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Controlled Pollination

OF DOUGLAS-FIR

A Pictorial Manual on Technique

By Kim K. Ching



Research Note 40

April 1960

Forest Lands Research

OREGON FOREST RESEARCH CENTER

Corvallis

CONTROLLED POLLINATION of DOUGLAS-FIR

A Pictorial Manual of Technique

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Research Note 40, February 1960

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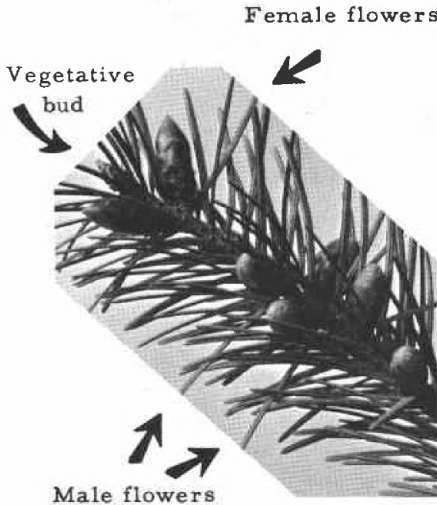
CHOOSE PARENT TREES

Forests can be improved by selecting parent trees. Controlled pollination is a powerful tool of the forester. Wood quality, drought resistance, growth rate, or other characteristics are influenced strongly by inheritance.

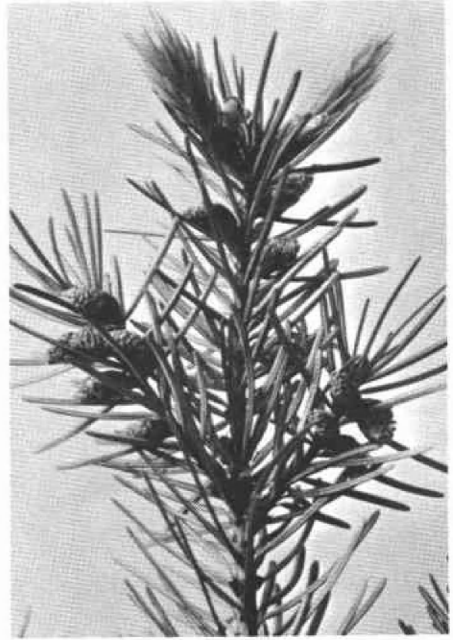
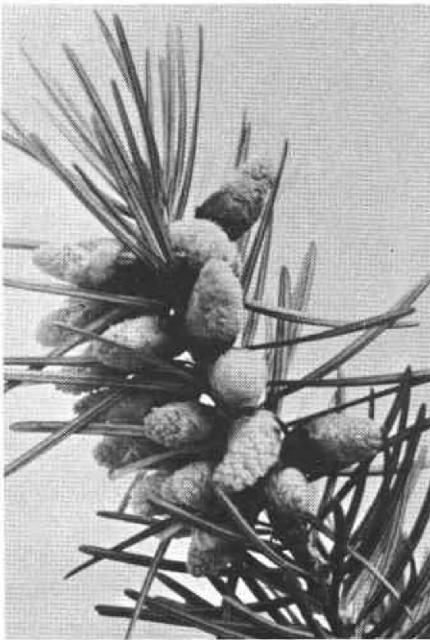
The tree pictured above obviously differs in foliage from its neighbors; desired characteristics may be similarly evident, or may be hidden. Whatever they are, controlled pollination of selected parents will help to perpetuate them in the new timber crop.

Information on following pages applies to Douglas-fir; other species may require different techniques. Suggestions presented are intended for practicing foresters; techniques that are complicated or require special equipment have been omitted.

IDENTIFY FLOWERS



Both male and female "flowers" (strobili) are found on the same twigs in Douglas-fir. Female flowers form laterally close to the terminal bud; usually one, two, or more to a twig. Male flowers, smaller than the female but much more numerous, cluster along the twigs.



As male flowers mature, pollen sacs rupture. Flowers on left are almost ready to shed pollen; on right, pollen is in production. At this stage, pollen can be collected by shaking the branches bearing opened male flowers inside a paper bag.

COLLECT POLLEN

To prevent mixing pollen from various sources, branches can be cut prior to pollen shedding in late March or early April for forcing indoors. On tall trees, branches can be shot off with rifle or shotgun. Keep cut ends of the branches under water, or moisten and wrap in plastic bags.



