

Seed Size Affects Germination of True Mountainmahogany

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Highlight: Five collections of seeds of true mountainmahogany from two sites in northern New Mexico were divided into three size classes. Large seeds germinated better than medium or small seeds, within a collection as well as overall. The results suggest, however, that relative size distributions of collections may not be a reliable index of differences in source germinability.

Relatively little is known about the factors affecting germination of true mountainmahogany (*Cercocarpus montanus*), recognized as one of our most important browse species. Variability among collections of seeds has been noted (Forest Service, 1948), and germination *in situ* was found too erratic (Woodmansee, 1969). Alternating night-day temperatures of 68–86°F have been recommended for germination (Smith, 1971).

This study was undertaken to determine if seed size is a factor in the germination of this species.

Seed size is known to affect final germination percentage, rate of germination, seedling vigor, and seedling emergence of several species. Large seeds generally germinate faster and produce more and larger seedlings (Rogler, 1954; Kneebone and Cremer, 1955; Lang, 1965; Knipe, 1970). Larson (1965), on the other hand, reported that different sizes of ponderosa pine seed, when planted in the field, germinate at essentially the same rate and percentage. Lang (1965) also notes cases in which an inverse relationship of seed size to final germination percentage exists.

Seeds for this study were collected in different years from two locations in New Mexico. Collections were made in 1964, 1966, and 1970 from a group of plants at the northern edge of the city of Santa Fe (S.F.), in the pinyon-juniper type at 7,300 ft elevation. The other collections were made in 1964 and 1969 on Pinabetosa Mesa (P.M.), an oak-mountainmahogany site (Daubenmire, 1943) at 8,000 ft elevation near the town of Coyote. The seeds were stored in paper bags at room temperature until the study was begun in July, 1971.

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A random sample of 500 seeds of each collection was measured to the nearest millimeter and then placed in one of three size classes. Seeds were classified as small if they were less than 0.8 cm in length, medium if 0.9–1.0 cm and large if longer than 1.0 cm. The seeds were found to range in length from a minimum of 0.5 cm to a maximum length of 1.3 cm. At this time, size classes and the collections were weighed to determine number of seeds per pound in these groupings.

The seeds were stratified at 38–42°F for 28 days to overcome dormancy (Forest Service, 1948). All size classes were subdivided into groups of not more than 50 seeds, due to the presence of an aqueous inhibitor (Moore, 1963). The seeds were dusted with a fungicide and then germinated in petri dishes on standard germination blotters. Germination tests were conducted at room temperature (72–80°F) and terminated after 28 days. Distilled water was added to the dishes as required.

The seeds were considered germinated when the radicle had penetrated the seed coats, grown for a minimum of 0.5 cm, and had a normal appearing meristem.

Germination was significantly higher for large seeds than for medium or small seeds (Table 1). Three times as many large seeds germinated as small seeds for the 1969 P.M. and the 1964 S.F. collections. The margin between large and small seeds, however, was less for the other collections. Significantly more medium size seeds germinated than small seeds.

Table 1. Germination of true mountainmahogany by size class.

| Seed lot | Percent germination | | | |
|-------------------|---------------------|--------|-------|-------------------|
| | Small | Medium | Large | Mean ¹ |
| P.M. 1964 | 53 | 64 | 70 | 62ab |
| P.M. 1969 | 19 | 42 | 66 | 42c |
| S.F. 1964 | 20 | 39 | 67 | 42c |
| S.F. 1966 | 33 | 53 | 64 | 50bc |
| S.F. 1970 | 59 | 70 | 80 | 70a |
| Mean ¹ | 37c | 54b | 69a | |

¹Any two means not followed by the same letter are significantly different at the 0.05 level according to Duncan's new multiple range procedure.

Most seeds in each collection—about 2/3 of the total number—fell within the medium size category (Table 2). This implies that germination of bulk samples from the five collections would approximate 54%, rather than some higher percentage representative of the large size category. Size distributions varied among the collections. Only 2% of the 1970 S.F. collection were large compared with 47%

Table 2. Percentage of seeds per size class in five collections of true mountainmahogany with number of seeds per pound in the size classes and in the collections.

| Seed lot | Size class | | | Number of seeds |
|-----------|------------|--------|-------|-----------------|
| | Small | Medium | Large | |
| P.M. 1964 | 3.8 | 59.0 | 37.2 | 31,000 |
| P.M. 1969 | 5.4 | 61.4 | 47.2 | 28,000 |
| S.F. 1964 | 4.0 | 72.6 | 23.4 | 32,000 |
| S.F. 1966 | 12.8 | 60.2 | 27.0 | 41,000 |
| S.F. 1970 | 20.2 | 77.8 | 2.0 | 35,000 |
| Mean | 9.0 | 65.0 | 26.0 | |

¹ Number of seeds per pound were: Small—46,000, Medium—35,000, and Large—28,000.

of the 1969 P.M. collection. Although the percentage of seeds classed as small was consistently low for the P.M. collections, size distribution tended to vary from year to year for both collection sites. These differences in size distributions probably resulted primarily from differences in environmental conditions during development of the seeds and secondarily from genetic factors, as the seeds were collected from the same interbreeding plants at each site.

