

A PRACTICAL TECHNIQUE FOR APPLYING RODENT REPELLENTS TO ACORNS¹

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Removal of the acorn pericarp and coating the seed directly with an Endrin-Thiram mixture had some effect in repelling caged squirrels in this exploratory study, but germination was both lowered and delayed. However, the results indicated that some such treatment would be worthwhile to prevent the usual heavy losses of planted acorns due to rodent pilferage.

Though successful chemical techniques have been developed for reducing rodent pilferage of coniferous seed, there is yet no effective method to similarly protect seed of the large-seeded hardwoods. Engle and Clark (1959), for example, found that coating oak acorns with an EndrinThiram mixture was of little value; pilfering animals simply shucked-off the external fruit coat (pericarp) and ate the untreated kernel. However, partial success was reported by Johnson *et al* (1964) who noted that caged squirrels would shun treated acorns if other food supplies were available. Crozier

and Merritt (1964) found that pilferage losses of acorns planted in open fields was reduced as alternative food supplies in adjacent wooded areas increased during the spring season.

These results seem to suggest that if an application technique with a chemical that would at least partially repel rodents were to be combined with properly timed planting in the spring to take advantage of maximum alternative food supplies, a significant increase in survival of direct-seeded acorns might be obtained. Since the EndrinThiram mixture seems to have some repellency value, even though its effect may be bypassed when animals discard the treated pericarp, removal of the pericarp before chemical treatment might provide a key to the problem.

The Study

A three-part exploratory study was therefore designed to test: (1) the effect of pericarp removal on germination, (2) the effect that coating an Endrin-Thiram mixture directly on the seed after removal of the pericarp would have on germination, and (3) the actual repellent effectiveness of such a seed-coating treatment.

¹ Published with the approval of the Director, Purdue University Agricultural Experiment Station, as journal Paper No. 2872.

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Previously stratified acorns of northern red oak (*Quercus rubra L.*), were used in this study. Germination tests were conducted in a greenhouse using flats of sand and vermiculite. Each treatment involving germination was applied to 200 acorns divided into four flats of 50 acorns each. These treatments were assigned as follows: (1) acorns with pericarps intact and without repellent coating; (2) acorns with pericarps removed and without repellent coating; and (3) acorns with pericarps removed and coated with a mixture of Endrin ³ (0.12 per cent by weight) and Arasan ⁴ (0.38 per cent by weight) in a methyl-cellulose sticker.

To study the efficacy of this method of applying repellents, varying proportions of treated and untreated oak seed were offered to captive squirrels housed in large wire cages.

Results

The results of the germination tests are presented in figure 1. As may be seen, removal of the pericarps both hastened germination and increased the germinative capacity. The latter result was attributed primarily to the improved opportunity for directly detecting and discarding rotted seed but the germination potential of low vigor seed may also have been enhanced to some

³ Endrin Emulsible Concentrate containing 19.7% by weight (1.6 lbs. ai per gal.). Supplied by Shell Chemical Co.

⁴ Arasan 42-S containing 42% Thiram by weight (4 lbs. ai per gal.). Supplied by E. I. DuPont DeNemours & Co.

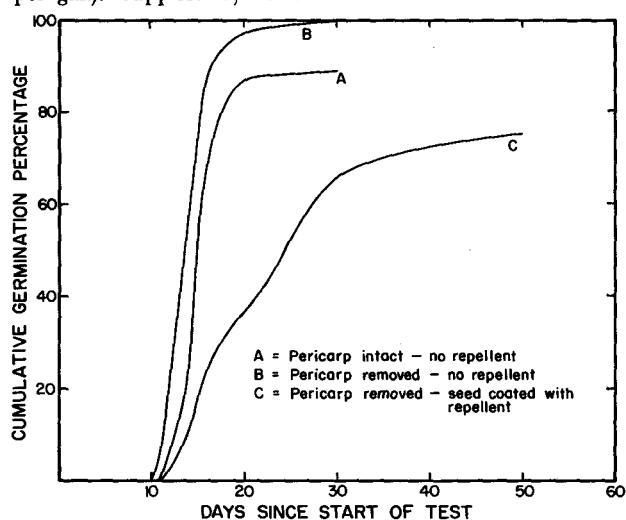


Figure 1.—Effect of pericarp removal and treatment with Arasan-Endrin repellent mixture on germination of northern red oak acorns. Curves are terminated at the point of maximum germination percentage as determined by a 60-day test. Note the irregular germination of repellent coated seed.

extent.

