GERMINATION STUDIES OF BROMEGRASS SEED, *BROMUS INERMIS* LEYSS

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Difficulties attending the seeding of bromegrass have given impetus to investigations of methods of processing bromegrass seed to facilitate its seeding with ordinary farm machinery. The seed is relatively large and light in weight. Caryopses are rather loosely held within the lemma and palea. Both of the latter are nearly equal in size and the paleas are slightly ciliated. Caryopses are slightly curved, with the point of attachment to the rachilla rather abruptly turned in. This brief description is included in an attempt to better illustrate the reasons for difficulties encountered in seeding and processing the seed without damage.

Farmers have been hesitant to use this excellent forage grass because it has necessitated the use of a vehicle to carry it through ordinary seed drills. Attempts to seed it alone with a drill usually results in "bridging," and a nonuniform seeding results. Various agitator attachments have been recommended but most drills are not constructed to use these agitators. This has made hand seeding necessary. Here again, considerable difficulty is encountered in obtaining uniform seedings of bromegrass, particularly on windy days. This paper reports some results of germination studies in the greenhouse with untreated bromegrass seed, hulled seed, and seed from which the hulls were removed by abrasive action. Treatment was intended as a means of facilitating easy and effective seeding. The effect of depth of planting is also considered and reported.

Source of Seed and Treatment.—The seed used in these experiments was produced in southeastern Illinois, on the Agronomy South Farm at Urbana in 1941, and at the Soil Conservation Service regional nursery located at Elsberry, Missouri.*

Three lots of seed were used in the so-called treatment tests: Lot 1, seed not subjected to special processing or selection—whole seeds taken from an ordinary lot of seed; Lot 2, naked caryopses selected from seed after it had passed through the combine; and Lot 3, hulled seed from which lemmas and paleas were removed by using an abrasive. In preparing the hulled seed, sandpaper was first used, but it proved to be too severe. This method seriously damaged most of the caryopses. In the second method, the lemmas and paleas were removed by means of rubber buffers. No observable damage to caryopses occurred with this method. The third method utilized a hammer-mill, a machine first used experimentally for commercial seed treatment. A fourth method consisted of rubbing seed gently between a wood block and a stone table top.

Untreated seed from Lot 1 was used in depth of germination experiments. Whole seeds were planted on greenhouse benches at depths of ¼, ½, ¾, 1, 1¼, and 1½ inches. Germination counts and measurements of seedling growth were made. Temperature, moisture, and light conditions were the same for all depths of planting.

Results of Germination Tests Treatment Series.—Germination percentages of the different lots of seed were closely related to the severity of treatment. Whole seed, or seed that retained the lemmas and paleas, gave normal germination under greenhouse conditions. A slight drop in germination during the period from January 8 to 20 was due to slightly lower temperatures in the greenhouse, and coincided with low outdoor temperatures. This lot of seed was of high quality and good germinability (See Table 1).

The second lot of seed, selected from the first lot, but with lemmas and paleas

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absent, gave an average germination considerably lower than the first. All conditions were similar to those of the first lot. The seed was accidently hulled in the process of combining. Examination of the caryopses showed no observable damage which might account for lowered germination.

The third lot consisted of seed from which lemmas and paleas were removed either by (1) rubbing with sandpaper—obviously too severe, (2) the use of a rubber buffer, (3) the hammer-mill, or (4) rubbing with a board on a smooth concrete slab. Methods 1 and 3 proved most damaging (Table 1). The hammer-mill was previously considered as having the greatest potential use in seed processing but these results indicate that it is too severe, destroying the viability of a large percentage of seeds. From the practical point of view, the second method, i. e., using a rubber buffer, has more potentialities than any method of treatment by which the chaffy and light seed coverings are removed.

TABLE 1.—PERCENTAGE GERMINATION OF SEEDLINGS AT THE END OF EACH 12-DAY PERIOD

Sample no.	Period	Replications[1]					Average
		1	2	3	4	5	
Whole Seed Germinations		pct.	pct.	pct.	pct.	pct.	pct.
1	11/8—11/21	96	80	96	96	86	90.8
2	12/1—12/12	96	94	92	92	92	93.2
3	1/8— 1/20	92	86	80	92	96	89.2
4	2/2— 2/14	90	96	98	96	94	94.8
Hulled Seed Germinations							
1	11/8—11/21	74	72	86	80	86	77.6
2	12/1—12/12	80	86	86	76	74	80.4
3	1/8— 1/20	58	66	68	58	48	59.6
4	2/2— 2/14	70	70	78	68	60	69.2
Damaged Seed Germinations							
1	11/8—11/21	6	2	6	8	12	6.8[2]
2	12/1—12/12	46	40	60	68	68	56.4[3]
3	1/8— 1/20	22	30	34	18	26	26.0[4]
4	2/2— 2/14	70	70	78	68	60	69.4[5]

[1] Each replication consists of 50 seeds.
[2] Sandpaper.
[3] Rubber buffer.
[4] Hammer-mill.
[5] Rubbed with board on concrete.