Differences in size distribution does not adequately explain the differences in germination among the five collections. The collection with the greatest number of large seeds (1969 P.M.) had the lowest average germination, whereas the collection with the fewest large seeds (1970 S.F.) gave the highest average germination. Differences in average germination due to age differences may have been a factor, as demonstrated by the decreasing germination in the S.F. collections with increasing age.

In conclusion, the results show: (1) a higher percentage of large seeds germinate within a given collection, and (2) collections containing mostly large seeds will not necessarily exhibit a greater average percent germination than a collection with a smaller number of larger seeds.

Literature Cited

Daubenmire, R.F. 1943. Vegetational zonation in the Rocky Mountains. *Bot. Rev.* 9:323-393.
 Forest Service, 1948. Woody-plant seed manual. U.S. Dep. Agr. Misc. Pub. 654. 416 p.
 Kneebone, W.R., and C.L. Cremer. 1955. The relationship of seed size to seedling vigor in

some native grass species. *Agron. J.* 47:472-477.
 Knipe, O.D. 1970. Large seeds produce more, better alkali sacaton plants. *J. Range Manage.* 23:369-371.
 Lange, A. 1965. Effects of some internal and external conditions on seed germination, p.848-893 *In* W. Ruhland (ed) *Encycl. Plant Physiol.*, Springer-Verlag, Berlin Vol. 15, Part 2.
 Larson, M.M. 1961. Seed size, germination dates, and survival relationships of ponderosa pine in the southwest. Rocky Mountain Forest and Range Exp. Sta., Forest Service U.S. Dep. Agr., Fort Collins, Colo. Research Note 66.
 Moore, T.C. 1963. A germination inhibitor in achenes of true mountainmahogany, *Cercocarpus montanus*. *Ecology* 44:406-409.
 Rogler, G.A. 1954. Seed size and seedling vigor in crested wheatgrass. *Agron. J.* 46:216-220.
 Smith, D.R. 1971. Growth responses of true mountainmahogany (*Cercocarpus montanus*) on four soil types within the front range of Colorado. Utah State Univ., Ph.D. Dissertation, 206 p.
 Woodmansee, R.G. 1969. Natural reproduction of *Eurotia lanata*, *Atriplex canescens*, *Cercocarpus montanus*, and *Cowania mexicana* in New Mexico. Univ. of New Mexico, Masters Thesis, 77 p.

First Call for Papers

27th ANNUAL MEETING
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The objective of the Program Committee for the 1974 Annual Meeting is a stimulating program of important topics that will provide something of value and interest to all those who attend. To accomplish this objective, the format for the meeting will include both invited and volunteer papers; it will also provide a forum for airing controversial issues and the expression of ideas. The Committee solicits members—and nonmembers—to volunteer papers reporting their work, their research, and their ideas. *Although papers on any subject relevant to range science and range management—or the affairs of the Society—will be considered, papers representing new knowledge and fresh ideas are encouraged.* A volunteer session titled "Viewpoints" is being arranged to accommodate those wishing to express their particular viewpoint orally to the Society.

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(2) name and affiliation of authors, (3) name of individual to present the paper, (4) name and address of author to whom correspondence should be addressed, (5) a preliminary abstract of not less than 250 or more than 500 words, and (6) a supporting statement indicating the significance of the offered paper and the subject matter area(s) under which he thinks his paper could be classified. For research papers, this statement should also indicate the relative amount of data supporting the paper (e.g., years of study). All illustrative materials must be adapted for use in Kodak 35-mm Carousel projectors.

Deadlines: Three copies of the preliminary abstract and supporting statement should be in the hands of the Program Committee chairman not later than **August 15, 1973** (October 5 for student papers). Authors will be notified of acceptance or rejection of their paper by October 1, 1973 (November 1 for student papers). Final abstracts for all papers must be received by the Program Committee by November 15, 1973.

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