Coating the seed directly with repellent had a pronounced effect on germination. Not only was germinative energy greatly reduced but germinative capacity was also significantly lessened.⁵ Since this study was exploratory in nature, a complete set of treatments was not made and the causal mechanism remains obscure. The primary factor was felt to be interference in water uptake by the methyl-cellulose sticker, though an interesting phenomenon observed in chemically treated flats points to the possibility that Arasan-Endrin is toxic to the acorns.

Of 378 untreated acorns that germinated, 6 per cent were double-stemmed; no triple or quadruple stems were observed. In the chemically treated flats, however, of 151 acorns that germinated, 27 per cent were multiple-stemmed; 20 per cent were double-, 6 per cent triple-, and 1 per cent quadruple-stemmed (table 1). Visual inspection suggested that terminal meristems may have been killed thus stimulating the production of multiple lateral buds.

TABLE 1.—Stem characteristics of germinating acorns as influenced by treatment

Treatment	Stem Character			
	Single	Double	Triple	Quadruple
Pericarp Intact.....	166	12	0	0
Pericarp Removed.....	190	10	0	0
Pericarp Removed plus Arasan-Endrin..	110	30	9	2

Repellent effectiveness on caged squirrels was somewhat variable. If an animal ingested sufficient

⁵ Analysis of variance indicates significance at 1% level of probability.

Endrin to make him ill but not enough to kill him outright, he learned to leave the treated acorns alone-at least for a time. But if, instead, he ate small enough amounts such that no immediate ill effects were suffered, he continued to nibble away at a few acorns each day. In both instances, however, the animals showed a distinct preference for untreated acorns when a choice was offered.

Evaluation

When we evaluated the repellent results, it seemed that stronger chemical concentrations should have been used. An additional short test was therefore made of the effectiveness of a mixture four times stronger than that described above.

(Such a concentration is more in line with current recommendations.) Since time was short, the original animals were used in the second study, and unfortunately they all quickly died. Fresh animals not previously exposed to the chemicals would possibly have eaten smaller amounts in their initial sampling and hence been "educated" rather than killed, but this speculation must await further experimentation with the technique.

There are obviously many questions remaining unanswered and the authors make no strong claims regarding the practicality of the method. Yet results were sufficiently encouraging to suggest that other researchers might experiment with the technique. Germinative capacity of coated seed, though considerably reduced, was still preferable to the usually disastrous losses from unrestrained animal

pilferage. Caged squirrels were repelled to a certain degree and some were observed to be actually "educated" to avoid treated seed. When untreated alternative food supplies were available, they showed a distinct preference for these. The advantage of a time delay in pilferage, however, seemed to be offset by the greater time necessary to achieve full germination. If the sticker should prove to be the culprit, possibly other stickers could be found which would not cause this trouble.

Pericarp removal may seem too time-consuming to be of practical value, but it actually was not too great a chore in this study. Many had split during stratification and removal was accomplished quickly with a small knife. Perhaps some mechanical device could be contrived if the technique proves of value.

Literature Cited

- Crozier, R. and Clair Merritt
1964. Rodent pilferage of northern red oak acorns. Purdue Univ. Ag. Expt. Sta. Res. Prog. Rpt. 116.
- Engle, L. G. and F. B. Clark
1959. New rodent repellents fail to work on acorns and walnuts. Central States For. Expt. Sta. Note No. 138.
- Johnson, F. M., J. Stubbs, and R. A. Klawitter
1964. Rodent repellent value of Arasan-Endrin mixtures applied to acorns. J. Wildlife Mgmt. 28:15-19.