HYBRID POPLAR NURSERY PRODUCTION

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SUMMARY

The following aspects of nursery production of hybrid or cultivated poplars are described: (1) The production of aspen seedlings, with an introduction to aspen seed, its collection and handling, (2) The production of cuttings, with chapters on establishment and management of stool areas, (3) The production of rooted cuttings, and (4) The nursery production of aspen suckerstock.

INTRODUCTION

The methods of hybrid or cultivated poplar nursery production depend on the needs of the plantation management and on the biology of the poplar produced.

The needs of the plantation management determine the quantity and the quality of the stock required. The need for quality, or a certain kind of stock, will vary according to the intensity and the goal of management. Thus, intensive plantation culture will require uniform, clonal stock; while forest-type culture will use less homogenous seedling stock. Plantings in narrow spacing, in which small-size trees for fibre are produced, will require cheap stock, such as cuttings; while wide spacing, for high quality trees, will use more expensive, large, rooted stock.

The biology of cultivated poplar also affects the nursery methods. Some poplar cultivars, such as cottonwoods and balsam poplars, are easy to propagate by cuttings. Naturally, these will be produced by cuttings. Other poplars, such as aspens, can be mass-reproduced readily by seed. So, seedling production has to be taken into consideration for aspens.

The biological properties of poplar and the needs of plantation management resulted in various methods of poplar nursery production. The most important of these are described in the following.

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THE PRODUCTION OF ASPEN SEEDLINGS

The seedling-stock of aspens and their hybrid cultivars is usually requested. For a successful seedling production it is important to understand the specific features of the aspen seed.

The aspen seed is born on female trees (poplars are usually dioecious), on catkins, in capsules. The seeds mature in 3 to 4 weeks in late spring. Good seed crops occur often and during seed dispersal the ground is covered with white fluffy seeds. The seeds are pear-shaped. They are discharged from the capsule with a tuft of long silky hair attached to the proximal end, and are dispersed long distances by wind.

The seed production is abundant. There are approximately 10 seeds in 1 capsule, and 500 seeds in 1 catkin. An average trembling aspen tree bore approximately 1,600,000 seeds (Maini, 1968). The seeds are small and light and there are approximately 250,000 seeds per ounce.

Aspen seed is shortlived in natural conditions. It loses its germinative capacity in 2 to 4 weeks and even sooner if collected immature, or if exposed to heat, moisture and subsequent drying. The longevity of the seed can be prolonged by cleaning and drying at normal room temperature and storing in a dry atmosphere, over calcium chloride at -5 C.

The collection can start when the seed is almost mature. This stage can be detected by a) the capsules, which turn from green to yellowish and start to open, and b) the seed in the capsules, which turns from soft and transparent to hard and white. The mature catkins with opening capsules are placed on a sheet of dry paper, covered with another sheet of paper to stop the seed from flying, and kept at normal room temperature and humidity. The branches collected with immature, green catkins are kept in water (in buckets) at normal room conditions until the catkins start opening.

Once the capsules are completely open and dry the seed is cleaned from the silky cotton attached to it by rubbing it against a piece of window screening until the seeds pass through. The sifted seed is usually mixed with remains of capsules and catkins. As these are lighter than the seed, they can be separated by placing them on a fine screen held over a fan. The clean seed is spread out thinly and dried for a few days at room temperature and then packed in bottles or paper bags and placed in a refrigerator.

Aspen seed germinates in 1 to 3 days. Testing for germinative capacity is simple and always recommended before sowing. Seeds

placed on a sheet of wet filter paper or moist sand covered with glass or plastic and kept at room conditions should germinate and develop cotyledons within a few days. Seed lots showing a minimum of 20% germination are usable.

The aspen seed germinates and survives only on continuously fresh, moist, exposed mineral soils. Seed germination starts with the emergence of the radicle. A brush of fine hairs develops at the junction of the hypocotyl and radicle. These delicate hairs elongate and come in very close contact with the soil particles and anchor the seedlings to the soil surface. Cotyledons appear, and after 2 to 3 days the elongating hypocotyl raises the cotyledons from the ground. The radicle does not penetrate the soil until 6 to 8 days after germination. Before radicle penetration occurs the young germinants are very sensitive, because they live on the soil surface. If the soil surface dries, the germinants wilt and die. Once the root develops and the first leaves appear the seedlings are safer.

The nursery seed beds are prepared with a finely-granulated sandy loam. The soil has to he fertile and fresh. The seed can be sown only when the risk of night frosts has passed. It is sown in a mixture with coarse sand (90% sand, 10% seed), in 1/8" deep, 1" wide trenches, which can be prepared across the beds at 1 ft. spacing. The seed beds are thoroughly watered before sowing. It is very important to keep the soil surface continuously humid and warm, especially during the critical first weeks after sowing. This can be done by building 1 ft. high plastic covered lath frames over the beds, and by checking and watering the seed beds regularly. The frames can be gradually removed when the seedlings have leaves. However, the seed beds have to be continuously managed to the end of the season.

