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Germination of Kentucky Bluegrass Harvested at Different Stages of Maturity

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GERMINATION OF KENTUCKY BLUEGRASS HARVESTED AT DIFFERENT STAGES OF MATURITY[1/]

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Germination testing of Kentucky bluegrass presents many problems to the seed analyst. Test results from different laboratories are often at variance, particularly when the seeds are tested soon after harvest. Bass (2)[3/] concluded after a detailed study of the factors affecting germination of Kentucky bluegrass that the stage of maturity at which the seeds were harvested had the most important influence on germination. Immature, freshly harvested seed required light, 0.2 percent KNO_3 as the moistening agent, and prechill treatment for maximum germination. The need for these treatments, however, diminished with time.

The work presented in this report was undertaken to extend some of the observations mentioned above, particularly the influence of maturity on germination. The pertinent literature on seed dormancy and germination of Kentucky bluegrass has been reviewed by Bass (2).

Materials and Methods

Seeds of Kentucky bluegrass were obtained by hand harvesting an ungrazed stand near Ames, Iowa, at various intervals during June and July, 1953 and 1954. Moisture contents of the samples ranged from approximately 8 percent to 53 percent. They were dried at room temperature and reached equilibrium with the atmosphere at about 8 percent moisture.

The seeds were planted on fine quartz sand in Petri dishes and placed at 15-30°C. (15° for 15 hours, 30° for 9 hours) for germination. Distilled water and 0.2 percent KNO_3 solution were used as moistening agents. Light was supplied at about 100 foot-candles for 9 hours per day. In the study on the effect of duration of light treatment the seeds were exposed to light (9 hours per day) for 1, 2, 4, 8, 16, and 32 days after which they were placed under dark conditions for the remainder of the 35 day germination period. Darkness was obtained by placing the Petri dishes in black plastic boxes. Prechilling was accomplished by exposing the imbibed seeds to 10° C. for 5 days after which they were removed to the 15-30° C. germinator. The duration of all tests was 35 days.

Results

The effect of light, prechilling and KNO_3 singly and in combination on germination of Kentucky bluegrass was evaluated 1, 4 and 8 weeks after harvest. The results of the 1953 and 1954 tests are presented in Table 1.

Light was most effective, KNO_3 was moderately effective and prechilling was least effective in stimulating germination. Highest germination of seed harvested at the higher moisture contents and tested one week after harvest was obtained when the three treatments were applied in combination. Even then, however, complete germination was not obtained. Four weeks after harvest KNO_3 and light suffficed to bring about complete germination. Eight weeks after harvest either light or KNO_3 alone was sufficient to promote complete germination. The seeds had largely lost their dormancy by this time.

Stage of maturity influenced the initial degree of dormancy; seed samples harvested at the lower moisture contents had a smaller proportion of dormant seeds than those harvested at the higher moisture contents. The rate at which dormant seeds after-ripened and became non-dormant, however, was not greatly influenced by stage of

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Table 1. Effect of light, prechilling and potassium nitrate on percentage germination of Kentucky bluegrass harvested at different moisture contents. (Average of 4 x 100 seeds; 35-day test.)

Weeks After Harvest	Moisture Percentage At Harvest	No Prechill				Prechill[1]			
		Dark		Light		Dark		Light	
		H_2O	KNO_3	H_2O	KNO_3	H_2O	KNO_3	H_2O	KNO_3
1953									
1	50.8	2	42	46	62	24	52	64	72
	33.8	6	44	57	72	30	57	70	82
	18.9	10	51	66	82	30	63	84	86
	8.0	10	50	75	88	34	62	81	86
	Average	7.0	46.7	61.0	76.0	29.5	58.5	74.8	81.5
4	50.8	6	60	74	92	16	68	74	90
	33.8	16	74	88	93	41	86	86	96
	18.9	16	70	82	92	72	93	92	92
	9.0	24	68	86	86	62	83	87	90
	Average	15.5	68.0	82.5	90.8	47.8	82.5	84.8	92.0
8	50.8	82	90	89	92	79	91	90	92
	33.8	78	92	92	92	83	92	91	92
	18.9	82	92	90	92	94	91	93	92
	8.0	86	92	92	93	92	94	96	95
	Average	82.0	91.5	90.8	92.2	87.0	92.0	92.5	92.8
1954									
1	53.0	10	54	62	71	24	57	75	83
	44.2	25	50	60	70	31	62	70	82
	32.8	29	57	65	72	35	64	72	72
	21.8	35	61	71	80	43	70	76	88
	11.2	40	73	76	80	53	72	78	84
	Average	27.8	59.0	66.8	74.6	37.2	65.0	74.2	83.8
4	53.0	28	73	84	88	22	66	83	87
	44.2	36	70	89	94	42	84	92	96
	32.8	36	72	83	92	36	73	85	89
	21.8	46	82	94	90	55	82	89	88
	11.2	63	93	90	92	81	89	88	88
	Average	41.8	78.0	88.0	91.2	47.2	78.8	87.4	89.6
8	53.0	61	82	89	93	75	89	92	91
	44.2	82	87	89	93	85	90	91	93
	32.8	84	88	91	91	85	93	89	91
	21.8	87	89	92	91	82	90	93	92
	11.2	93	91	90	90	92	91	94	91
	Average	81.4	87.4	90.2	91.6	83.8	90.6	91.8	91.6

[1]Prechilled at 10° C. for 5 days.