Place selected branches in jars of water, on paper spread to catch pollen. Ordinary room temperature of about 70 F, with relative humidity about 66 per cent, will encourage pollen shedding in a day or two, if male flowers show pollen sacs when cut (left lower picture on page 2).



Tapping twigs when pollen is being produced will assist in dislodging the grains onto a paper held under them.

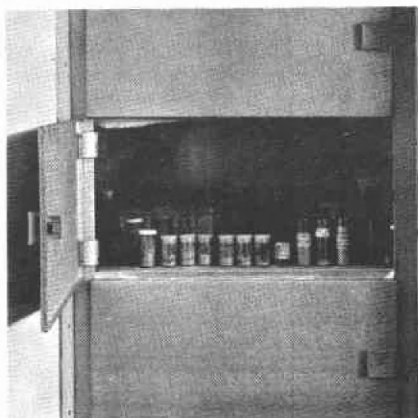


STORE POLLEN



A 60-mesh screen will separate pollen from needles and other debris.

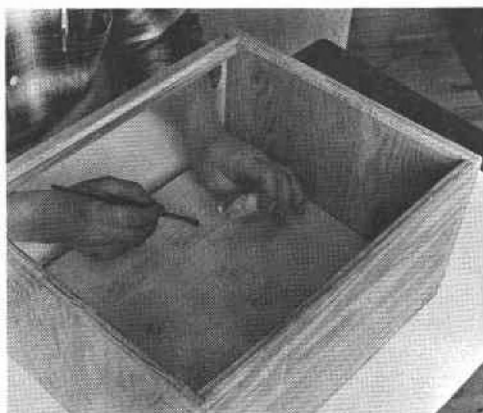
Pollen can be used immediately, or can be stored for about a year in capped glass or plastic containers in a refrigerator at 34 F. For prolonged storage, a deep freeze will serve. Lack of control of relative humidity in storage may cause some loss of viability.

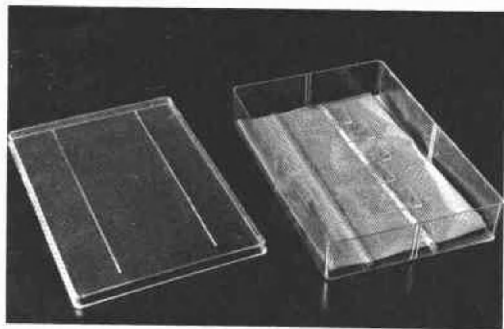


TEST POLLEN

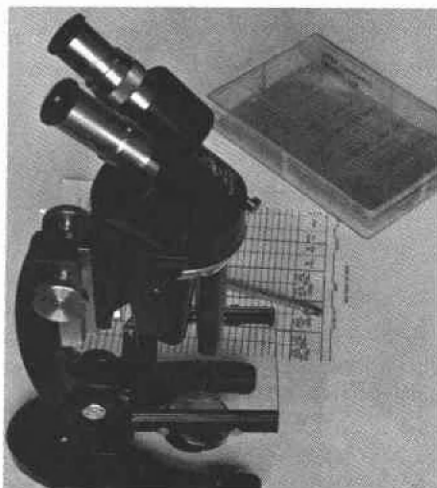
Viability of the pollen should be checked after storage to avoid loss of time or confusion over results. Pollen can be germinated in small vials of distilled water. The pollen

also can be tested by other methods. The glass slides pictured are coated with a one per cent solution of bacto-agar containing 10 per cent sucrose (cane sugar). Pollen is dusted lightly over the agar with a Q-tip for one-time use, or with a brush that should be sterilized in alcohol and dried before dipping into a new lot.





After dusting the agar coating with pollen, the slides are incubated at 80 F for 24-48 hours. Here, wet paper towels in the container maintain moist conditions needed to germinate the pollen.

