The Effect of Selected Presowing Seed Treatments on Germination of Lehmann Lovegrass Seeds

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Highlight: Samples of Lehmann lovegrass seeds were treated with various presowing seed treatments, oven drying, mechanical scarification, moistening, and moistening plus oven drying. The pretreated seeds were then allowed to germinate with adequate moisture at 24°C for 24 and 48 hours. Germination was significantly increased by mechanical scarification, oven drying, moistening plus oven drying, and certain moistening treatments of warm-vapor or cold-water imbibition.

Lehmann lovegrass (*Eragrostis lehmanniana* Nees.) has been used extensively for range reseeding in the semiarid southwestern United States (Jordan and Maynard 1970; Cable 1971; Herbel et al. 1973). In southeastern Arizona, Jordan and Maynard (1970) observed that Lehmann lovegrass seedlings seemed to emerge better from seedings made in March than in June of the same year. This difference was observed only when March seedbeds contained some residual winter moisture but not enough for germination and the following summer was marginal with respect to precipitation. Neither March nor June seedbeds contained moisture adequate to support germination until the arrival of summer rains in July and August. Thus, we can assume seeds were subjected to various combinations of moistening, drying, heating, and attack by microorganisms during the interval between planting and the arrival of summer rains.

Moistening, drying, and heating may act as presowing seed treatments in dormancy removal. They also could increase the rate of germination of Lehmann lovegrass seeds. Brauen (1967) found dormancy and sensitivity to light were removed from Lehmann lovegrass seeds with chemical or mechanical scarifi-

cation. Wilhelm (1969) showed total and rate of germination were increased by pretreatments of moistening at 10 or 24°C followed by air drying at 24°C. Jordan (unpublished data) observed the rate of germination for Lehmann lovegrass seeds was increased when seeds were imbibed in a water saturated atmosphere and then oven dried at 70°C. Oven drying of air dry seeds at 70°C also was effective. Seed response varied with age of seed, with older seed responding better than 1-year-old seed. Bleak and Keller (1972) found that seeds of Lehmann lovegrass premoistened for 36 hours at 16°C and 18 hours at 28°C followed by surface drying for 2 minutes had 21 to 31% seedlings emerge in 5 days, while only 6% emerged for nontreated seeds.

In the present study the effects of 15 different presowing seed treatments on Lehmann lovegrass seeds were compared on a 10-year-old lot of seeds.

Materials and Methods

Seed Source

Seeds of Lehman lovegrass, Arizona Accession 68, lot 4856, were produced at the Soil Conservation Service, U.S. Department of Agriculture, Plant Materials Center, Tucson, Ariz. This lot was a mixture of seeds collected in November 1963, July 1964, and October 1964, and was approximately 10 years old. Variation in seed size was reduced by sorting with air.

Seed Treatment

The fifteen treatments listed in Table 1 included air drying, oven drying, mechanical scarification, moistening, and moistening plus oven drying.

Control: Seeds were air dried and stored in the laboratory.

Oven dried (OD): Seeds were oven dried for 24 hours at 70°C in a mechanical convection oven immediately prior to testing. Seeds contained approximately 2% moisture (dry weight basis) after oven drying.

Scarified: Seeds were mechanically scarified in a modified Forsberg seed cleaner (Brauen 1967; Wright 1973). An 8-ml volume of seeds was placed on the abrasive inner surface of the inner cylinder. The cylinder was held in a horizontal position and seeds scarified for 8 sec.

Warm vapor imbibition (24v): Separate treatments consisted of imbibing samples (100 seeds) for 24, 48, or 72 hours in a water saturated atmosphere (approximate relative humidity 95%) in the dark

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Table 1. The effect of various presowing seed treatments on germination percentage of seeds imbibed with adequate water for 24 and 48 hours at 24°C.

Treatment	Period of imbibition	
	24 hours	48 hours
Control	4 ¹	36 ^{2,3}
Scarified	42	82
OD	58	80
24v for 72 hours	30	68
24v for 48 hours	14	59
24v for 24 hours	15	46
24v for 72 hours + OD	38	89
24v for 48 hours + OD	33	84
24v for 24 hours + OD	47	80
10w for 72 hours	32	86
10w for 48 hours	21	69
10w for 24 hours	14	57
10w for 72 hours + OD	39	79
10w for 48 hours + OD	33	81
10w for 24 hours + OD	47	85

¹ LSD $p = .05$, 15.1.

² LSD $p = .05$, 11.4.

³ Data are averages of six replications.

at 24°C, followed by oven drying for 24 hours at 70°C. Another set of samples (100 seeds) received the same imbibition treatments but was not oven dried. Individual 100 seed samples, in small nylon sacks, were placed in a larger cloth sack and suspended in a modified Stults germinator for treatment.

Cold water imbibition (10w): Separate treatments consisted of imbibing samples (100 seed) for 24, 48, or 72 hours in free water in the dark at 10°C, followed by oven drying for 24 hours at 70°C. Another set of samples (100 seed) received the same imbibition treatments but were not oven dried. Samples (100 seeds) were imbibed on two pieces of Eaton-Dikeman No. 617 filter paper moistened with 7 ml of sterile distilled water (SDW) in 100 by 15 mm disposable petri dishes. Dishes were randomly distributed on four trays situated in the center of a Model 500 T. L. Cleland International, Inc. germinator.

