

a small area of the rooting chamber is negatively affected. As our experience and knowledge of the system expands, problems diminish. Cuttings generally root 80% to 100%. Most species root up in 1 to 4 weeks.

ROOM FOR IMPROVEMENT

A controller that adjusts flow level or switches unit on and off by monitoring RH directly is used. Currently there are no humidistats reliable at such high humidity. Possibly install another 2-stage controller to give a total of four settings automatically responding to temperature and/or solar intensity.

SUMMARY

Fan-forced fog using a Humidifan is a viable alternative for rooting softwood cuttings. A very low flow water source is sufficient to cover a 900 ft² area. Initially maintaining optimum conditions for rooting can be challenging. Once familiar with the system and with the proper controller in place, the optimal environment can be attained and cuttings rooted successfully.

The Forest Nurseries in Northeast China®

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The forest region of northeast China includes the forest areas of Heilongjiang, Jilin, and Liaoning Provinces and the forest area in the eastern part of Inner Mongolian Autonomous Region. It is the largest forest region and the most important timber production base in China.

There are very good forest nurseries in this forest region of Northeast China. It is said that if you want to find good nurseries in China, go to the forest region of Northeast China. There are 83 forest industry enterprises (state-owned and managed) in the forest region of Northeast China and each county in the region has its own forestry bureau. Each enterprise and forestry bureau holds one or two standard nurseries with relatively good facilities. For example, Hongwei Nursery in Lushuihe Forest Industry Enterprise in Jilin Province houses a small meteorological station; facilities for employee's rest such as a small park; and rooms for stay and short rest; facilities for seedling growing such as seed cellar, seedling cellar, road system, irrigation system, septic tank, and sterocorary, and equipment for soil tilling, seedbed forming, sowing, and lifting; they can also conduct seed tests and scientific research work, and they have their own specimen room and archives for various regulations and records. Not all of the standard nurseries are equal to Hongwei Nursery, but as a standard nursery, it is essential to have the proper irrigation and fertilization system, road and drainage system, seed treatment and seedling growing facilities, and business office. Software management such as archives and advertisement are very weak in most nurseries because most of the nursery managers do not have such a need and the seedlings grown in these nurseries are mainly used within the enterprise or bureau. They need time and outside influences to change their ideas and be more market driven.



Figure 1. Four-year-old *Pinus koraiensis* seedlings in 2-2 pattern are ready for lifting in Dailing Nursery in Yichun forest region of Heilongjiang Province.

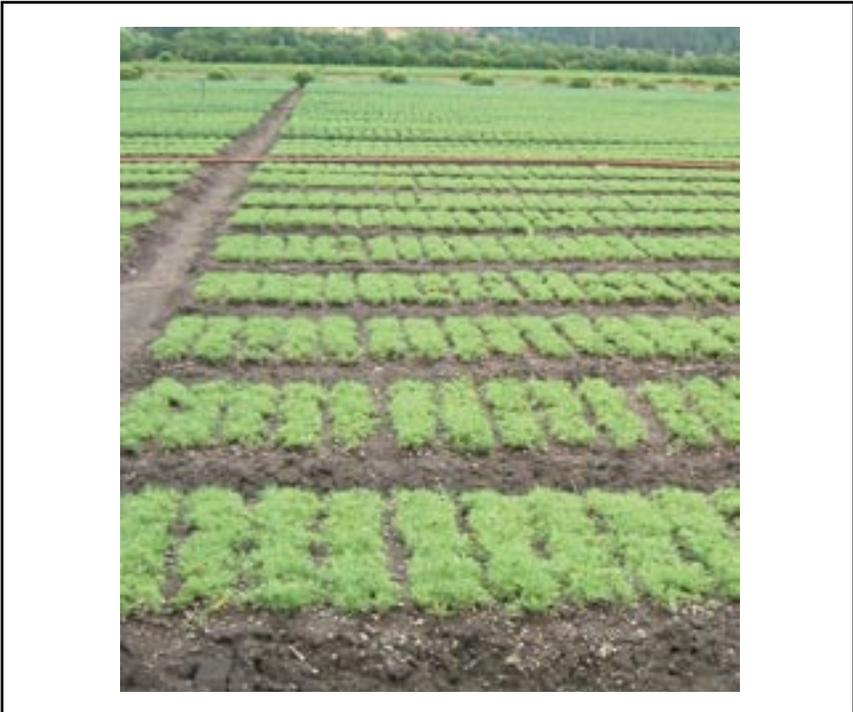


Figure 2. Two-year-old *Pinus koraiensis* seedlings in 2-0 pattern are ready for transplanting to new seedbed in Wuying Nursery in Yichun forest region of Heilongjiang Province.