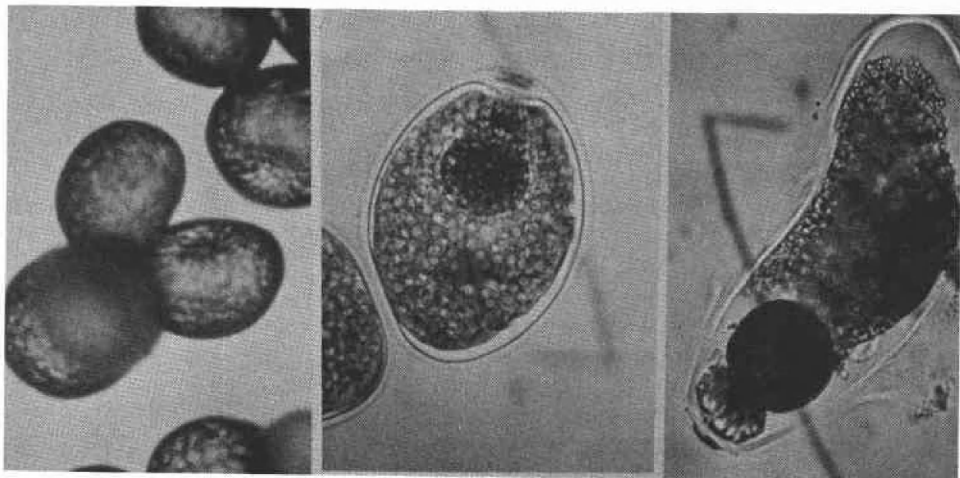


Progress of germination in Douglas-fir pollen can be seen with a low-power microscope at about 36 diameters magnification. At this low magnification, almost any microscope will be satisfactory.

Here, the pollen grains have not started to germinate.

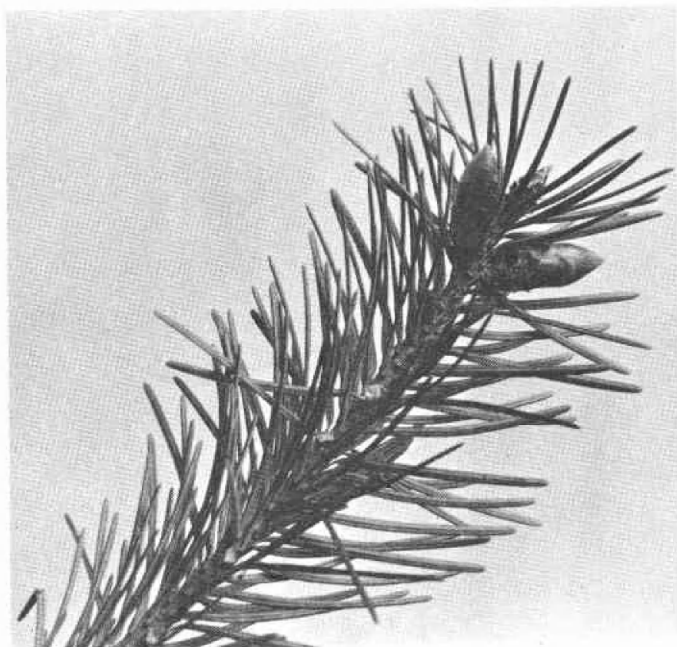
After incubation, this pollen grain shows signs of germination.

Germination has proceeded so that this grain has started a tube.

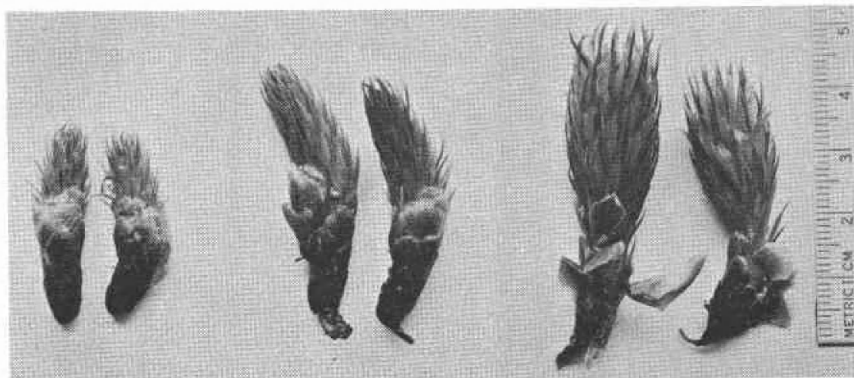


PREPARE FLOWERS

Female flowers must be isolated while still in the bud stage to avoid contamination with unwanted pollen. First step is removal of male flowers on the same branch.



