Rating Scale of Seeds as to Their Relative Palatability by Deer Mice

by

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INTRODUCTION

The purpose of this experiment is to make a rating scale of tree seeds, of importance in the northwest, as to their relative palatability by white-footed, or deer mice (Peromyscus spp.), so that the seeds that are the least palatable to the mice may be considered in the choice of seeds to be used in the direct seeding of an area.

This study will be an important step toward the discovery of a method of reforestation by direct seeding which will keep our forest lands perpetually producing timber crops.

The large areas of deforested lands, which include burned areas, logged over areas, and blow-down areas, in the United States has created a reforestation problem which has thus far baffled foresters for an adequate solution. At the present time, planting of nursery grown seedlings and transplants is the accepted method of reforestation. Planting, however, is an expensive and slow operation (12).

It is apparent that if the problem of reforesting this vast acreage of denuded land is to be solved, cheaper, faster, and silviculturally desirable methods must be developed (12).

At present there does not seem to be any solution to our reforestation problem other than planting and some direct seeding. Since direct seeding, when successful, is both faster and more economical than planting, it seems logical that further research be devoted to this method.

Reforestation by direct seeding has been attempted many times, but in a majority of the cases it has been unsuccessful. The causes

of these failures have been investigated and found to be mostly due to rodents, such as chipmunks and mice, birds, and unfavorable site conditions (8). However, it has been found that mice are the most important single factor relating to the direct seeding failures.

REVIEW OF PAST EXPERIMENTS

Many experiments have and are being carried on in seeking possible means to offset the high seed loss to rodents in direct seeding.

Mice have been found to eat nearly all the seed that is sowed because they have a very acute sense of smell and will find almost all the seed on an area. The mice will also locate the seeds by smell and dig up the ones that are lightly covered with soil or duff in seed spots.

Small seeded species have been used in direct seeding because the mice seem to show a decided preference for the larger seeds. The mice do not seem to eat as many of the small seeds if they are small enough to amount to about 200,000 to 500,000 seeds per pound (2)(10). The reason for this seems to be unknown except that it may be that the seeds, if scattered, are too small to give the mice enough food for subsistence. Some successful direct seeding operations have been shown when using seeds of Western redcedar, western hemlock, Sitka spruce, and red alder sown as one species or sown in mixtures (3).

Some work has been done in the treating of seeds with substances distasteful to mice. The use of Port Orford White-cedar oil, which is disliked by mice, has been attempted, but poor germination of seeds was obtained after the treatment (13).

Many poisons and poisoning methods have been tried against rodents, but none have been very successful. Poisons have been used on an area prior to direct seeding to kill the rodent population and then using poison coated seeds (7). This has given fairly good results, but the economics of this method are not so favorable. The elimination of one of the prepoisoning treatments is being considered but no results are yet available (9).

Poisoning has not always proved successful because of the extra cost of poisoning and the social problems involved. The prepoisoning of an area and the seeds used, causes the death of the rodents, birds, and other small animals in the area, thus causing an acute social problem with the human inhabitants of the surrounding areas, if the use of the poisoning method is discovered.

Seeding experiments have also been carried on in large fresh burns of one or two years by direct seeding inward some distance from the borders of the burned area in order to get away from the rodents (2) (11). Since large groups of mice will not travel long distances in one year, it is some time before other mice replace the ones that were killed by the fire.

Experiments are being carried on in the use of conical screens for protecting seed spots from rodents (7)(11)(8). Schopmeyer (8) did work along this line and reported the following information:

> "Seeds of western white pine, Ponderosa pine, and Engelmann spruce were sown in spots on the same area. One half of the spots were covered with a conical screen and one half were not. Among the screened spots the average germination of the seeds was 22 per cent per seed spot, whereas the germination on the unscreened spots were 2 per cent. In the unscreened spots, rodent depredation was the limiting factor in germination because practically every unscreened spot showed evidence of rodent digging within 2 days after sowing." (8)

This showed a large variation in the per cent of germination and success in the screened spots as against the unscreened spots. This method of using screens has proved to be too expensive for extensive use, but has proved to be a step in obtaining good seeding results. To make direct seeding economical, a cheaper means of protection than screens must be devised.

DISTRIBUTION AND HABITS OF WHITE-FOOTED MICE

"Owing to their numbers, white-footed, or deer mice (Peromyscus spp.) consume more conifer seed over this Douglas-fir region than do animals of any other group. From the sandy beaches to the summit of the Cascade Mountains, these mice are omnipresent. They may be found in the smouldering burn, or their dainty paired tracks may be traced through the hoar frost on the snow in subzero weather. They are present whether the annual precipitation is measured in inches or in feet. During the rainy season, however, they take advantage of the dryer and more protected travel routes in their nightly wanderings, and low trap catches during the first few nights of this season probably indicate that these mice object to rainfall.

The white-footed mouse can be mistaken for no other mouse in the Douglas-fir region. The young are slate gray, changing to brown as they approach the adult stages. The under parts and feet are white, and the tail, which is more than one-third of the mouse's length, is sparsely haired. The normal weight of adults is about 15 to 20 gm. The rounded membranous ears, about half an inch long, are gray and lightly haired. The nose is rather pointed, and the protruding black eyes are comparatively large.

The white-footed mouse shows great adaptability in food habits. In normal seed years, the forest provides food from September to April. Years occur, however, in which little or no seed is available, yet the numbers of mice appear to remain rather constant. After the forest is logged, this source of food is removed entirely and the animal must depend upon produce of the succeeding flora for a living." (5)

Cogshall made studies in the east on the food habits of four forms of Peromyscus. The diet consists of seeds, fruits, and nuts of 52 plant species; buds and bark from 16 species of trees and shrubs; and 20 groups of animals, including insects, slugs, spiders, crayfishes, and salamander and frog eggs (1). It was noted that most of the seeds, fruits, nuts, buds, and bark were from eastern tree species. Cogshall's conclusion as to food habits was that:

"Food is probably not an important factor in limiting the habitat distribution of the different species of deer mice. Regardless of the wide variation of range inhabited by the forest, prairies, and desert forms of Peromyscus observed, all readily ate the same sorts of food with only slight differences in food preference (1)."

