were made. As a result of investigations in various artificial plantations of cryptomeria, it was found that in natural conditions cryptomeria of types I and II suffered less frost damage than tree-type III.

Twigs of different tree-types collected at random in midwinter were frozen at -20^0 C for 20 hours to determine the degree of frost-hardiness. Twigs from trees of types I and II were much hardier than type III. Besides, in the seasonal variations during the period from November to May, both frost-hardiness and osmotic concentration were much greater in the twigs of type I than type III. Twigs from trees of type I were also much greater than type III in desiccation resistance.

From these results, 750 trees of typical type I, ranging from 5 to 12 years were selected with reference to tree-type from artificial plantations of 770 hectars and marked. Finally, 46 trees with the highest frost-hardiness and high cutting ability among 750 trees were selected by 3 freezing tests and one cutting test.

Résumé

Titre de l'article: *Sélection de* Cryptomeria *résistant au* froid. I.

On a réalisé certaines expériences en vue de sélectionner, dans des plantations artificielles de 770 hectares, au sud d'Hokkaido, des *Cryptomeria* résistant au froid. On a trouve, d'après les etudes faites dans diverses plantations artificielles, que les *Cryptomeria* de types I et II souffrent moins des dégâts du froid que les arbres de type III.

Des rameaux d'arbres de divers types récoltés au hasard au milieu de l'hiver ont été soumis a un froid de -20^0 *C* pendant 20 heures, en vue de déterminer le degré de résistance. Cette expérience a confirmé que les arbres de types I et II étaient plus résistants que ceux de type III. En outre, de novembre a mai, la resistance au froid et la pression osmotique étaient ensemble plus élevées dans les rameaux de type I que dans ceux de type III. De plus, les rameaux des arbres de type I resistent beaucoup mieux à la dessiccation que ceux de type III.

D'apres ces resultats, 750 arbres du type I, de 5 a 12 ans, ont ete sélectionnés et marqués dans cette plantation de 770 hectares. Finalement, on a retenu, parmi ces 750 arbres, 46 arbres qui, d'après trois tests de resistance au froid et un essai de bouturage, montrent la meilleure resistance et la meilleure aptitude au bouturage.

References

OKANOUE, M.: Depth of frozen ground on slopes with no snow cover in winter. Japan Forest. Soc. 42, 339—342 (1960). — SAKAI, A.: The relationship between the process of development and the frost hardiness of the mulberry tree. Low Temp. Sci., Ser. B. 13, 21—31 (1955). — SAKAI, A.: The effect of temperature on the hardening of plants. Low Temp. Sci., Ser. B. 14, 7—15 (1956). — SAKAI, A.: Relation of increase of carbohydrate and water soluble protein to frost-resistance in tree. Low Temp. Sci., Ser. B. 15, 17—29 (1957). — SAKAI, A.: Relation of increase in sugar concentration to dehydration resistance. Low Temp. Sci., Ser. B. 17, 35—41 (1959 a). — SAKAI, A.: The frost-hardening process of woody plant. V. The relationship between developmental stage and frost-hardening. Low Temp. Sci., Ser. B. 17, 43—49 (1959 b). — SAKAI, A., TAKATOI, I., and WATANABE, T.: Frost damage of seedlings of Yezo spruce grown in frozen soil. I. Jap. Forest. Soc. 45, 412—420 (1963). — SAKAI, A.: An electrolytic method for testing the survival of tree and for evaluating its frost-hardiness. Jap. Forest. Soc. 46, 142—144 (1964 a). — SAKAI, A.: The frost-hardening process of woody plant. X. The effective frost-hardening temperature in twig. Low Temp. Sci., Ser. B. 22, 29—50 (1964 b). — SIMIYQVITCH, D., and BRIGGS, R. D.: Studies on the chemistry of the living bark locust in relation to its frost hardiness. III. The validity of placmolysis and desiccation tests for determining the frost-hardiness of bark tissue. Plant Physiol. 28, 15—34 (1952). — WILNER, J.: Relationship between certain methods and procedure of testing for winter injury of outdoor exposed shoots and roots of apple trees. Canad. J. Plant Sci. 41, 309—315 (1961).

