Preplanting Treatment to Hasten Germination and Emergence of Grass Seed[1]

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Highlight

Seeds in the crested wheatgrass complex were placed under conditions favorable for germination for periods of 10 to 90 hr, superficially dried, and then planted on a greenhouse bench. The most effective treatment was at 63 F for 60 to 70 hr. Seedlings resulting from this treatment emerged about 40 hr ahead of untreated seeds. The study suggests that if field tests yield similar results, pretreatment of seed may contribute towards greater success in range seeding.

[1] Cooperative investigation by the Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, and the Utah Agricultural Experiment Station.

Many seeding failures have occurred when unfavorable conditions have developed subsequent to planting. Hot drying winds, unexpectedly low temperatures, or rain that briefly wets the surface and causes the soil to crust, are a few conditions that damage range seedings. Failures in this category should be reduced if practices could be employed that would hasten emergence.

McKee (1935) conducted vernalization experiments with grass seeds. He reported that ". . . in the case of grasses and certain legumes, seed that have been slightly sprouted and again dried will start into growth quicker than unsprouted seeds." Chippendale (1934) states that ". . . although the soaking of grass seeds was formerly carried out frequently by farmers, this procedure is not applied in modern agriculture." He reported that under conditions favorable for the growth and development of plants, many species "derive extremely little benefit from previous soaking in water," but that "the benefit from presoaking was enhanced as the conditions for establishment deteriorated." No reports have been found in the literature in

Table 1. Percent emergence on September 9 and 10 from seeds planted on greenhouse bench September 6. Means of 3 replications.

Hours treated	September 9 Treatment temp.				September 10 Treatment temp.			
	Control	40 F	63 F	82 F	Control	40 F	63 F	82 F
0	0				5			
10		0	0	0		19	15	28
20		0	1	11		23	36	57
30		0	6	5		33	48	53
40		0	21	19		37	61	57
50		0	38	16		37	71	52
60		3	10	8		44	53	60
70		1	21	10		51	67	55
80		6	48	16		44	79	64
90		9	33	16		52	63	61
Avg.		2 c[1]	20 a	11 b		38 b	55 a	54 a

[1] Duncan's multiple range test indicated significant differences at the 1% level for September 9 ranging from 11.0 for adjacent values to 13.3 where the two extremes are compared. For September 10 these differences were 15.3 to 18.6, respectively. For each date, different letters following averages indicate significance at the 1% level.

which presoaked seeds have been used to enhance establishment of grass on arid range land, however.

In the present study seeds of grasses in the crested wheatgrass complex, were "treated" by being exposed to moisture for various periods of time and brought to various stages of germination before planting. The objective was to determine if emergence could then be hastened.

Materials and Methods

Shallow plastic boxes with self-sealing lids to maintain high humidity were used. In each box a scattered single layer of seeds was placed on a wet paper towel resting on a wet germination blotter.

In the first study nine treatments are reported. They range from 10 to 90 hr, at 10-hr intervals. Each treatment was carried out at 40, 63, and 82 F. In the second study there were six treatments ranging from 40 to 90 hr at 10-hr intervals. These were all at 63 F.

The beginning time of treatment was so scheduled that all periods ended on the morning of the same day. At the termination of each treatment, external moisture was removed from the seeds by blowing warm air over them for 2 min. The seeds were then weighed and the numbers to be planted were counted out and wrapped in small sheets of aluminum foil to prevent further dehydration. In the second study, however, some seeds from one source were not rapid-dried, to determine what effect, if any, the rapid drying might have on emergence. Greenhouse plantings were completed the same day, although the seeds may have been held in the aluminum foil several hours. Rows were spaced 3 inches apart and seeds were uniformly covered with 0.5 inch of soil. The first planting was in 3 replications of 50 seeds/row. A single source of commercial crested wheatgrass *Agropyron desertorum* was used. The second planting was in 4 replications of 25 seeds each. Seeds of *Agropyron* from six sources were used. Following each planting, the soil was kept moist and emergence counts were made daily.

Results and Conclusions

Effect of treatment temperature and duration.—Seeds treated in the first study were planted September 6. Table 1 records percentage emergence on September 9 and 10. The data are quite variable, but the following conclusions appear warranted.

1. Emergence was hastened by the treatment at all temperatures and durations.
2. Seeds treated at 40 F were slower to emerge than those treated at 63 or 82 F.
3. Most of the increased emergence from treatment at 63 or 82 F had been achieved by 50 hr, but the data were far from consistent.
4. Emergence on September 9 for seeds treated at 63 F was greater than for those treated at 82 F, but again the data were far from consistent.

By September 16 all treated as well as untreated seeds had shown satisfactory emergence. Seeds planted dry had emerged 91.5%. Seeds treated for different periods of time had emerged 88 to 94% and those treated at different temperatures 89 to 91%.

Effect of seed source.—Seeds treated in the second study were from six different sources. They were planted October 8. Table 2 records percentage emergence on October 11. The following conclusions appear warranted from these data.

1. Emergence of each seed source was hastened by the treatment.
2. Seed sources differed markedly in emergence rate.
3. Seeds subjected to drying after treatments that lasted 80 or 90 hr were slower to emerge than non-dried seeds. The final emergence was also lower.
4. Seed source 5 was low in viability compared with all other lots.
5. Although seed sources did not all respond alike, treatments lasting 60 to 70 hr appeared to be slightly better, on the average, than those of shorter or longer duration.