Seedling Growth.—Height of seedlings in centimeters is not a direct indication of seed treatment but apparently combines the effect of interactions of temperature, light, and moisture. Seedling heights of the three lots of seed are shown in Table 2. Germination and height of seedlings seem to be related although it is probable this relationship would diminish with time under greenhouse conditions. Under field conditions, the stronger initial growth of seedlings may well favor more rapid establishment, an important factor in economical pasture husbandry.

Depth of Planting.—Rates of seeding bromegrass as well as other species are usually heavy enough to care for variations in soil, seedbed, and climatic factors. Much seed is planted too deeply and results in uneven stands due to failure of the plants to emerge. Seed size obviously is important. Bromegrass seed is large and can be planted at greater depths than the smaller seeded species, such as redtop, *Agrostis alba*, or Kentucky bluegrass, *Poa pratensis*.

In this experiment, bromegrass was planted at depths of ¼, ½, ¾, 1, 1¼, and 1½ inches, respectively. Emergence of seedlings did not vary greatly with the first four depths; however, the emergence percentage was distinctly lower with the 1¼ and 1½ inch depths.

Conclusions.—Within the scope of these experiments certain conclusions are apparent: (1) Untreated seed (unhulled) is definitely higher in germination than hulled seed (naked caryopses) regardless of how the hull was removed. (2) Seed planted at depths greater than one inch is lower in emergence than seed planted at shallower depths.

TABLE 2.—SEEDLING GROWTH IN CENTIMETERS AS MEASURED DURING GERMINATION PERIODS

Sample no.	Period	Replications[1]					Average
		1	2	3	4	5	
		cm.	cm.	cm.	cm.	cm.	cm.
Height of Seedlings from Whole Seed							
1	1st	8.2	8.3	8.0	8.0	7.6	8.0
2	2nd	5.8	5.6	5.8	6.3	6.3	6.0
3	3rd	6.6	6.1	6.7	6.0	6.6	6.4
4	4th	6.0	6.0	6.6	6.3	6.3	6.2
Height of Seedlings from Hulled Seed							
1	1st	7.0	7.3	7.1	6.9	7.3	7.1
2	2nd	5.7	5.6	5.7	5.4	6.1	5.7
3	3rd	5.9	6.0	5.8	5.8	5.9	5.9
4	4th	3.9	4.6	4.1	4.6	4.3	4.3
Height of Seedlings from Damaged Seed							
1	1st	2.0	2.7	2.1	1.9	3.2	2.3
2	2nd	5.9	5.4	5.0	5.2	5.3	5.4
3	3rd	3.3	4.2	5.2	4.8	4.5	4.4
4	4th	4.1	4.2	4.2	4.3	4.7	4.3

[1] Each replication consists of 50 seeds.

TABLE 3.—GERMINATION OF BROMEGRASS SEED WHEN PLANTED AT VARYING DEPTHS

Depth of planting inches		Replications[1]					Average	S. D.
		1	2	3	4	5		
¼	Perct. germination	90	96	98	96	94	94.8	2.71
	Seedling height, cm	6.0	6.0	6.6	6.3	6.3		
½	Perct. germination	96	88	98	92	90	92.4	3.74
	Seedling height, cm	5.8	5.5	5.4	5.7	5.8		
¾	Perct. germination	96	98	98	90	94	94.2	2.98
	Seedling height, cm	4.7	4.6	4.7	5.0	5.2		
1	Perct. germination	98	88	90	90	82	89.6	5.12
	Seedling height, cm	4.8	4.8	5.0	4.8	4.8		
1¼	Perct. germination	82	82	88	84	86	84.8	2.35
	Seedling height, cm	4.4	5.0	4.6	4.1	4.8		
1½	Perct. germination	86	74	78	82	72	78.4	3.96
	Seedling height, cm	4.9	3.9	4.6	4.4	4.0		

[1] Each replication consists of 50 seeds.