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## *TREE-BREEDING TECHNIQUE:*

## *SOME EFFECTS OF CONTINUOUS BAGGING*

In tree-breeding operations, it is standard practice to protect the tree flowers with vegetable parchment or sausage-casing bags during the pollination period so no unwanted pollen can get to them. Since the bags often damage the tree, they are usually removed as soon as the pollination period ends--within 2 or 3 weeks.

Some bags were accidentally left on in recent years (1947-50) and stayed on the trees until seed-maturity time. The results may be of interest to other tree breeders.

### *Some species damaged*

Some of the effects of leaving the bags on were harmful, which was not surprising. Where the bags were left on, all the leaves were killed. Branches of Norway maple, boxelder, and oaks died early in the following summer.

One green ash branch (pollinated by Arizona ash) matured 387 samaras from 400 flowers--but all the samaras were empty. Green ash from which

the bags had been removed developed only one-fourth as many samaras; yet nearly all of these contained good seed.

In 1949 seven continuously bagged yellow-poplar flowers produced only 7 good seeds--about one-third the number obtained from comparable flowers that were unbagged soon after pollination. (In 1950 some continuously bagged flowers produced nearly as many seeds as flowers that were unbagged after pollination.)

*Some beneficial effects*

But with some species the continuous bagging was unexpectedly worth while.

On one tree of Betula maximowiczii a branch that was bagged continuously matured all its catkins, as did all branches that were not bagged at all. But on the branches from which the bags were removed shortly after pollination, 80 percent of the catkins died soon after the bags were taken off. Since there was no frost, it is possible that the change in environment from the warmth of the bag to the coolness of open air was more damaging than either continuous warmth or continuous cold.

In pine, continuous bagging gave seed yields much greater than we had previously got by taking the bags off as soon as the flowers were past bloom, or from flowers that had not been bagged at all. The cone and seed yields are compared in the table.

These results with white pine were particularly significant because the parent (No. G-1636) that yielded the most seed normally matures only about 5 percent of its cones. Previously it had

| Female parent | Male parent | Strobili | | Seeds per cone | |
|---|---|---|---|---|---|
| | | Pollinated | Matured | Empty | Full |
| | | Number | Number | Number | Number |
| YIELDS FROM CONTINUOUSLY BAGGED BRANCHES | | | | | |
| Pinus strobus (No. G-1636) | P. strobus (No. G-1955) | 5 | 2 | 7.5 | 24.5 |
| P. densiflora (No. G-1937) | Self | 2 | 2 | 4.0 | 16.5 |
| BEST PREVIOUS YIELDS FROM BRANCHES NOT CONTINUOUSLY BAGGED | | | | | |
| P. strobus (No. M7482) | P. strobus (No. G-1636) | 5 | 2 | 0.0 | 15.0 |
| P. densiflora (No. G-1937) | Self | 3 | 3 | 1.3 | 0.0 |

not yielded any viable seed.

Continuous bagging seems to have an effect on selfing in P. densiflora tree No. G-1937. Data for this tree are meager and we have no other data on selfing in other trees of the species. However, the yield of 16.5 good seeds per cone on this tree is considerably higher than the yield to selfing in any pine species we have worked with.

Since the bags were badly weathered and broken when the cones were harvested, they probably had little effect on the bagged cones during most of the second growing season. This was also true in two other cases where continuous bagging apparently had a beneficial effect on cone set: an Abies homolepsis and a Pinus griffithii on which parthenocarpic cones that developed under continuous bagging were the only cones found on the tree.

*Tentative conclusions*

In none of these cases were the beneficial effects of long bagging due merely to the bags'

protecting the developing fruit against weevils, squirrels, or late frost. Such large seed yields produced by continuous bagging were not observed in any of the thousand and more unbagged and sound cones that have been collected from the pine species mentioned. And there were no late frosts that could have affected these cases we have cited.

The beneficial effects may be due to a change in the physical environment of the developing fruit. The most obvious factors are greater warmth and humidity. Neither the eastern white pine nor the P. densiflora is native in the Philadelphia area where this work was done. It is possible that the effects of continuous bagging might be quite different if the work were done within the species' natural range or in a warmer climate.

As a result of these observations, fairly large-scale trials were made in 1948 of conventional bag removal vs. continuous bagging. In spring-fruiting red maple, there was no difference in seed set, although continuously bagged seeds matured a few days earlier and consequently germinated earlier. During 1950 all bags were left on until seed maturity: we got 1,976 seeds from 3,376 flowers, an average yield of 29 percent. Continuous bagging is now our standard technique with this species. It saves considerable time and produces satisfactory yields of seed.

Further tests of continuous bagging are being made. --JONATHAN W. WRIGHT

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