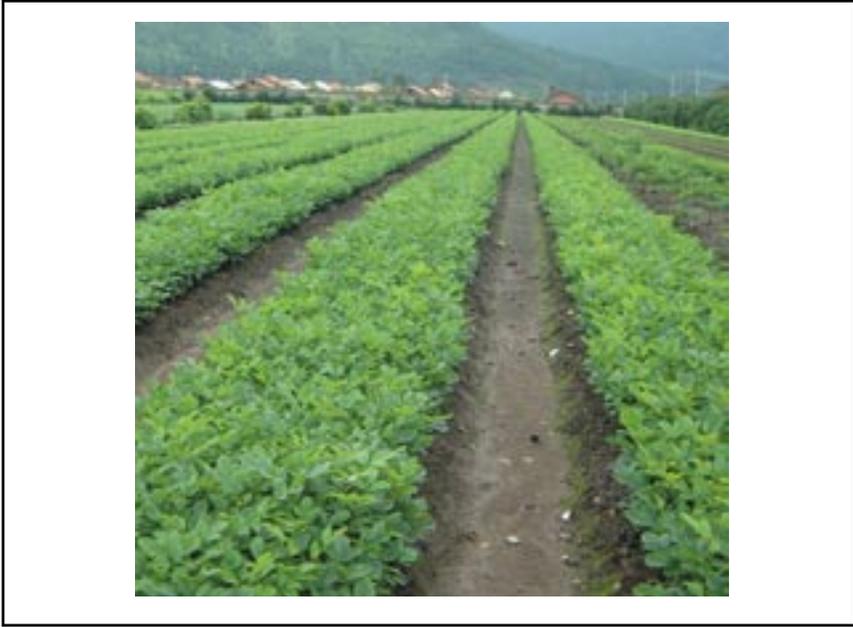


Figure 3. One-year-old seedlings of *Fraxinus mandshurica* ready for planting in Dailing Nursery in Yichun forest region of Heilongjiang Province.

Most of the activities in our nurseries, such as sowing, weeding, thinning out seedlings, seedling sorting during lifting, transplanting, and sometimes fertilizer and insecticide dispersing, are done by laborers. Mechanical operations are limited to a small scale such as seedbed forming and root undercutting before lifting. Irrigation and fertilizing are generally operated automatically by sprinkler irrigation systems. This is mainly because it is less expensive to use manpower. Partly because of the above-mentioned situation and partly because of lacking proper technical support, most decisions in nurseries are decided mainly by experience, for instance, most of the nurseries do not know the pH value of their irrigation water, and rely on experience to determine the amount of irrigation and fertilization to use, not by testing as in U.S.A. They are not aware how to change this situation; they need to learn from other advanced countries like U.S.A. and Canada.

Korean pine (*Pinus koraiensis*) (Fig. 1), Korean spruce (*Picea koraiensis*), Manchurian Scots pine (*P. sylvestris* var. *mongolica*) and larch (*Larix gmelinii* in northern part, *L. gmelini* subsp. *olgensis* and/or *L. kaempferi* in southern part of Northeast China) are the main species artificially grown in Northeast China. Sometimes broadleaved trees such as poplars (many cultivars), *Fraxinus mandshurica*, and birch (*Betula platyphylla*) are also grown. We plant these species for two purposes: timber production and ecological benefits. But now we also have tree crops just for timber production in our region, some fast-growing poplar lines can reach 8 m high and 8 cm thick when 3 years old, even when grown in relatively high density. Table 1 shows a sample.



Figure 4. Simple green house in Dailing Nursery in Yichun forest region of Heilongjiang Province. Seed are sowed at the beginning of March and the seedlings will be moved to open land at the end of June, then seed are sowed again at the beginning of July and the seedlings will be in green house without coverage in winter till next March. In this manner, standard seedlings of *Pinus koraiensis* can be obtained in 2 years.

Table 1. Seedlings ready for market in Youyi Nursery of Youhao Forest Industry Enterprise (18 May 2004)

Tree species	Age type (yr)	Seedling height (cm)	Number ($\times 10^4$)
<i>Larix gmelinii</i>	S1-0	10-18	300
<i>Pinus koraiensis</i>	S2-0	8-12	100
<i>Pinus koraiensis</i>	S2-3	30-50	4
<i>Picea koraiensis</i>	S2-0	8-15	150
<i>Schisandra chinensis</i>	S1-0	10-18	150
<i>Schisandra chinensis</i>	S2-0	30-50	15
<i>Aralia mandshurica</i>	C1-1	25-45	2
<i>Populus ussuriensis</i>	C1-1	50-100	10

For conifer species, seeds were sowed in high seedbed density (1000–2400 seeds/m², emergence rate is above 90%), in wide rows (10–20 cm) in south-north direction on seedbed in east-west direction and stay in seedbeds for 1–2 years (depending on species grown and location) (Fig. 2), then transplanted to a new seedbed for 1–2 years in low seedbed density (100–400 seedlings/m²) (Fig. 1). Mulching in winter protects seedlings and soil mulching shows very good effects. For hardwood species, there are no strict regulations on seedbed density patterns. Usually, hardwood seedlings like *F. mandshurica* will be lifted when 1 year old, therefore, the seedbed density is low (150–200 seedlings/m²) (Fig. 3). However, most poplars are asexually propagated as clones and they may stay in seedbed for 1–3 years.

We also have greenhouse production in Northeast China. Some nurseries have very modernized greenhouses as in U.S.A., but they are not suitable for commercial seedling production because of high costs. Simple polyhouses (Fig. 4) are more suitable. Such simple houses can produce two crops a year (sowing in March and July); the first crop is removed for acclimatization at the end of June and the second crop is left in house with no cover during the winter period before next March. Paper pots are very popular and the medium is specific for each species. Because of poor environmental control systems, our container seedlings are not as good as seedling produced in countries such as the U.S.A. with there fully automated systems.

We also have horticultural nurseries in Northeast China. Some old nurseries grow good quality large specimens for city greening, however, most of the new ones as well as some forest nurseries grow poor nursery plants because of technological and management problems. They need technological and management help from advanced countries to improve their propagation and management.

I cannot tell you all about our nurseries by this short poster. “Seeing is believing”, if you want to know more about our nurseries and seedling growing, you can come to Northeast China. I hope some day that our annual meeting will be held in Northeast China (Northeast Forestry University in Harbin) (2006?, 2007?, or...?). At that time you can learn more about our nurseries and seedling growing. The fall scenery in forest region of Northeast China is very beautiful and attractive.