Scaffolding for Work in Tree Crowns

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More and more attention is given to the development of tools in forestry which enable the ascension and climbing in crowns of high trees notably at the collection of forest tree fruits. A summarizing report carried out by FAO gives a total survey of these tools used in various parts in the world (MATUSZ 1964).

Forest research indicates more complicated problems because of more difficultios and challenging work output, more challenging than the usual collection of fruits. The work in crowns is mostly repeated on the same tree for several times and it is often necessary to erect various aids and apparatuses in the crown or in precincts. The present tools are not fully suited for the climbing of trees, mainly for the reason that they enable only access to the stem and not to all parts of crown, notably to its surface and top. In our conditions the tree net used for large American trees is unsuitable (SEAL, MATTHEWS, WHEELER 1962). Also the use of transportable ladders and extension platforms is mostly limited only on the lowest trees (up to 20 m.) and on localities with suitable terrain conditions (accessible ways).

For this reason, the controlled pollination in forest tree breeding or physiological and rnicroclimatical investigations use mostly complicated tower constructions. Towers are as a rule of wooden material (ROHMEDER-SCHÖNBACH 1959); recently also metal tubes applied in the system of bvilding scaffolding are used. Besides that there exist also brick box constructions; for instance, FRASER (1957) describes a light portable tower from alluminium composed of individual frame parts.

These construetions enable work in tree crown space in several stories (according to the allocation of working platforms) and secure the maximal accension to the crown and the work safety. But their common drawback is a large consumption of material notably at the erection on large trees (high cost value) and high labouriousness (at the transport to the place of destination, at the construction and dismantling). This conduces high costs of these devices and makes the broader use in forest research impossible.

A new type of a simple mounted pollination tower for high trees was designed by my countryman CHIRA (1963).

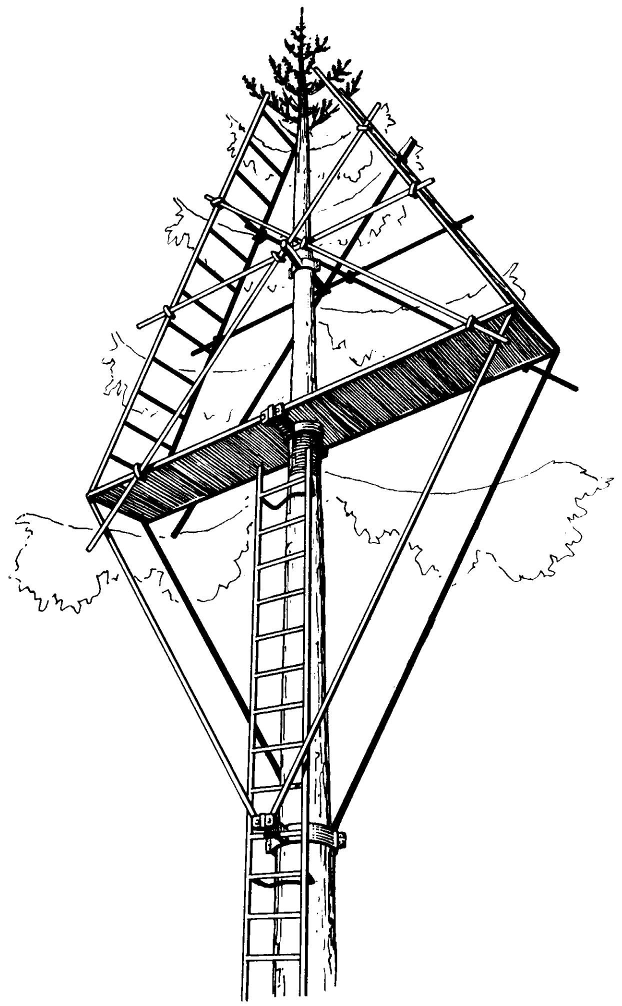

Figure 1. — Drawing of ladder scaffolding for work in crowns of trees.

The main principal of this construction is the fact that the main supporter is the tree stem. The working platform is borne by a system of supporting and connecting tubes mounted on the stem holders. The platform is composed of individual floor sections in one level on the girth of the whole crown and is equipped with railing. This enables comfortable work in one level, mainly in the lower part of crown. The whole construction is relatively rapid, the consumption of material with reference to the tree height low.