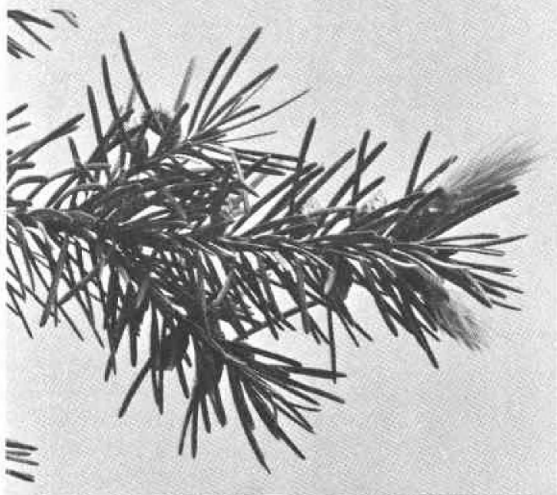
After the branch is bagged, the female flowers must develop to a receptive stage before injecting pollen. The three pairs of flowers below show stages about five days apart. The right-hand pair is receptive, but is not open enough to ensure optimum results.



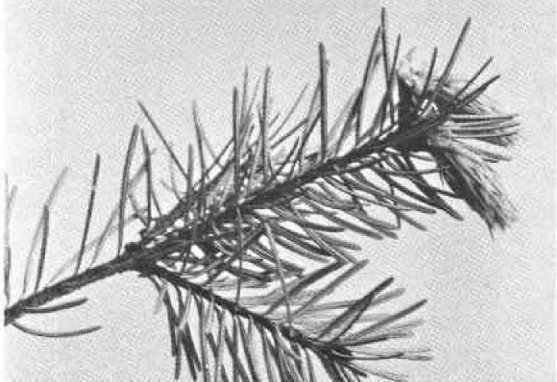
At the most receptive stage, female flowers are completely open and stand up-right on the twig end. This stage may last ten days.



When the scales of the potential conelet begin to close, optimum time for injecting pollen is long past. Male flowers still on this twig should have been removed, also.



After pollination, the scales close, the conelets point downward, and elongation proceeds.



INJECT POLLEN



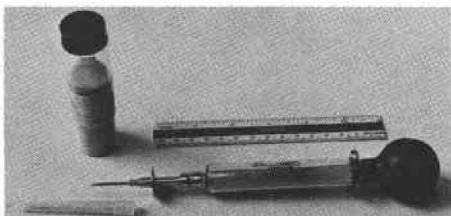
To maintain protection against contamination from unwanted pollen, the branch bearing female flowers is placed in a bag. Shown here is a double-layered canvas bag with a plastic win-

dow. Others are made from viscose casing or parchment. A. R. Liddicoet tells how to make the pictured bag in Forest Research Note 47, California Forest and Range Experiment Station, Pinus Pollination Bag Construction.

Bag, cotton, and tie with identifying tag are shown here separated. The cotton is wrapped around the branch at the point where the bag will be tied.



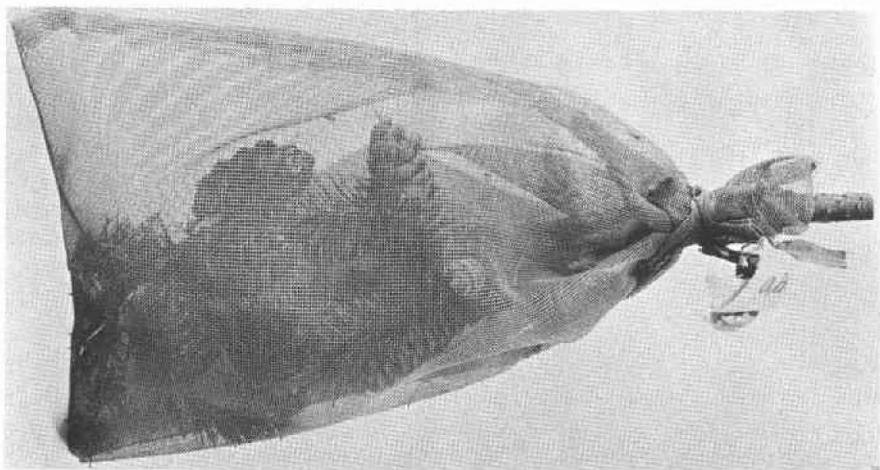
Equipment for injecting pollen. The glass or plastic hypodermic needle is equipped with a rubber bulb and internal glass tube so made as to agitate the pollen when in use. The needle size is number 18. Note cap for protection to (and from) the needle. A separate, sterilized syringe and needle should be at hand for each batch of pollen when several are to be applied to a given tree.



Push the needle through the bag, and inject pollen directly onto the flowers. If pollen supply permits, make more than one injection at intervals of several days to ensure fertilization, because not all flowers are receptive simultaneously. Seal or tape the puncture hole to



exclude unwanted pollen. When working high in a tree, strong cord will be needed to hold the limb where the bag can be manipulated. A safety belt, and long hooks as shown on page 3 are necessary.



