Light Delays Germination of Alkali Sacaton

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Highlight

Exposure of alkali sacaton seeds to light for a few seconds after imbibition delayed germination 24 hr, exposure for 9 to 13 hr delayed germination 28 hr, exposure for more than 13 hr delayed germination 72 hr, and continuous exposure reduced germination 40%.

In previous studies on factors affecting the germination of alkali sacaton (*Sporobolus airoides* Torr.), the growth chamber was programmed for 8 hr in light and 16 hr in darkness (Knipe, 1967; 1969). These tests were started at 8:00 AM at the start of the light period.

Seeds exposed to light during the first 8 hr of each test showed no appreciable germination until about the 48th hr. On one occasion when a test was started at 4:00 PM, the time corresponding to the start of the 16-hr dark period, a considerable number of seeds germinated by the 24th hr. This indicated that alkali sacaton is negatively photoblastic, at least during the early or pregermination stage.

The purpose of this study, therefore, was to determine the effect of light on germination of alkali sacaton.

Literature Review

Prior to the turn of the century, photoblastism was thought to be an isolated phenomenon restricted to very few species (Evenari, 1965). The first cases of negative photoblastism were described in 1903. We now know that both phenomena are widespread. Research has shown that light is required for optimum germination in a large majority of species, and that it increases the rate of germination in many others. This relation is par-

ticularly true in grasses. In Rules for Testing Seeds (Association of Official Seed Analysts, 1960) light is specified as a requirement for more than 60 grass species. The germination requirements for alkali sacaton, or any other species of the genus, were not specified.

Comprehensive reviews of experimental work on light effects and germination have been made by Evenari (1956), Toole et al. (1957), and Hendricks and Borthwick (1963). Unfortunately, most of the research has been restricted to a very few species; there are innumerable papers dealing with light requirements of lettuce (*Lactuca sativa*) and *Phacelia tanacetifolia*. Sauer and Struik (1964) found that most kinds of crop seeds are indifferent to light, and that germination of many weed seeds is promoted by light. Germination of only a few species is known to be inhibited by light.

Apparently, very little research has been done on the effect of light on the germination of grasses. Cumming and Hay (1958) found that wild oats (*Avena fatua*) germinated only 10% when surface planted, but 65% when planted at a depth of 1 inch. Koller and Roth (1963) found that *Panicum turgidum* germinated best in darkness or when held for 24 hr in darkness and in light thereafter. The presence of light at any time

¹ Forest Service, U.S. Department of Agriculture, with central headquarters maintained at Fort Collins in cooperation with Colorado State University; author is located at Albuquerque in cooperation with the University of New Mexico. Research reported here was conducted in cooperation with the Bureau of Land Management, U.S. Department of the Interior. It is extracted in partial fulfillment for the Ph.D. in Range Management, Department of Watershed Management, University of Arizona. Received May 5, 1970; accepted for publication July 3, 1970.

Table 1. Germination (%) of alkali sacaton seeds exposed to light for the time specified after 30 min imbibition.

Duration of exposure to light	Germination at various hours after start of imbibition		
	24	48	72
None	89a	93ab	96a
Flash	80bcd	93a	94ab
30 seconds	81bcd	94a	94ab
1 minute	74cd	93ab	93ab
5 minutes	80bcd	88abc	91bcd
10 minutes	83ab	85c	89bcde
20 minutes	76bcd	84cd	90bcd
30 minutes	80bcd	82cde	87abc
1 hour	79bcd	88abc	92abc
3 hours	76bcd	87abc	92abc
5 hours	82bcd	87bc	87cde
7 hours	72de	88abc	89bcd
9 hours	64ef	82cde	92abc
11 hours	58f	81cde	93ab
13 hours	60f	77de	94ab
15 hours	23g	84cd	85de
17 hours	20g	81cde	82ef
19 hours	18gh	75e	77f
21 hours	19gh	74e	74f
Continuous	12h	54	59

All values in columns not followed by the same letter are significantly different: all values in rows not underscored by the same line are significantly different (.05 level, Tukey procedure).

during the first 24 to 72 hr of incubation did not inhibit germination if the seeds were held in darkness thereafter; in fact, this procedure actually hastened the start of germination.

Koller and Negbi (1959) found that germination of *Oryzopsis miliacea* was restricted by either constant light or darkness. The dark-imposed restriction was broken by a single illumination period between 1 and 28 days after the start of imbibition. Although not so stated by the authors, it appears that *O. miliacea* requires light at some time during the incubation period for optimum germination.

Wright and Baltensperger (1964) found that germination of black grama grass (*Bouteloua eriopoda*) was as high in light as in darkness, but that germination was more rapid in darkness.

all treatments, except the constant exposure, so that seeds received the specified exposure but once during the 72 hr period. The study was terminated after 72 hr because previous research has shown that, for all practical purposes, germination of alkali sacaton seeds is completed by this time.

Results and Discussion

The results show that germination of alkali sacaton is inhibited by light (Table 1). Short exposures primarily delayed germination, while the more lengthy exposures not only delayed but also reduced total germination.

After 24 hr, germination of seeds kept in darkness was significantly better than that of seeds which received light for all periods ranging from flash to continuous exposure with the exception of those exposed for 10 min. The insignificant difference between darkness and 10 min exposure appeared to be due to shading of the petri dishes exposed 10 min by other dishes above and around them. Similarly, seeds exposed 1 min did not germinate significantly better during the first 24 hr than those exposed 10 min. With the exception of seeds kept in darkness, seeds exposed 10 min were the only ones whose germination did not increase significantly from 24 to 48 hr after the start of the study; in other words, this was the only treatment in which exposure to light did not significantly delay germination during the first 24 hr after imbibition.

The same phenomenon was evident, and to a much greater extent, from the 48th to the 72nd hr after start of imbibition: germination of seeds in darkness and exposed flash through 10 min did not increase significantly from 48 to 72 hr. This is understandable if we assume these short exposures were not sufficient to delay germination for more than 48 hr. We would then also have to assume that longer exposures would delay germination longer, with the amount

Procedures

To determine if alkali sacaton is negatively photoblastic, seeds were placed in black petri dishes on moist blotters and allowed to imbibe moisture for 30 min at 90 F. After imbibition the seeds were subjected to light treatment of 1,000 ft-c intensity for periods ranging from flash exposure to constant exposure (exposure for the duration of the study; Table 1). Flash exposure and exposures of 30 sec and 1 min were obtained by removing the petri dish lids and replacing them after the desired exposure. Extended exposures were obtained by replacing the black petri dish covers with clear covers for the specified time. Germinated seeds were counted and removed from the dishes every 24 hr for 72 hr. Triplicate dishes were prepared for

of delay proportional to the length of exposure. This was not the case, however; germination of seeds exposed 20 and 30 min increased significantly from 24 to 48 hr, whereas germination of seeds exposed 10 min did not. Table 1 shows other such irregularities.

These apparent reversals of light effect may not have been real, but may have been due to shading of certain petri dishes by dishes on the shelves above and around them, or the result of other unmeasured sources of variation.

Conclusions

Light affects germination of alkali sacaton in the following ways:

1. Exposure of imbibed seeds for a few seconds to 9 hr will delay germination of some of the seeds for more than 24 hr but less than 48 hr.
2. Exposure for 9 through 13 hr will delay germination of some of the seeds for more than 48 hr but less than 72 hr.
3. Generally, exposure for more than 13 hr not only delays but significantly reduces final germination.

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