Table 2. Effect of removing the hulls and breaking the seed coat on the germination in darkness of Kentucky bluegrass harvested at different moisture contents. (Average of 2 x 100 seeds; 35-day test.)

Moisture Percentage At Harvest	Percentage germination			
	Seeds intact	Seeds hulled	Seeds hulled, seed coat broken	Seeds punctured into endosperm
1953 seed[1]				
50.8	3	83	68	34
33.8	9	83	56	47
8.0	12	85	67	41
Average	8.0	83.7	63.7	40.7
1954 seed[1]				
53.0	12	87	52	60
32.8	27	91	65	51
Average	19.5	89.0	58.5	55.5

[1]Tested one week after harvest.

maturity. The time interval after harvest appeared to be more important than stage of maturity. It is of interest that seeds from the 1954 harvest were less dormant at equivalent stages of maturity and intervals after harvest than those harvested in 1953.

The influence of length of light treatment on germination of Kentucky bluegrass was also studied. Seeds harvested in 1953 at 33.8 and 8.0 percent moisture were used as experimental material. Tests were made three and six weeks after harvest employing water as the moistening agent. Germination percentage increased with increased duration of exposure to light until complete germination was obtained (Figure 1). This point varied with maturity of the seed and time after harvest. Curves from an equivalent series of tests using 0.2 percent KNO_3 as the moistening agent were similar except that the points were higher on the germination scale.

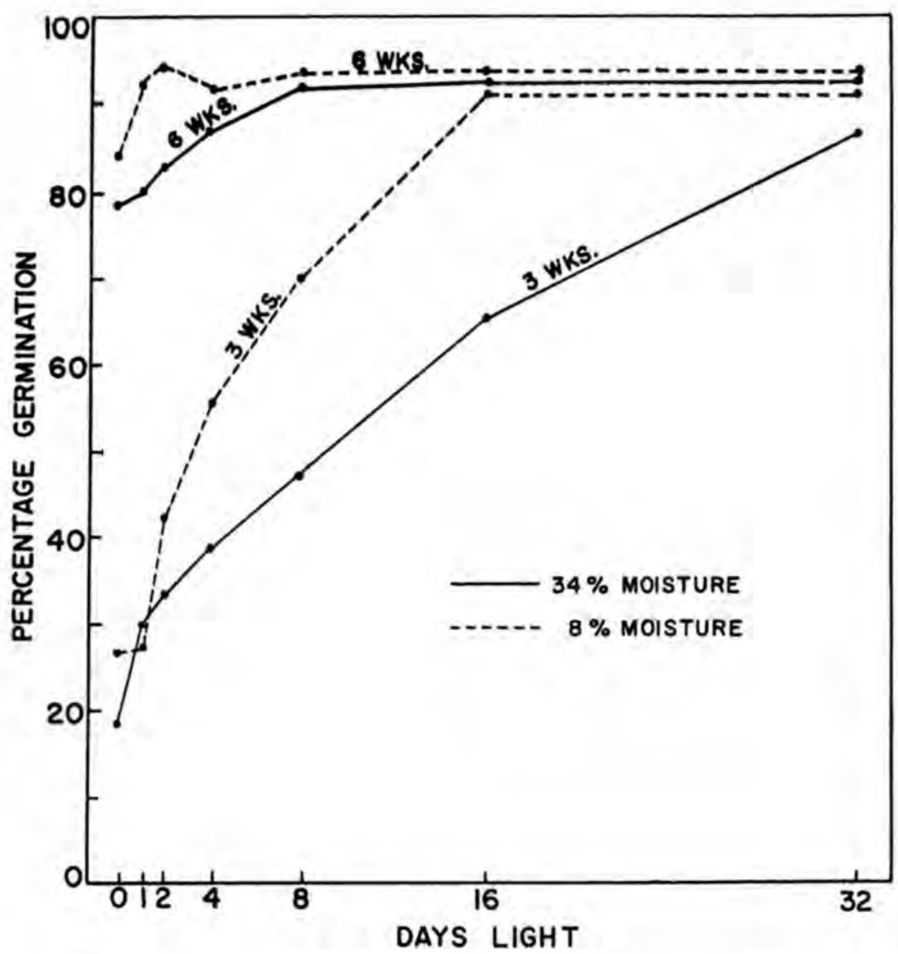

Figure 1. Influence of duration of light treatment on germination of Kentucky bluegrass seed harvested at two stages of maturity when tested three and six weeks after harvest.