By the end of the season, well-developed seedlings reach 1 to 2 feet in height and can be used as planting stock. When large size stock is required the seedlings are left in the bed for another year. Two-year-old well-developed seedling stock is 5 to 10 feet in height.

For best outplanting results, the seedlings lifted should be completely dormant. Poplar tolerates branch and root pruning. Good stock has completely pruned side branches. The roots can be pruned to a few inches. This facilitates the packing, storing and planting.

The seedlings are sorted according to their height and depending on their size tied in bundles of 5, 10 or 25 trees, and properly heeled-in. They can also be kept in coolers, or frozen (at -5 C), with the roots packed in moisture holding substratum and wrapped

in plastic. The proper labelling of seedlings, for the identification of cultivars, is very important.

At times, container-grown aspen seedlings are preferred over nursery-bed-grown stock. Relatively small-size containers (3/4 to 1" diameter and 4 to 5" deep) allow the growth of 1 to 2 ft. tall aspen seedlings. The advantages of a greenhouse container-system over the nursery seed beds are (i) better control of humidity and heat, resulting in better growth of seedlings, (ii) the seedling production can be started early in the greenhouse, regardless of the outside conditions, and seedlings ready for outplanting can be produced by mid-season. At the Ontario Ministry of Natural Resources (OMNR) Experimental Nursery at Maple, pregerminated seeds are planted in containers in February, and the seedlings are moved from the greenhouse to a lathouse in June for a hardening period.

THE PRODUCTION OF CUTTINGS

The cutting stock of cottonwoods, balsam poplars, their hybrids, as well as some hybrid aspen clones of good rootability is in high demand for nursery and field planting.

Cuttings are parts of dormant, lignified, one-year-old stems or vigorously growing, juvenile, one-year-old coppices (sprouts, whips). In a nursery system, cuttings are produced from annually-harvested whips grown in nursery stool areas.

The stool areas are established by cuttings. These are planted in the spring, in well-prepared fertile sandy-loams. The spacing is narrow, usually 1/2 to 1 ft. in the rows and 2 to 3 ft. between the rows (15,000 to 43,000 stools/acre), to secure the growth of slender, branchless whips desired for cuttings. Monoclonal stool compartments are recommended to maintain the identity of the propagated clones and to avoid mixtures.

Well-managed stools usually produce 3 to 6 ft. long whips in the year of planting and just one whip per stump. These whips can be harvested and used for cuttings. Two-year-old and older stools produce several vigorous whips per stool, some 10 ft. or more in height. The growing potential of stools peaks at 3 to 6 years of age, and then gradually subsides. Stool longevity depends on soil fertility, management and clonal characteristics. However, most stools perish and have to be renewed after 10 to 15 harvests.

Stool areas have to be managed intensively for good production. Fertilization, irrigation, pest and weed control must be applied when needed. However, caution is recommended with the use of

herbicides, many of which can be harmful to poplars.

The whips produced in stools can be harvested during the period of dormancy, from fall to spring. Biologically, the late winter or early spring cutting of whips does the least damage to the reproductive ability of stumps. However, fall and winter harvesting gives the advantage of using labour during less busy nursery seasons.

The whips are cut at the ground level, or close to the ground. Presently, the operation is manual, but mechanical cutting devices can be developed. The cut whips are sorted, bundled and protected from drying by heeling-in or proper storing in a cooler (for a short term) or a freezer (at -5 C). The bottom 2 ft. of properly stored whips should be packed in a moisture-holding substratum.

Cuttings are made from whips by using scissors, shears, or fine-tooth saws making clean, sharp cuts. The entire length of whips can be used for cuttings, except for the soft, unlignified terminal part. The diameter: of the whip is not a determining factor as long as the part of the whip used for cutting is lignified, and the cutting made is technically plantable. Even parts of whips with side branches can be used after proper pruning. However, the use of side branches for cuttings should be avoided, because topophytic effects (branch-like growth) may occur.

The clonal purity and identity of cuttings must be preserved. Therefore, the whips of different clones must be separated, and all the cuttings and unused parts of whips of a clone cleaned away before the whips of another clone are taken for cuttings.

