A rapid method for vegetative propagation of aspens and their hybrids

Mass propagation of the best aspen clones could be solved in a practical way

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The propagation of aspen cuttings of sucker origin is described. The suckers were stimulated on root-cuttings planted in the greenhouse. Abundant suckers were produced and rooted without difficulty in plastic tube containers. Suckering and rooting ability varied between and within species and hybrids.

Vegetative propagation allows the tree breeder to capitalize fully on superior plants which owe their outstanding value to a desirable combination of genes. In the process of generative reproduction these combinations of genes are broken up, probably never again to be reconstituted.

Clones are produced by vegetative propagation, and represent plants derived from one tree. Because all members of a clone are of the same genotype, they tend to perform uniformly and in a very predictable manner. Hence, their use in plantations is advantageous.

Poplar clonal plantations have the potential to meet increased timber requirements. Features particularly favouring poplars include their great ecological amplitude, fast growth, the multi-various use of their wood and the ease of vegetative propagation (Maini 1968).

The rooting of stem cuttings is a commonly used method of vegetative propagation. Although stem cuttings of balsam poplars and cottonwoods root with relative ease, the rooting ability of aspen stem cuttings is extremely poor (Maini 1968).

Aspens typically regenerate by suckers, which are adventitious shoots formed on roots (Maini 1968). This property of aspens has been used for vegetative propagation in several ways: (1) suckers with roots have been lifted from stands and used as transplants; (2) roots of a known tree have been used for root cuttings; and (3) green cuttings have been taken from herbaceous suckers.

Suckers of satisfactory quality and known origin seldom can be found in large quantities in stands. Such suckers are often growing on decayed roots,

have an unbalanced root system or are of uncertain origin. Root cuttings of a specific tree rarely can be supplied in desired quantity and quality. Old, thick, stained or rotten roots do not make good root cuttings. Green cuttings taken from young succulent suckers offer the best possibility for vegetative propagation of aspens. This method was recommended by Muhle Larsen (1943), Barry and Sachs (1968), Benson and Schwalbach (1970) and I attempted to propagate aspens and their hybrids in the same way.

Suckering

In the fall of 1968 and in the spring of 1969 trembling aspen (*Populus tremuloides* Michx.), largetooth aspens (*P. grandidentata* Michx.) and hybrid aspen plus trees (Tables 1 and 2) were selected from native stands and from plantations of hybrids for vegetative propagation. Parts of roots (1 to 2½ inches in diameter) of each tree were excavated and cut into 8-inch long cuttings.

Four root cuttings from each tree were taken. Muhle Larsen (1943) laid the root cuttings for suckering in moist peat litter and kept them in an unheated greenhouse. Maini and Horton (1966) found optimum suckering to occur at 75°F and only well aerated root cuttings formed suckers. We planted the root cuttings horizontally, a half-inch deep, in coarse sand in flats (12 x 8 x 6 inches). We kept the flats in the greenhouse under full light and under variable conditions of temperature and humidity (60-90°F, 30-90% relative humidity).

Suckering of the fall planted trembling aspen root cuttings started 25 days after planting and continued for 5 months (Table 1). Suckering was most intensive during the first month when 67% of all the suckers were produced. It decreased in the second month (22%) and dropped to a very low level in

TABLE 1. Sucker production and rooting in experiment established in fall 1968

Species	Origin	Age (yr.)	No. of suckers produced and planted					Total	Per cent rooted
			Dec	Jan	Feb	Mar	Apr		
<i>P. tremuloides</i>	T28 Maple	12	169	56	12	4	4	245	85
<i>P. tremuloides</i>	T134 Swastika	45		2	2			4	100
<i>P. tremuloides</i>	T135 Swastika	45	44	13	3	4	4	68	78
<i>P. grandidentata</i>	G57 Maple	20			13	8	2	23	78
Total			213	71	30	16	10	340	84

