Germination and Longevity of Velvet Mesquite Seed in Soil

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Velvet mesquite (*Prosopis juliflora* var. *velutina* (Woot.) Sarg.) reproduces only from seed. Therefore, the germination rate and longevity of the seed in the soil affect not only the spread of the species but also reinvasion after control. Germination, as used in this paper, refers to cotyledon emergence from seeds buried in soil 1 inch below the surface. Longevity refers to the length of time seeds remain viable in soil.

Mesquite seed in dry storage remains viable indefinitely. Martin (1948) reported 60 percent germination of 44-year-old mesquite seed that had been stored in a Tucson herbarium. Six years later Glendening and Paulsen (1955) obtained 60 percent germination from another sample of the same lot of seed. Germination tests have not been made on older seed, but there is no reason to expect a rapid decline of viability when the seed is stored in a dry atmosphere and moderate temperature.

Glendening and Paulsen (1955) studied the germination and longevity of mesquite seed buried in the soil. They reported on germination for a 4-year period and longevity for a 2-year period. This paper is based on subsequent observations of the

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same study to cover a 10-year period.

Materials and Methods

Mesquite seeds were planted in the soil in fenced exclosures on the Santa Rita Experimental Range[3] in August, 1948. Replicate installations were made at elevations of 3000, 3800, and 4000 feet. Mean annual rainfall is approximately 12, 15, and 17 inches, respectively; soil types are Tubac gravelly clay loam, Sonoita sandy loam, and Whitehouse gravelly loam, respectively, for the three areas. The areas have similar plant cover and slope exposure.

The seeds used in this study were collected from the 1948 seed crop of two trees. Prior to the study germination tests of hulled seed and seed still in pod segments were made on moist filter paper in Petri dishes. Hulled seed gave a 20 percent germination after scarification, for a total of 96 percent. None of the seed still in pod segments germinated on moist filter paper.

Germination

The rate of germination was tested by taking soil from each of the areas and packing it into 1-gallon cans that had been dipped in tar. Six cans were then buried at each area with the tops of the cans level with the soil surface. Three cans contained 50 hulled seeds planted 1 inch below the soil surface. The other three cans contained 50 seeds still in the pod segments planted at the same depth (Fig. 1). Hardware cloth was placed over all of the cans to prevent disturbance by birds and rodents.

Seedling emergence was checked at weekly intervals during the summer rainy season and monthly during the rest of the year for 2 years after the start of the study. Thereafter, checks were made only during the summer rainy season. When seedlings emerged they were counted and then removed carefully so that the seeds still in the ground were disturbed as little as possible.

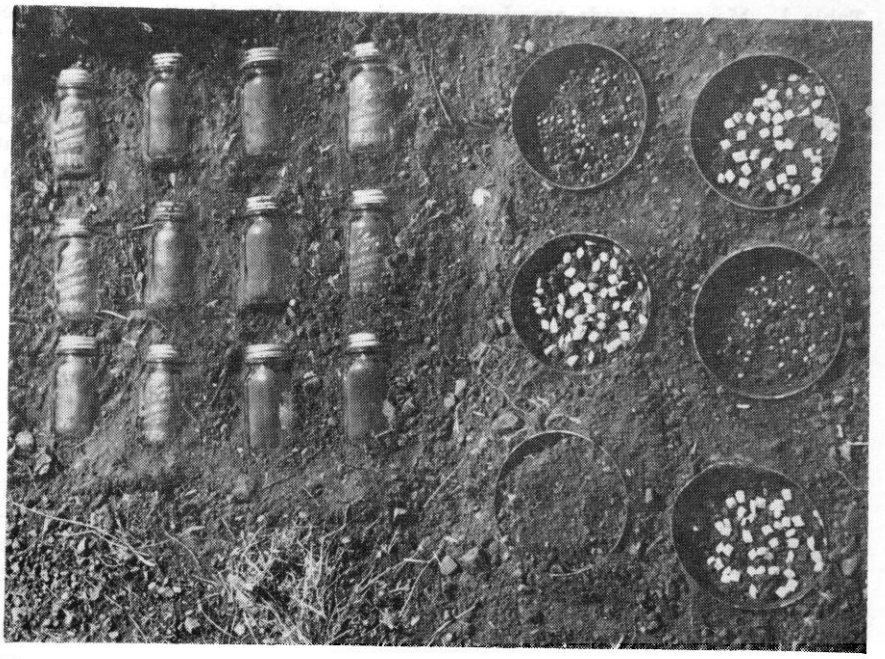

FIGURE 1. Field installation of mesquite seed for the study of germination and longevity.

