Nut Culture and Foreign Competition

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I became involved in piñon nut research in 1976 when work at Mora Research Center was begun to improve products obtained from piñon-juniper woodlands. Two researchers were particularly helpful in developing a basic understanding of woodland biology: Dr. Ron Lanner of Utah State University and Dr. Elbert Little of the U.S. Forest Service. Both have encouraged a stewardship view while adding greatly to our knowledge of piñon-juniper biology.

A previous speaker mentioned the absence of nuts in local markets owing to poor production in New Mexico this past year. Next year may again prove disappointing, or mark another bumper crop as occurred in 1941. Bumper crops come along at three-to-seven-year intervals. Nut yield over a span of years resembles somewhat the alternate bearing pattern observed in fruit and nut trees. Alternate bearing of commercial fruit and nuts appears related to the loss of tree nutrients to harvested product and to the time required to restore nutrient levels. Carbohydrates and nitrogen are especially critical to pine seed production.

However, piñon nut crops can fail for many reasons, including environmental stress. For example, nut crops suffer when weekly temperatures rise above 24°C from late August to early September. Drought can increase yield when occurring at the time ovulate primordia form. After primordia are set, drought reduces yield by reducing photosynthesis. Mineral nutrition and crown exposure are also important factors influencing yield.

The unpredictability of yield and remoteness of nut bearing stands has drawn attention to artificially manipulating stands and even to the possibility of developing nut orchards. Nut orchards presently appear impractical because of the time required for trees to begin bearing nuts. Native trees begin bearing at about 25 years but commercial scale production occurs much later, at about 75 years. There is a possible "out" and that is to exploit the relationship between pine seed bearing and tree size reported by tree improvement foresters working in the South. Pines begin bearing upon attainment of a given size rather than a minimum age. Preliminary efforts to improve or domesticate piñons should therefore focus on fast growth.

Trees could be selected for crown shape and nut yield. Because cones are borne just beneath terminal buds, yield is related to crown surface area. Differences in crown shapes observed among trees should not be confused with the changes occurring as trees age. In the immature stage, piñons tend to have a pyramidial, Christmas tree form (i.e., excurrent). With advancing maturity, crowns widen and more cones are produced.

The potential for yield can be estimated from the relative accumulation of cones beneath unharvested trees. Cones do not decompose for a decade or so, thus enabling the heavier producers to be identified.

Gene conservation could be a part of tree improvement activities. Deforestation potentially endangers some Mexican piñons with small geographic ranges (e.g., *P. maximartinezii*). Forced crosses between *P. edulis* and Mexican species could improve nut attributes such as size, shell thickness, and yield. The seed of *P. maximartinezii* is about twice as large a *P. edulis.* We should not rely on exotics, but possibly some features can be bred into isolated planted stands managed for nut production.

Efforts toward conserving or mass producing germplasm of native species begin by recognizing seed zones. Foresters working in New Mexico and Arizona presently recognize provisional seed zones indicating areas of similar climate and topography. Zoning follows the assumption that trees grown from seed collected at a given site can be safely planted there. Conversely,

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moving outside the conditions to which it is adapted invites risk. Work begun in 1975 at Mora Research Center is contributing to our understanding of the genetic factors governing the adaptability of native conifer populations. Our zones will remain provisional until much more is known about New Mexico's conifer populations. Vegetative propagation and biotechnology offer potential means for producing genotypes identified as superior through provenance (i.e., seed source) testing and field trials.

Crop manipulation with or without the help of genetic improvement could improve New Mexico's production. At present, only crops harvested abroad are managed to improve yield. *Pinus pinea*, or Italian stone pine growing in the Mediterranean region and *Pinus siberica* occurring in the Ural mountains of Russia are both cultured for their nuts.

In the United States, crop manipulation of native stands received the most concentrated attention when Dr. Elbert Little worked in this region. Although his work identified several methods of potential value, the subject has been largely ignored for decades by both researchers and land managers. More recently, work conducted near Mora Research Center examined basal pruning as a means for improving yield. The experimental treatment imposed on 25-ft. trees involved pruning all branches within 5 ft. of the ground. We believed this treatment might make more carbohydrate available for nuts because shaded low branches may act as carbohydrate sinks. This belief was confirmed in the sense that pruning increased nut volume and weight and more of the nuts were filled, 98% versus 84%. Because this treatment was imposed after the ovulate cones were set, its effect was apparently to improve the loading of carbohydrates into the nuts. This simple treatment potentially could be combined with other woodland activities such as thinning and fuelwood harvesting to reduce treatment cost.

We can, of course, improve nut production in the next century by planting more piñon, especially on accessible sites where woodland multiple use is the goal. Other techniques can provide more immediate benefits. Some appear more feasible than others, owing to their practicality or return on investment. The removal of poor nut producers from dense stands can improve the yield of nuts and other more desirable products such as Christmas trees. Foresters call this process selective thinning. Basal pruning could be accomplished at the same time. The prospects for justifying woodland fertilization appear less attractive. Conceivably, irrigation done by simple means such as altering land slightly to concentrate water near trees could have merit. The practical features of cone insect control have received so little attention that it is meaningless to even estimate feasibility. Overall then, the estimated feasibility of selective thinning and basal pruning is good, with treatments such as land leveling having intermediate promise, and fertilization having doubtful potential.

On the subject of market competition, it is important to understand nut production on global as well as regional scales. There are about twenty pine species that produce edible nuts. Twelve piñon pine species, that is pines of the subsection *Cembroides*, occur in North America. Two of these are found exclusively in the United States, while five other species are found in Mexico as well. Five species are found only in Mexico. Four piñon species occur in New Mexico: *Pinus edulis*, *P. monophylla*, *P. cembroides*, and *P. discolor*. The latter species was described in recent years by Bailey and Hawksworth (1979) and occurs in southwestern New Mexico.

Among the remaining eight non-piñon species, three deserve additional comment. The Italian stone pine essentially created a market for pine nuts in New York when a demand for them arrived with immigrants from the Mediterranean region. Much of the bumper crop of 1941 was shipped to New York to meet this demand. Korean pine (*P. koraiensis*) is of immediate interest because it is imported in large quantities and is displacing native piñon nuts owing to its lower cost. In New Mexico, shelled nuts of Korean pine sell for about $3.50/lb. compared to $9.00/lb. for native piñon. New Mexico obviously can not compete on a dollar-per-pound basis with no safeguards in place. New Mexico piñons can compete only in a specialty market owing to their intrinsic value, their nutritional advantage over other nuts, and possibly some sort of crop subsidy.

Table 1 indicates the relative size of the nuts of some of the species discussed. Korean pine seed is more than twice as large as *P. edulis*. *P. pinea* has the largest seed listed and is comparable to *P. maximartinezi* (not listed).

In summary, some practices for improving nut crops appear feasible. These can be combined with tree improvement practices which can also be called upon to conserve the global germplasm of the piñons. Finally, and perhaps most importantly, we need to protect the economic value of nut crops to protect the resource.

Table 1. Some representative pine nut species.

Subsection/ Species	Region	Seed/lb
Cembroides		
P. edulis	SW USA	1900
P. monophylla	" "	1110
P. cembroide	Mexico	1110
Pineae		
P. pinea	Europe	600
Cembrae		
P. koraiensis	China	820
P. siberica	Russia	1800

LITERATURE CITED

Bailey, D.K. and Hawksworth, F.G. 1979. Piñons of the Chihuahuan Desert region. Phytologia 44:129-133.