TABLE 2. Sucker production and rooting in experiment established in spring 1969

Species or hybrid	Age (yr)	No. of suckers produced and planted				Percent rooted
		June	July	Aug	Total	
<i>P. alba</i> x <i>grandidentata</i> AG47.....	13	74	3		77	36
" " AG195.....	11	3			3	33
" " AG208.....	11	28			28	32
<i>P. canescens</i> x (<i>alba</i> x <i>grandidentata</i>) CAG196 .	9	13	7		20	20
" " CAG205	9	9	2		11	27
<i>P. canescens</i> x <i>grandidentata</i> CG48.....	7	27	10	1	48	37
<i>P. alba</i> x <i>sieboldii</i> AS41.....	9	75	7		82	39
" " AS42.....	9	57	20	8	85	47
<i>P. alba</i> x <i>daurica</i> AK40.....	9	230	23	1	254	47
" " AK41.....	9	161	55	6	222	53
" " AK42.....	9	141	23		164	41
" " AK57.....	9	151	19		170	37
<i>P. tremuloides</i> x <i>daurica</i> TK14.....	7	16	2		18	50
<i>P. tremuloides</i> T28.....	12	137	9		146	66
<i>P. grandidentata</i> Dufferin 1.....	40	46	7		53	30
" Dufferin 2.....	40	14	10	2	24	46
" Dufferin 3.....	40	23	21	10	54	28
Total.....		1113	218	28	1359	48

the third and consecutive months. The largetooth aspen root cuttings in the same experiment started suckering 2 months after planting. They produced 57% of all suckers during the third month and 35% of all the suckers during the fourth month. The sucker production ceased after 5 months.

The roots planted in spring started suckering 12 days after planting. Suckering was intensive during the next 30 days when 82% of all the suckers appeared. It ceased completely 3 months after the start (Table 2).

The root cuttings of *P. tremuloides* T28 planted in both experiments produced 40% less suckers in the spring than in the fall.

Suckers emerged 2 weeks earlier on the root cuttings planted in spring than on those planted in the fall. In both cases, the suckering was intensive during the first 2 months. This means that for practical purposes the root cuttings should be kept suckering for 2 months and then discarded. New root cuttings could be excavated and new sucker production started any time during the year. A maximum production of suckers would then be maintained in such a way.

Benson and Schwalbach (1970) dipped the root cuttings in captan solution, waxed the root wounds and kept the rooting media dry in order to prevent pathogens from attacking the roots and suckers.

We did not observe harmful effects of pathogens on root cuttings or suckers.

Large variation in sucker production between and within species and hybrids occurred (Tables 1 and 2). This observation is in accordance with Maini's (1967) findings. In Muhle Larsen's (1963) experiments aspen gave on the whole more suckers per root cutting than did grey poplar (*P. canescens* Smith = *P. alba* x *tremula*). In our experiments the suckering of *P. alba* L. hybrids, which possess rooting ability from stem cuttings, varied, but in general it was not inferior to the suckering of pure aspens.

Rooting of suckers

The suckers were collected in a succulent stage, 2 to 4 days after their first appearance, when they were 1½ to 4 inches long (Figs. 1 and 2). The entire sucker was removed including the etiolated base adjacent to the root cutting. Each sucker was planted 1 to 1½ inches deep in a slit polystyrene tube (¾ x 3 inches) of the type described by McLean (1959) (Figs. 3 and 4). The tubes contained a rooting medium of a 2 inch layer of coarse acid sand over a ¾ inch layer of black loam used as a source of nutrition.

The flats with suckers in tubes were kept in a clear polyethylene tent, with a bottom layer of wet

Fig. 1 *P. alba x davidiana* AK57. Suckering root cuttings.

Fig. 2 *P. tremuloides x davidiana* TK14. Suckers ready for planting.

Fig. 3 Tubed suckers. The flat is 12 x 8 x inches.

Fig. 4 *P. tremuloides* T28. Suckers planted and rooted in tubes, 14 days after planting.

Fig. 5 *P. tremuloides* T28. Rooted tubed suckers two months after planting.

peat moss to maintain humid conditions, until rooting occurred. For the fall experiment the tent was placed in the coolest part of the greenhouse and shaded with burlap during the sunny days. Inside the tent the temperature varied from 65° to 75°F and the humidity from 60 - 70%. For the spring experiment, the tent was set up in a growth chamber with better control of temperature (68-70°F) and humidity (70-75%).