Longevity

Only hulled seeds were used in the seed-longevity tests. Fifty hulled seeds, together with a small amout of soil, were put into each of 12 one-half-pint fruit jars at each elevation. The jar covers were punctured and a piece of blotting paper was placed inside the jar lid. The 12 jars at each location were divided into four sets of three jars each. Three jars were scheduled for excavations 2, 5, 10, and 20 years after burial. The jars were buried under 6 inches of soil with their long axes parallel to the soil surface (Figure 1) to prevent the direct entrance of water.

After excavation, germination tests were made by putting the seeds on moist filter paper in Petri dishes and storing them in a dark chamber. Seeds that failed to germinate in 3 weeks were nicked with a file to break the seed coat and again stored in the dark. Seeds were discarded if they had not germinated 2 weeks after being nicked with a file.

Results and Discussion

Germination

The results of the field germination study are given in Table 1. Most of the seed at the two lower elevations germinated in 1949—the first year after they were planted—and a few more germinated in 1950 and 1951. At the highest elevation, approximately as many seeds germinated in 1950 as in 1949. Very few seeds germinated after 1951. None have germinated since 1954.

Elevation and soils had no apparent effect on germination, but there was a highly significant difference between hulled seed and that in pod segments. Only 15.8 per cent of the hulled seed germinated as compared with 44.7 percent of seed planted in pod segments. Some physical and chemical actions during de-

[3]*Maintained by the Rocky Mountain Forest and Range Experiment Station about 30 miles south of Tucson, Arizona.*

Table 1. Mesquite seeds germinating each year after planting (150 planted seeds represented in each column).

Year	3000-ft. elevation		3800-ft. elevation		4000-ft. elevation		Mean	
	In pod segments Percent	Hulled Percent	In pod segments Percent	Hulled Percent	In pod segments Percent	Hulled Percent	In pod segments Percent	Hulled Percent
1948	0.0	1.3	0.0	1.3	0.0	0.0	0.0	.9
1949	39.4	8.0	48.0	13.3	18.0	5.3	35.1	8.9
1950	2.0	1.3	6.7	6.0	17.3	7.3	8.7	4.9
1951	0.0	0.0	2.7	0.7	0.0	1.3	.9	0.7
1952	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1953	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.2
1954	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.2
Total	41.4	10.6	57.4	21.3	35.3	15.3	44.7	15.8

composition of the pod apparently increase the permeability of the seed coat.

Much of the seed eaten by domestic livestock passes through the digestive system unharmed. Deposition of seed in manure provides a favorable habitat for germination because of adequate and prolonged moisture. The combination of seed germination following its passage through a digestive system and the high germination percentage of seed buried in pod segments is an ecological adaptation well designed to perpetuate the species.

Germination occurred almost entirely during the summer rainy season, which usually starts in July and continues through August. Temperatures in late May, June, and September are high enough for germination, but moisture is usually inadequate. Some germination did occur when rain fell during the May-June and September dry periods.

Longevity

Root fragments found in the jars at the time of excavation are adequate evidence that conditions were favorable for germination. Soil moisture was not determined in jars excavated 2 and 5 years after burial. Jars buried for 10 years had soil moisture percentages of 1.59, 4.01, and 8.31, respectively, for the 3000-, 3800-, and 4000-foot elevations.

The essential data on the longevity of seed in soil under approximately natural conditions are given in Table 2. The recovery of apparently sound seed decreased from 63 percent after 2 years of burial to 47 and 10 percent, respectively, after 5 and 10 years of burial. It is of interest, however, that the apparently sound seed recovered after burial for 10 years still had high germination percentage. Such seed could, presumably, still germinate under natural conditions. In fact, one live, recently-germinated mesquite seedling was found in one of the jars at the 4000-foot level.

Summary

The rate of germination and longevity of velvet mesquite seeds were studied. Rate-of-germination tests showed that most of the seeds germinated in July and August of the summer following an August planting date. Only 15.8 percent of the hulled seed germinated, but 44.7 percent of the seed planted in pod segments germinated. Longevity tests showed that some seeds are still viable after 10 years of burial even where soil moisture has been adequate for germination. The discovery of one live, recently-sprouted seedling shows

Table 2. Condition of recovered mesquite seed after 2, 5, and 10 years of burial and the germination percentages of the apparently sound seed.

Years after burial	Elevation, feet	Percentage of seed germinated or rotted	Percentage recovery of apparently sound seed	Percentage germination of apparently sound seed
2	3000	37	63	83
	3800	54	46	94
	4000	19	81	91
	Mean	37	63	89
5	3000	56	44	85
	3800	71	29	91
	4000	33	67	92
	Mean	53	47	89
10	3000	89	11	82
	3800*	95	5	80
	4000	86	14	95
	Mean	90	10	86

*One jar containing 50 seeds was not found. The percentages are based on the original 100 seeds in the remaining two jars.

that germination can occur after 10 years of burial in soil.

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