a plant in 6-7 months using this method. A second year of growth resulted in well-branched plants 2 m or more in height. This is the first apparent record of the use of this method for aspen production.

Table 2. Grafting results obtained with columnar European aspen

Rootstock	Year	Percent Graft take		Height (meters)	Diameter (cm)
Brooks # 4	1970	40.0	1 yr	1.3	.95
''			2 yr	2.1	2.54
''	1971	12.5		0.4	.60
Brooks # 6	1970	20.0	1 yr	1.6	.97
''			2 yr	2.3	2.54
''	1971	47.5		0.4	.55

CONCLUSIONS

This study has indicated three rootstock-scion compatibility relationships: non-successful unions, incompatible unions and compatible unions. The most promising rootstocks on the basis of rooting, compatibility and growth are the two hybrid poplar selections Brooks #4 and Brooks #6. These two clonal rootstocks appear useful for the following reasons:

1) The problem of obtaining root pieces of columnar European aspen followed by subsequent propagation of new plants from root pieces or etiolated cuttings from root pieces is overcome.

2) They can result in well grown whips within one season of growth either by budding or grafting.

3) The suckering problem can be overcome by their use.

4) They preserve the clonal characteristic of columnar European aspen.

Research into a wider range of rootstocks and tests with scions of the two native North American aspens, *P. tremuloides* and *P. grandidentata* Michx., is currently in progress. Suitable clonal rootstocks could result in a much wider use of these interesting aspen species.

LITERATURE CITED

1. Barry, W. J. and R. M. Sachs. 1968. Vegetative propagation of quaking aspen. *Calif. Agric.* 22:14-16.
2. Bortitz, S. 1963. Identification of Salicaceae and other forest trees by paper chromatographic separation of their fluorescent constituents. *Bulletin de L'Academic Colonaise des Sciences.* 11:549-554.
3. Farmer, Robert E., Jr. 1963. Vegetative propagation of aspen by greenwood cuttings. *J. For.* 61:367-368.
4. Nelson, S. H. 1968. Incompatibility survey among horticultural plants *Proc. Int. Plant Prop. Soc.* 18:343-407.
5. Winton, L. 1968. The rooting of liquid-grown aspen callus. *Amer. J. Bot.* 55:159-167.
6. _____. 1968. Plantlets from aspen tissue cultures. *Science* 160:1234-1235.

MODERATOR PINNEY: Our next speaker is Chiko Haramaki, a personal friend of mine and a very interesting fellow who will be telling us about tissue culture of gloxinias.