Time gained by treatment.—Time gained by treatment was determined by interpolation, after plotting the rate of emergence of dry seeds. In the

Table 2. Percent emergence on October 11 from seeds treated at 63 F and planted on greenhouse bench October 8, 67 hours earlier. Each value is an average of 4 replications.[1]

Hours treated	Source[2] 01[3]	1	2	3	4	5	6	Average
0	0	0	8	0	0	0	0	1
40	29[4]	28	37	86	74	4	41	43c
50	43	40	59	84	70	11	53	51abc
60	53	38	42	86	76	13	61	53ab
70	68	58	42	78	79	10	59	56a
80	74	43	42	71	61	10	51	50abc
90	67	53	45	66	54	5	38	47bc
Average	56 c	43 d	44 d	78 a	69 b	9 e	50 cd	50

[1]The 4th replication, which remained in place three more days had 74 to 92% emergence for different sources, except source 5 which was 41%, and 69 to 83% for different treatments, the 40-, 80-, and 90-hour treatments being somewhat lower than 50 to 70 hours.

[2](1) Commercial Nordan grown in Northern Utah in 1965 (used also for 1st study); (2) certified Nordan from North Dakota, 1965 seed; (3) induced tetraploid *A. cristatum* × *A. desertorum* (from D. R. Dewey); (4) Summit F. C. 38332; (5) commercial Fairway F. C. 38561; (6) Nebraska 3576 Fairway.

[3]01 designates seeds of source 1 that were not exposed to the 2-minute drying treatment. Otherwise for each treatment they were directly comparable to source 1.

[4]Duncan's multiple range test indicated significant differences at the 1% level at 20.3 for adjacent values to 25.4 where the two extremes are compared. Within each set of averages, those not having a letter in common differ significantly at the 1% level.

first study, the 63 F treatment 88 hr after planting is presented in Table 3. The following conclusions appear warranted.

1. There was a progressive time gain, following pre-treatment, of 3 to 44 hr, as treatment time increased from 10 to 50 hr.

2. Time gain, for treatments beyond 50 hr, was erratic, which suggests injury or other operating factors.

In the second study, comparable emergence time was determined for 67 hr after planting. The data are presented in Table 4. The following conclusions appear warranted.

1. Pretreatment of 70 hr gave maximum gain.

2. The range of 60 to 70 hr pretreatment appeared superior to either 40 or 90 hr.

3. Seed sources differed in response.

4. The 2-minute warm air drying slowed emergence when treatments lasted 60 hr or more (compare 1 and 01, Table 4).

Discussion

The studies reported in this paper will require extensive field testing. They suggest that seeds which have been allowed to absorb water for 2 to 3 days, at near room temperatures, produce seedlings which can emerge from the soil in less time than dry seeds. If the same relations hold under field conditions, soaking seeds could be the decisive factor between success and failure. The results obtained suggest one means of overcoming some of the hazards involved in range seeding and lowering the incidence of seedling failure.

Table 3. Percent emergence of treated seeds at 63 F, 88 hours after planting in the first study and hours required for seeds planted dry to reach same emergence, by interpolation.

Hours treated	Emergence 88 hours	Equal emergence for dry seeds	Pretreatment gain
0	5		
10	15	91	3
20	36	101	13
30	48	109	21
40	61	121	33
50	71	132	44
60	53	113	25
70	67	126	38
80	79	154	66
90	63	123	35

If the time between planting and emergence can be reduced, it follows that conditions existing at the time of planting will be a better indicator of subsequent emergence. The probability of satisfactory emergence of a seeding might then be predicted with greater accuracy from moisture available in the soil at the time of planting.

The time gained by pretreatment, reported in Tables 3 and 4, was never sufficient to offset the actual treatment time. For example, the 50-hr treatment (Table 4) yielded a gain of 41 hr, but the seeds had been wet 50 hr, and 6 hr lapsed between the end of the 50-hr treatment and planting. Even if it is assumed that the superficial drying stopped growth, there is a loss of 9 hr for treated

Table 4. Hours required for untreated seeds to reach the emergence recorded for treated seeds 67 hours after planting in the second study, by interpolation.[1]

Hours treated	Source[2] 01	1	2	3	4	5	6	Average hours	Gain hours
40	80	79	84	128	97	101	105	96	29
50	101	99	113	122	95	121	105	108	41
60	108	97	99	128	98	125	114	110	43
70	126	113	102	110	102	122	112	112	45
80	132	101	99	100	91	119	103	106	39
90	122	108	102	95	90	101	93	102	35
Avg. hours	112	100	100	114	97	115	105	105	39
Avg. gain hours	45	33	33	47	30	48	38	38	

[1]The 40-, 50-, 60-, 70-, 80-, and 90-hour treatments began 45, 56, 67, 80, 90, and 98 hours, respectively before planting.

[2]For identity of sources see footnote 2, Table 2.

seeds compared to those put dry into the soil. This suggests that moist soil on the greenhouse bench was a more favorable environment than the plastic boxes with the moisture and temperature provided in the laboratory. Whether a more favorable pretreatment environment can be found remains to be determined, as well as the effect that it will have on subsequent seedling development.

Surface-drying of the treated seeds may be essential to their successful planting through drills in common use. Drying seeds treated 60 hr or longer delayed emergence compared with wet seed. However, most of the advantage from pretreatment persisted.

LITERATURE CITED

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