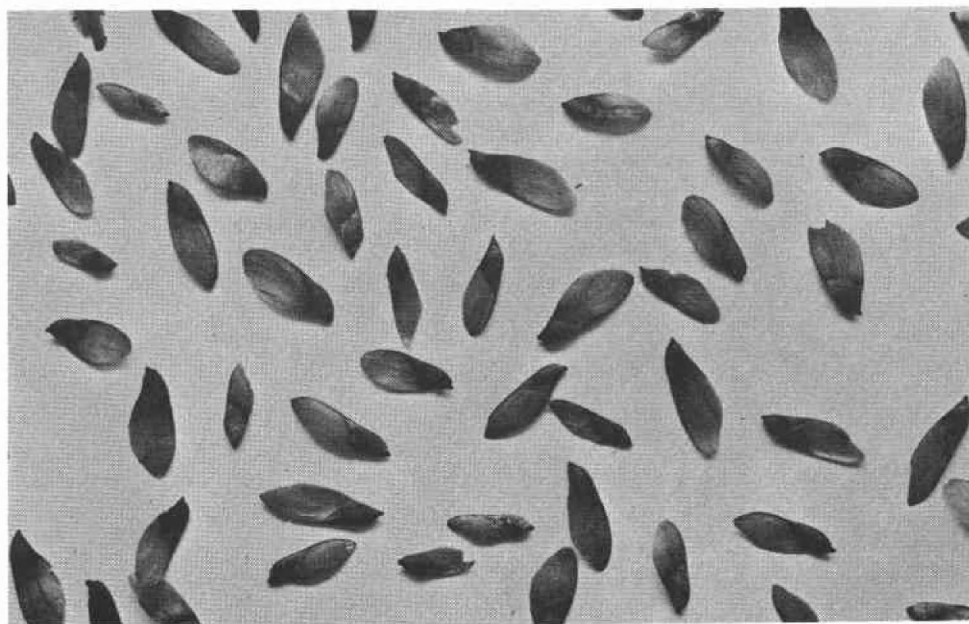
The protective bag can be removed after the female flower has closed and points downward, usually by the middle of May. Bags of plastic screen of about 20 mesh can be applied to protect the conelets against insects and animals and to catch seed if cones open early.

COLLECT SEED



Harvested cones should be dried. Temperatures in the range between 80 F and 100 F will be satisfactory. Seeds then can be extracted and cleaned.

Your crop, as pictured below, is ready for planting. Resultant seedlings should be tested to assess their characteristics, but that is beyond the intended scope of these suggestions.



RECORD DATA

Write down information about parent trees and procedure followed to aid in judging results of the pollination, and to improve technique. Below is a suggested form that can be changed to fit individual requirements.

Tree No. 1E Location Arboretum, south slope

Bag no.	Flowers in bag	Date			Pollen		Cones collected		Remarks
		Bag		Pollinated	Tree no.	In-jected	date	no.	
		In-stalled	Re-moved						
1	5	3-5-59	6-1	4-1	4a	Cc 1	10-5	4	E. side upper crown
				4-5	4a	1			
2	4	3-5-59	6-1	4-1	4b	1	10-5	4	
				4-5	4b	1			
3	6	3-5-59	6-1	4-1	3d	1	10-5	6	Insect damage

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OREGON FOREST RESEARCH CENTER

Two State programs of research are combined in the Oregon Forest Research Center to improve and expand values from timberlands of the State.

A team of forest scientists is investigating problems in forestry research of growing and protecting the crop, while wood scientists engaged in forest products research endeavor to make the most of the timber produced.

The current report stems from studies of forest lands.

Purpose . . .

Develop the full potential of Oregon's timber resource by:

- increasing productiveness of forest lands with improved forest practices.

- improving timber quality through intensified management and superior tree selection.

- reducing losses from fire, insects, and diseases--thus saving timber for products and jobs.

Keep development of the forest resource in harmony with development of other Oregon resources.

Current Program . . .

- Seed production, collection, extraction, cleaning, storage, and germination.

- Seedling production, establishment, and survival for new forests.

- Growth and development of trees, quality of growth, and methods of thinning and harvesting to grow improved trees.

- Study of forest fire behavior and fire weather to prevent fires.

- Insect pests and their control, to save trees.

- Disease control and prevention in Oregon forests.

- Mammal damage and the controls to help regrowth.

- Soils and their relationship to growth.

- Development of improved forests through selection and breeding.