Seed dormancy in many kinds of grasses can be overcome by breaking the pericarp. An experiment to determine whether Kentucky bluegrass seed reacted similarly was carried out. Seeds harvested at several different moisture contents were treated as follows one week after harvest: the lemma and palea were removed, the lemma and palea were removed and the pericarp scratched over the embryo, the seeds were punctured into the endosperm through the lemma and pericarp. The seeds were then planted on sand moistened with water and placed in darkness at 15-30°C. for germination.

Maximum germination was obtained, regardless of the stage of maturity at harvest, when the seeds were hulled (Table 2). Puncturing into the endosperm or scratching the pericarp over the embryo of hulled seed favored germination, but were less effective. The latter two treatments appeared to be somewhat injurious. The effect of hulling can, possibly be attributed to small breaks in the pericarp incident to removal of the hulls.

Discussion

Dormancy in the Kentucky bluegrass seeds used in these experiments was transitory. Germination above 80 percent was usually obtained without special treatment by 8 weeks after harvest regardless of moisture content at harvest. The more immature the seeds, however, the greater was the degree of dormancy. Stage of maturity at harvest did not greatly influence the rate of after-ripening. Rapidity of germination, however, was influenced: the more mature the seeds the more rapid the germination.

The results of these studies are in general agreement with those obtained by Bass (2), but are somewhat at variance with his in detail. In particular, he found that dormancy was much more persistent in seed harvested while immature (35 percent moisture), and that stage of maturity greatly influenced rate of after-ripening. It appears that both degree of dormancy and duration of dormancy vary from year to year and probably from field to field. The prevailing preharvest environmental conditions and the plant population, possibly are the controlling factors.

The relative importance of various factors affecting germination or any biological phenomenon are difficult to evaluate. In the present case, however, it would appear that the time interval between harvest and planting plays the predominant role. Regardless of stage of maturity at harvest or germination method, a variable interval of time (after-ripening) between harvest and planting is necessary for germination of all viable seeds. The fact that the length of this time interval is influenced by germination method, stage of maturity, and differs from year to year does not obscure its role.

Dormancy in Kentucky bluegrass seed was overcome by removing the lemma and palea, and to a lesser extent by puncturing the seeds after hulling or through the hulls. Injury appeared to be associated with the latter two treatments. The small breaks in the pericarp caused by hulling probably account for the beneficial effects of this treatment. Anderson (1) found that hulling Poa compressa had a stimulating effect on germination.

Seeds of Kentucky bluegrass were fully viable when harvested at moisture contents as high as 53 percent. They were more dormant and sensitive to germination conditions, but after an interval of time they germinated as well and as rapidly as seed harvested at very low moisture contents. Grabe (1956) found that functional maturity of smooth bromegrass was attained at a moisture content of 47 percent. It is quite likely that Kentucky bluegrass seed follow a similar course of development. The term maturity, however, as used throughout this report has been used in a physiological rather than functional sense. That there were physiological changes occuring in the seeds long after functional maturity was reached -- and indeed even after harvest -- is evident from the data that has been presented.

Summary and Conclusions

Seeds of Kentucky bluegrass harvested at moisture contents as high as 53 percent were fully viable. Degree of dormancy, however, was associated with moisture content of the seed; the higher the moisture content at harvest the greater the degree of dormancy. Stage of maturity at harvest did not appear to greatly influence the rate at which dormant seed became non-dormant.

The time interval after harvest plays a predominant role in germination of Kentucky bluegrass. The interval required before all viable seeds will germinate varies from year to year and is affected by stage of maturity and germination method.

Dormant seeds require continuous light treatment for maximum germination. As the time interval after harvest increases the need for light or other treatment for germination diminishes.

Hulling the seeds allowed complete germination regardless of time interval after harvest or stage of maturity. It was suggested that small breaks in the pericarp incident to hulling probably account for the beneficial effects of hulling.

Literature Cited

1. Anderson, Alice M. 1932. The effect of removing the glumes on the germination of Poa compressa. Amer. Jour. Bot. 19: 835-836.
2. Bass, L. N. 1954. Factors affecting germination of Kentucky bluegrass seed. Iowa State Coll. Jour. Sci. 28: 503-519.
3. Grabe, D. F. 1956. Maturity in smooth bromegrass. Agron. Jour. 48: 253-256