The development of the main idea of this construction is a further type of ladder scaffolding for work in tree crowns (Ch ra-Vinš 1963). This type of "brick box construction" is composed of double gallery mounted by means of a holder on to the tree stem across the crown about 6 m. under the tree top. This place of the stem represents a supporter of sufficient strength (ϕ 15—20 cm). The gallery is on the outer ends supported by two pairs of oblique struts mounted by an other holder on the stem. The gallery consists of welded frame with revolving sill and strong profile sheet metal, the proper floor of the gallery. From both sides of the crown on the outher ends of the gallery there are in two revolving sills two double ladders 6 m. long. Both opposite ladders are mounted obliquely on the crown surface by a pair of spreaders and a further holder on the tree stem. The spreader represents simultaneously the railing of the working gallery which on both ends exceeds the proper ladder construction and forms a platform for secure ladder ascension and descension. The reinforcement of the whole construction and fastening of ladders is further based on the use of oblique supporting by means of further mutually connected supporting tubes from both sides of ladders. The diagram of the whole construction is obvious from the drawing and the description of main parts.

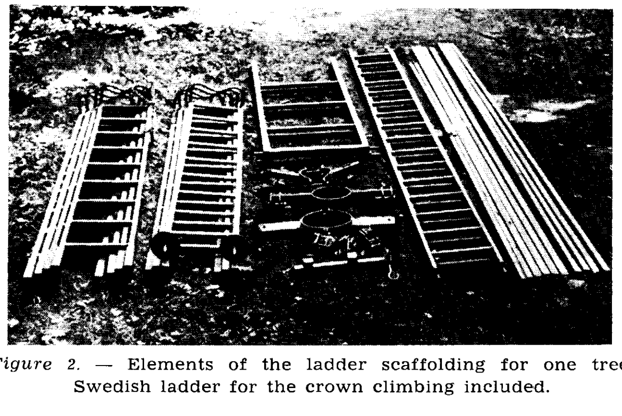

Figure 2. — Elements of the ladder scaffolding for one tree, Swedish ladder for the crown climbing included.

Figures 3, a—b. — Work in tree crowns on ladder scaffolding for controlled pollination.

The construction of scaffolding and other works like maintaining and repair use the folding ladder (Swedish type) from two meter parts with a supporter fixed on the stem by means of a chain. This ladder ist a part of the whole device. At the use of other tools for repeated ascensions into crowns ("Baumvelo" climbing device, rope ladder, simple hoisting device etc.) ladder of several sections can be applied for the construction and dismantling of more scaffoldings.

The described construction is made from special steel tubes, the so-called Jökl profiles. The connecting material are bolts and stirrups. The whole construction, ladder included, weighs about 300 kg., the largest dimension is the lenght of the supporters 450 cm. The supporting parts of the ladder and chains are covered by rubber for preventing damage on stem. Holders are padded by wooden pads supported on the stem side also by a broad belt of hard rubber. In this way, pressures mainly of the supporting holder are spread on a larger area and the stem is not mechanically injuried and physiological functions are not disturbed. A complement to the construction is a pulley for hoisting the individual components at the construction and dismantling.

Tests of the prototype described scaffolding were successful and results are fully satisfactory. The relatively low weight of the whole device enables easy transport up to the place of construction (a small one ton lorry may transport three sets). The construction in the tree crown is relatively simple and the work done by three — four workers team requires only 3—5 hours (according to the tree height). The scaffolding enables the ascension and work on the whole crown surface as the side branches can be drawn nearer to the ladder. When using the scaffolding at widespread crowns or when carrying out special works on the whole crown the device can be completed also by another gallery and a pair of ladders so that the crown surface is accessible from four parts. This type of ladder scaffolding is suited for trees with straight stem and long conical crown. It may be used notably at conifer breeding (Norway spruce, silver fir, larch, Douglas fir, *Abies grandis* etc.) as it enables all works at the controlled crossing (control of flower development, isolating of flowers, pollen collection, artificial pollination, observation of further development and collection of fruits) also in the top parts of the crown where most flowers are concentrated as a rule. But we can make use of the scaffolding for other tree species and for other investigations in tree crown space, like physiological, phenological or microclimatological studies etc., in some cases also in the practice (harvesting of cones in trees with frequent rich fruiting etc.).