Cogshall also stated that in their natural habitats, forest deer mice are undoubtedly of value in helping to control the harmful insects that attack forest trees; on the other hand, mice do a great deal of damage by eating the seeds and seed sprouts (1).

Trapping the Mice

To give the reader an idea of the density of the deer mice in a stand of approximately 80 year old Douglas-fir, located on a well drained hillside about 5 miles north of Corvallis, Benton County, Oregon, a record was kept of the trapping results. Live traps of the Scheffer type (4)(6) were used with paper as nesting material to keep the mice from dying from exposure. The traps were set under cover of logs and were baited with Douglas-fir seeds.

Three traps were used, and the location of the traps was changed once during the 15-day period. The traps were checked every 24 hours. Table 1 shows the trapping results for the two settings.

Experimental Procedure

Two of the mice caught were put into a cylindrical screen cage, with a wooden bottom, $1\frac{1}{2}$ feet in diameter. Six small tin plates containing six different species of seed were then put into the cage, also a small cup of water was placed into the cage. The same amount of seed, by weight, was put into each plate and the time of day was marked on the data sheet. Ten hours after the beginning of the experiment the plates of seed were removed and weighed and the weight was recorded. If all the seed was not eaten, each plate was returned to the cage. Twenty-four hours later the weights were again recorded, and if all the seed of a certain species were eaten, the plate containing that species was eliminated from the test as No. 1 choice. Thirty-eight hours later the seeds were again removed and weighed and checked to see which were completely eaten, then the species that was

all eaten was eliminated as No. 2 choice. This same procedure was carried throughout the experiment. The hours of interval between each check was not the same. The checks were made when convenient and an attempt was made to have the checks carried on when there was some visible difference in the number of seeds eaten, thus assuring more accurate results.

Table 1

Trapping results for two settings, using 3 traps for 15 trap nights each, near Corvallis, Oregon

Trap No.	Trap nights	Deer mice caught	Shrews caught
	1st setting		
1	10	5	2
2	10	2	1
3	10	1	1
	2nd setting		
1	5	2	0
2	5	1	0
3	5	2	0

Table 2 shows the species of seed used, the beginning weight, the hours of interval between checks, the seed weight after each check, and the results as to the mices' choice of seeds, numbered in order of palatability, in experiment #1. Table 3 shows the same type of data as Table 2, but is for experiment #2 in which two different mice were used.

Obtaining the results by seed weights alone was not considered to be accurate enough because the mice eat only the meat out of a seed and leave the hull. Thus, observation of the number of seeds eaten along with the seed weights gave accurate results. The reason that results by seed weights alone would not be accurate is that the proportional weight of seed coats to meat is not the same for all sizes of seeds.

Table 2

The results as to the palatability of different species of seeds by deer mice and the amount of each species remaining after given hour intervals

Experiment #1
2 mice used

*Species	Remaining Seed Weight in Grams										
	Time Interval from Start										
	start	10 hrs.	24 hrs.	38	48	62	72	84	96	120	134
Lodgepole Pine	5	1.79	1.62								
Douglas-fir	5	3.83	2.25								
Sitka spruce	5	5	4.75	1.93	1.50						
Western Hemlock	5	5	5	5	4.50	1.12	5				
Western Redcedar	5	5	5	5	5	5	5	3.55	2.60	2.0	1.80
Port Orford White-cedar	5	5	5	5	5	5	5	4.20	4.20	3.95	2.25

*Seed species are listed in their order of palatability by deer mice from most palatable to least palatable.

Table 3

The results as to the palatability of different species of seeds by deer mice and the amount of each species remaining after given hour intervals

Experiment #2
2 mice used

*Species	Remaining seed weight in grams				
	Time interval from start				
	Start	8	18	30	40
Douglas-fir	2	.83	.45	.30	
Lodgepole Pine	2	.97	.48	.45	
Sitka Spruce	2	1.70	.57	.50	
Western Hemlock	2	1.85	.56	.50	
Western Redcedar	2	2	2	1.85	1.50
Port Orford White-Cedar	2	2	2	1.95	1.70

*Seed species are listed in their order of palatability by deer mice from most palatable to least palatable.

CONCLUSIONS

In conclusion it may be said that fairly definite results were obtained. In the two experiments in which the same methods were used, but different mice, it was found that the results came out to be quite similar.

From the two experiments it was found that Douglas-fir and lodgepole pine were both eaten equally well and were rated as first in palatability, because in test No. 1, Douglas-fir was 1st choice and in test No. 2, lodgepole pine rated as 1st choice. However, there was very little variation between the seed weights of the two species.

For final results in rating the seeds as to their palatability by mice, Douglas-fir and lodgepole pine tied, with little difference in choice. Sitka spruce was rated as third most palatable, western hemlock ranked fourth, western redcedar rated fifth and Port Orford White-cedar rated last or sixth choice.

It was found that the deer mice ate quite readily the first four species of seeds, but distinctly disliked the western redcedar and Port Orford White-cedar seed, and had to be starving before noticable amounts were eaten.

It was also found that mice had to be accustomed to a species of seed to some extent before it was readily eaten, because a new species of seed was not eaten for some time when put into the cage for the first time.

Much work has been done and should be continued with hopes of finding economically and silviculturally successful methods of reforestation by direct seeding.

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