The suckers rooted 8 to 21 days after planting. In the fall experiment 84% of the suckers had rooted, while in the spring experiment only 48% of the suckers rooted (Tables 1 and 2). The T28

trembling aspen suckers rooted 85% in the fall experiment and 66% in the spring experiment. Variation in rooting appeared between the varieties in the experiments.

Benson and Schwalbach (1970) observed difficulties in rooting largetooth aspen suckers. In our case, the rooting of largetooth aspens was not much inferior to the rooting of trembling aspens (in the fall experiment) or to the rooting of hybrid varieties (in the spring experiment).

The suckers that did not root died. Mortality was due to the necrotic spots which gradually spread over the whole sucker. The necrotic spots appeared

especially on the places where the leaves or the stems of the suckers were touched or squeezed. According to Benson and Schwalbach (1970) the success of rooting of the succulent suckers depends on the control of pathogens. This too is accomplished by using clean tools, sterilizing the rooting media and controlling the media moisture.

Use of tubes

Rooting suckers in the tubes seems to be advantageous. Normal and well distributed root systems developed on the suckers planted in tubes (Figs. 4 & 5). Santon (1970) observed unilateral and unbalanced root development of aspen seedlings in tubes. In our case the tubes had no harmful effect on rooting or root development. The benefits of this method are: 1 / the suckers planted in tubes can be checked, moved or outplanted anytime without risk of breaking the roots or losing the plant; 2 / the tubes require less space, and 3 / the pathogens are somewhat isolated to the single tubes.

Discussion

The vegetative propagation by rooting young suckers shows the following advantages: 1 / suckers grow vigorously and behave similarly to the seedlings. Conversely, stem cuttings taken from mature trees are affected by topophysis (a tendency of cuttings to retain some of the characteristics of the branches from which they were taken); and 2 / rooting suckers allows for a fast initial propagation of a tree. In our experiment, more than 200 suckers were produced by only 4 root cuttings of a tree in a period of just one month. Other methods result in slower initial propagation. For example, the rate of propagation of *P. alba* L. hybrids by stem cuttings varied from 2 to 5 times annually (Zufa 1968).

Once the initial hundred ramets of an aspen tree are produced, the clonal propagation could continue in a simpler way in the nursery by taking advantage of the aspen's suckering capacity. The rooted suckers of each clone could be planted in a separate nursery compartment. They should be allowed to develop to a desired size, then lifted and outplanted. More suckers would then develop from the roots left in the soil. During the growing season the developing suckers should be thinned to a desired spacing and number. Such propagation could continue for a number of years, giving sev-

eral generations of suckers. Mass propagation of the best aspen clones could be thus solved in a very practical and inexpensive way.

Conclusions

The experiments on rooting young suckers of aspens and their hybrids gave the following results:

- 1 Root cuttings planted in coarse sand suckered intensively for a period of 60 days.
- 2 Aspen suckers were successfully rooted in plastic tube containers.
- 3 Fast initial clonal propagation was achieved.
- 4 Between and within species variation was observed in the suckering and in the rooting of suckers.

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Méthode rapide de propagation végétative des peupliers et de leurs hybrides

L'auteur discute de la propagation de boutures de peupliers provenant de rejets. La formation de ces derniers s'obtenait au moyen de boutures racinées en serre. De nombreux rejets furent ainsi produits et s'enracinèrent facilement dans des récipients tubulaires. L'obtention des rejets et de l'enracinement variait autant entre les espèces et leurs hybrides qu'à l'intérieur de ceux-ci.

Les méthodes de propagation végétative permettant à l'améliorateur forestier de miser pleinement sur des individus supérieurs dont la valeur tient à un agencement génique avantageux qui peut ne plus se reproduire lors des générations successives.

Les clones ainsi formés constituent une population issue d'un même individu et est caractérisée par le même génotype; ainsi tous ces sujets se comportent de façon homogène qu'il est facile de prévoir. Leur utilisation s'avère donc avantageuse en reboisement.

Les plantations de clones de peupliers représentent un potentiel pouvant satisfaire à la demande croissante en bois. Les principaux critères prêchant en faveur des peupliers comprennent leur grande amplitude écologique, leur croissance rapide, les usages multiples de leur bois ainsi que leur facilité à la propagation végétative.

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