Germination Environment

To evaluate the effect of the 15 presowing seed treatments, samples (100 air-dry seeds) were treated and then imbibed at 24°C for 24 or 48 hours. Samples were immersed in 10 ml SDW contained in 125 ml Erlenmeyer flasks closed with rubber stoppers containing holes plugged with glass wool. Flasks were randomly distributed atop a metabolic shaker (Fig. 1) designed for the flasks to tilt 30° from horizontal twelve times each minute for aeration purposes. The shaker was placed in a Sherer Controlled Environment Lab. Model CEL 37-14 growth chamber. Samples imbibed for 24 hours were maintained in the dark, but samples imbibed for 48 hours were illuminated once with 12.92 kilolux for 3 hours between hours 24 and 27. The shaker was used for germination studies and additional metabolic studies because complete seedling recovery was possible with this method. Brauen (1967) suggested some seeds of A-68 were light sensitive. Preliminary studies had indicated that this lot of seeds would also respond to light. Separate samples were used for germination counts at 24 and 48 hours without replacing in chamber and thus were not exposed to light. One flask per treatment was removed after 24 hours and one flask per treatment was removed after 48 hours of imbibition in germination conditions. Germination percentage was determined with a Luxo magnifying lamp or binocular microscope (10×). Seeds were considered germinated when the testa was split.

Statistical Treatment

Six replications were run over time for each treatment at 24 and 48 hours of imbibition. Data were subjected to analysis of variance, and LSD were used to separate means where a significant difference occurred ($p < 0.05$). The use of FLSD for multiple comparisons was based on reports from Carmer and Swanson (1968, 1971).

Fig. 1. Metabolic shaker and set of flasks used for germination of treated seeds, as described in the text.

Results and Discussion

Germination percentages for pretreated Lehmann lovegrass seeds are presented in Table 1. Control seeds germinated 4 and 36% after 24 and 48 hours of imbibition, respectively. Germination at 24 and 48 hours was significantly ($p < 0.05$) increased by scarification, oven drying (OD), certain periods of warm vapor (24v) or cold water (10w) imbibition and moistening plus oven drying. Treatments of short duration 24 and 48 hours of warm vapor imbibition and 24 hours of cold water imbibition did not significantly ($p < 0.05$) increase germination percentage at 24 hours above that for control seeds. Oven drying (OD) was as effective as any treatment used. OD following long duration, 72 hours of imbibition in warm vapor and 48 and 72 hours in cold water, did not yield germination percentages at 24 hours which were significantly ($p < 0.05$) greater than the same treatments without OD.

Pretreating Lehmann lovegrass seeds with treatments of mechanical scarification, oven drying, or moistening plus oven drying allowed rapid germination to occur. The moistening and moistening plus oven drying treatments might occur naturally in the field, especially when seeds are planted in moist soil in March rather than dry soil in June. Therefore, planting on the earlier date may be beneficial for seedling establishment.

The data suggest that several distinct mechanisms are involved in hastening germination. Mechanical scarification probably increased seed coat permeability to water and gas. Lehmann lovegrass seeds are covered by a gelatinous coating which can become a barrier to water and gas when moistened. Thus moistening plus oven drying or oven drying alone may have disrupted this barrier and improved germination. In addition, oven drying at certain stages of physiological development may have caused reorganization of some structural compounds and/or denaturation of others. Seeds imbibed in the warm vapor or cold water probably advanced physiologically with an increase in water content. Seeds which imbibed for more than 24 hours may have advanced physiologically to a stage that did not allow a response to oven drying like that

obtained after 24 hours of imbibition. However, if advanced physiologically, it appears some of the advancement may have been maintained even with oven drying. In order to test the possibility that presowing seed treatments affect metabolism and seed coat permeability, additional studies were initiated (Haferkamp 1975).

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Call for Papers

31st Annual SRM Meeting, February 6-10, 1978, San Antonio, Texas

The program committee for the 1978 Annual Meeting is issuing a call for volunteer papers. It is the desire of the program committee to develop a meeting which will serve as a forum for interaction and exchange of information among scientists, educators, administrators and managers who are concerned with the many aspects of range management. Papers which present new knowledge and ideas will be given special consideration. An attempt will be made to accommodate papers on any subject matter relevant to range management. All volunteer papers will be screened and those that provide reasonable assurance of meeting the standards of high quality that the Society expects will be accepted. Concurrent sessions will be developed based upon the response received. Authors of volunteer papers should indicate the subject matter area(s) which is most appropriate for this paper.

I. Range Management in Practice	IX. Range Resources and Products
II. Grazing Management	1. Plants
III. Range Improvements	2. Livestock
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V. Ecology	4. Insects
VI. Plant Physiology and Morphology	5. Watershed
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VIII. Resource Inventory and Analysis	
X. Other Special Topics (Anyone wishing to develop special sessions should contact program chairman before June 15, 1977.)	

Procedure for submitting papers: (1) Submit title of proposed paper by June 15, 1977, on a separate sheet giving the title of the paper, author(s) mailing address of the author to whom correspondence is to be sent, subject matter area which is most appropriate (1st and 2nd choice), and a brief supporting statement indicating significance of the proposed paper. (2) Submit abstract of paper complete with title, and author(s) and author affiliations by September 15, 1977. Authors will be sent information packet on preparation of abstracts after receipt of title so that all abstracts can be prepared uniformly for publication in *Abstracts of Papers*. Abstracts will be limited to 250 words or less.

Deadlines: Deadline for titles is June 15, 1977; deadline for abstracts will be September 15, 1977. Authors will be notified of acceptance of their paper by October 15. Deadline for undergraduate university students submitting papers for student conclave is October 15. Papers should be designated for student conclave.

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