At present serial production of scaffolding is secured in our country. Contingent more detailed information on the use and production of the above mentioned climbing device is given by The Forestry Research Institute at Zbraslav Strnady (or directly by the author of this article).

Literature Cited

FRASER, D. A.: A Light Portable Tower to Facilitate Measurement of Vertical Gradients in Tree Studies. Forest Research Division, Technical Note No 62, 1957. — CHIRA, E.: Nový typ jednoduchej montovanej opeluvacej veže pre vysoké stromy. Lesnická práce 42, 39—40 (1963). — CHIRA, E., und VINŠ, B.: Lešení pro práce v korunách stromů. PV 4393 ze dne 31. 7. 1963, Čs. patent č. 115551. — MATUSZ, S.: Collection of Seeds from Standing Trees. FAO — Eurof. for. Comm. — FAO/ECE/LOG/144, 1964. — SEAL, D. D., MATTHEWS, J. D., WHEELER, R. T.: Collection of Cones from Standing Trees. Forest. Comm.-Forest Record 39, 1962. — ROHMEDER, E., und SCHÖNBACH, H.: Genetik und Züchtung der Waldbäume. Hamburg u. Berlin, 1959.

Newsletter

Proceedings of the Seventh Southern Conference on Forest Tree Improvement. Gulfport, Mississippi, June 26—27, 1963. Sponsored Publication No. 23 of the Committee on Southern Forest Tree Improvement, 74 p.

NICHOLSON, G. W. E.: Impact of the pulp and paper industry upon forestry in the Southern United States (p. 1): —

Sixty per cent of the pulp production in the United States originates in the twelve southern states, for which 25 million cords of wood (60 million cubic meters) are cut annually. Approximately 100 000 men and women are employed in the pulp and paper industry. It is expected that 75 or 100 million cords will be harvested at the turn of the century.

STEVENSON, D. D.: Site preparation, fertilization, other cultural practices (p. 3): —

In the southern pine forests, controlled burning, drainage, fertilization, and release from weeds have shown to be economical in a number of cases. Thinning in natural stands of *Pinus elliottii*, for example, must be mechanized to a greater degree to become profitable. Plantations will be grown at a wide spacing without thinning and harvesting will be done by clear-cutting.

CHAIKEN, L. E.: Future management of the southern pines (p. 5): —

More intensive management is predicted with increased mechanization of the harvesting process.

MCKNIGHT, J. S.: Hardwood silviculture in tomorrow's southern forest (p. 9): —

About 100 million acres (40 million hectares), i. e. one-half of the forest area in the South, is dominated by hardwoods. Seventy million acres are capable of growing high-quality timber rapidly. Until recently plantability of hardwoods has been low but now it is known that *Populus deltoides, Liriodendron tulipifera, Liquidambar styraciflua, Platanus occidentalis, Fraxinus pennsylvanica* and some *Quercus* species can be planted. The genetic improvement of these species will be particularly advantageous.

MAKI, T. E.: Better forest management through better adaptation (p. 12): —

When planting native and exotic species, the adaptation that has taken place to climate, soil and biotic factors of the native locality must be considered carefully.

BARBER, J. C.: How much is forest genetics helping the forester by increasing growth, form, and yield (p. 16): —

A review assembles heritability data on various characters associated with growth, form, and yield. The improvement possible in a clonal seed orchard after roguing of poor clones is estimated as 10 to 15 per cent in volume, 4 to 6 per cent in specific gravity, and reduction of several per cent in compression wood. A 10-per cent increase in yield is equivalent to $ 90.63 that could be spent per pound of seed. Tree improvement is therefore economical and should be pursued aggressively.

MCELWEE, R. L.: Genetics in wood quality improvement (p. 21): —

Heritability estimates of several workers show that improvement of wood quality is possible. In seed orchards of *Pinus taeda* increased pulp yields of 40 pounds per cord (16 pounds per cubic meter) and increases of fibre or tracheid length up to 0.5 mm plus improvements of other fibre qualities seem feasible.

JEWELL, F. F.: How can genetic control of diseases aid the forest manager? (p. 25): —

Examples show that disease control may well be one of the early practical results of a breeding program.

CECH, F. C.: Breeding methods in tree improvement (p. 27): —

Following a review of breeding methods, past and present improvement estimates are discussed. In the South a 15 to 25 per