The cuttings made are properly sorted, packed, labelled and stored. They are first separated into classes according to diameter (large - 1" minimum diameter, medium - ⅝" minimum diameter, small - less than ½" diameter), buds lined-up in the same direction, and tied in bundles of 25. Each bundle is labelled with an appropriate clonal number or code. At times, colour coding is used by dipping the top section of bundled cuttings into a latex-based paint. Such coding gives the advantage of quick sighting of the top of the cutting (important in the course of planting) and of identifying the clones after planting. For storage, the cuttings are placed either in sealed plastic bags or in a moisture holding substratum and kept frozen (at -5 C). It is important to protect the cuttings from dehydration not only in storage, but also in the process of preparation and in transport.

Cuttings of different lengths are used for various purposes of planting. However, even the shortest cuttings must have at least

one axiliary or adventitious bud to allow new shoot growth. Shorter cuttings (6 to 8 inches) are used in the nursery where good rooting conditions can be secured for the production of rooted stock or to establish stool areas. Long cuttings (10 to 20 inches), with more food reserves, are used for less controllable field plantings. Very long cuttings or poles of up to 10 ft. in length are sometimes requested for special planting purposes (such as deep planting in sandy soils of high ground water level).

THE PRODUCTION OF ROOTED CUTTINGS

Rooted cuttings of cottonwoods, balsam poplars and their hybrids, as well as of hybrid aspens of good rootability, are often needed as planting stock.

Rooted cuttings are produced by planting cuttings and growing them in nursery rooting beds, on well-prepared, fertile and fresh sandy loams. Monoclonal compartments are established to avoid clonal mixtures.

The cuttings are planted vertically to the ground level and the soil is well packed around them. Usually, 6 to 8 inch long cuttings are planted in the spring. Soaking of cuttings in water for 2 days before planting promotes the rooting success especially with cuttings which were previously stored and transported. The spacing can vary from ½ to 1½ ft. in the row, and from 2 to 3 ft. between the rows (approximately 10,000 to 43,000 cuttings/acre), depending on the size of the stock grown: one-year-old rooted cuttings, from 2 to 6 ft. in height, can be produced in narrow spacings, while two-year-old rooted cuttings, from 6 to 14 ft. in height, can develop in wider spacings only.

The rooting beds do not have to be equipped with special misting systems. However, they have to be well maintained and irrigated in the case of dry spells. Fertilization, pest and weed control also have to be applied, when needed.

The rooted cuttings can be lifted during the period of dormancy, either in the fall or in the spring. The lifted stock is branch-pruned, root pruned, packed and stored similar to the seedlings.

In addition to one- and two-year-old rooted cuttings, stock with one-year-old-stems and two-year-old root systems is sometimes produced. Such stock develops when the stems of one-year-old rooted cuttings are cut back, and new, vigorous sprouts grow from the well-established stumps left in the ground. The cut-back stems can be used as cuttings if needed.

THE PRODUCTION OF ASPEN SUCKER-STOCK

The rooting ability of aspen stem cuttings is poor, thus the clonal propagation of aspens by rooting cuttings is difficult. However, aspens typically regenerate by suckers (adventitious shoots formed on roots). This ability of aspens can be used practically for clonal propagation, when producing suckers as planting stock in nursery.

Suckers of satisfactory quality and known origin seldom can be found in large quantities in stands. Such suckers are often growing on decayed roots and have an unbalanced root system or are of uncertain origin.

Root cuttings of aspens, planted in greenhouse or nursery rooting beds, will sucker and form a new tree. However, root cuttings of a specific tree rarely can be supplied in desired quantity and quality for nursery propagation.

The limited number of suckers or root cuttings obtained from a desired tree can serve, nevertheless, to initiate a large-scale clonal propagation. For this, Zufa (1971) proposed the following method, which has been experimented and proven feasible in several OMNR nurseries.

The initial, limited in number, sucker- or root-cutting stock is planted in a nursery compartment. Monoclonal compartments are established on fertile and fresh soil. To prevent clonal mixtures each compartment or nursery sucker bed is divided by heavy plastic sheets, sunk into the ground. This prevents the growth of roots beyond compartment boundaries. No other aspen trees are left close to nursery sucker beds.

The initially planted suckers or root cuttings are left for a period of 1 to 3 years to grow to a desired size and develop an abundant root system. The suckers are then lifted and used either for further propagation or as planting stock. More suckers then develop from the roots left in the soil. These can be lifted annually or bi-annually and used as planting stock. Such propagation can continue for a number of years, giving several generations of suckers.

The nursery sucker beds are managed intensively; they are fertilized, irrigated and weeded, according to needs. During the growing season the developing suckers are pruned and thinned to a desired number. The lifted suckers are branch pruned, root pruned, sorted, packed, labelled and stored similar to the rooted cuttings.

Some of the lifted suckers will have unbalanced roots or improper

stems. These can be either discarded, or cut back and put in a transplant bed, to develop to a stock of plantable size and quality.

LITERATURE CITED

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