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Seed germination and emergence of *Setaria pallidefusca* and *Pennisetum pedicellatum* (Cyperales: Poaceae) in Nigeria.

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Abstract: Seed weight, viability, germination and emergence of *Setaria pallidefusca* and *Pennisetum pedicellatum* were determined under controlled conditions. The seeds of *S. pallidefusca* and *P. pedicellatum* had 97% and 94% viability respectively. Optimum germination of all seeds occurred at 25°C. Maximum seedling emergence occurred at the soil surface, there was a progressive decrease at greater depth. Maximum depth for emergence were 5 cm (*S. pallidefusca*) and 7 cm (*P. pedicellatum*). Seeds of both species germinated well under varied light conditions. However, there was less germination under continuous light or darkness conditions than under alternating day and night conditions.

Key words: *Setaria pallidefusca, Pennisetum pedicellatum,* germination, emergence, temperature, soil depth, light conditions.

Setaria pallidefusca (Schum.) Stapf & Hubb., commonly known as cattail grass and *Pennisetum pedicellatum* Trin.; are widely distributed in Nigeria as weeds of arable crops and in waste places, roadsides and lawns (Hutchinson and Dalziel 1972, Akobundu and Agyakwa 1987). Literature on the two species are scanty. *S. pallidefusca* was reported to be among the serious weeds in Senegal, Sudan, Zambia, Fiji, Kenya and India (Holm *et al.* 1979). Bogdan (1977), reported on the palatability of *P. pedicellatum* to livestock.

The effect of grass weeds in reducing crop yields through competiton cannot be over-emphasized. The knowledge of the developmental physiology of grasses is of considerable importance in the management of grass weeds. Germination and establishment of seeds of *S. pallidefusca* and *P. pedicellatum* were investigated as prerequisites to the development of effective control measures.

MATERIAL AND METHODS

Mature seeds of *S. pallidefusca* and *P. pedicellatum* were collected from the main campus of the University of Ilorin, Nigeria; in November, 1989, and stored at room temperature during four months.

Seed weight was determined by weighing separately 100 seeds of each grass using an analytical balance (Turnbull 1975).

Viability was determined by placing sectioned seeds in 0.5% triphenyl tetrazolium chloride solution (Etejere and Okoko 1989); again using five replicates with 100 seeds of each grass.

The effect of temperature on germination of seeds of *S. pallidefusca* and *P. pedicellatum* was determined in incubators set at 10, 15, 20, 25, 30, 35, 40, 45 and 50°C. Twenty five seeds of each grass species were surface sterilized in 0.1% mercuric chloride solution for 60 seconds

to prevent fungal attack; rinsed in several changes of sterile distiled water and plated on double layers of filter paper placed in 9.0 cm petri dishes. Filter papers were initially moistened with 5 ml sterile distiled water. This was replicated five times. Emergence of radicle was the criterion for germination. Germination was counted after 14 days of incubation, and data were subjected to analysis of variance and means compared using Duncan's Multiple Range tests.

The effect of depth of sowing on seed germination of the two species was determined by sowing 50 seeds in plastic pots filled with heat sterilized top soil at depths of 1, 2, 3, 4, 5, 6, 7, 8, and 9 cm under five replicates. The pots were subirrigated to minimise soil crusting and compacting. The experiment was conducted outdoors, where day temperatures were 30-35°C and night temperatures were 24-28°C. Seedlings were counted and removed as they emerged for 40 days. There were five replicates of each planting depth for each grass.

Germination of seeds of the two grass species was also tested under different light conditions viz; (1) continuous white light supplied from four florescent tubes of 40 W each and maintained at 1.5 m above the seeds; (2) continuous darkness, and (3) alternating 14-h daylight and 10-h darkness at night, all at room temperature (30 ± 2°C).

RESULTS

Seed weight and viability tests: The weight of 100 seeds of *S. pallidefusca* ranged from 113 mg to 115 mg while the same number of seeds of *P. pedicellatum* ranged from 140 mg to 160 mg. Therefore, the average weight of a seed of these grasses was 1.14 mg and 1.5 mg respectively. Also, the seeds of the two grass species showed high viability: *S. pallidefusca* 97% and *P. pedicellatum* 94%.

Germination and emergence: Although both grasses appeared to have optimum germination at 25°C, the optimum range for *P. pedicellatum* included 30°C (Table 1). Below and above these temperatures, germination decreased progressively for both species.

Maximum germination and emergence -for both species occurred at soil surface and declined progressively with depth (Table 2). S. *pallidefusca* did not emerge below 5 cm while seedlings of *P. pedicellatum* emerged up to a depth of 7 cm. A distance of 1 cm below soil surface significantly reduced emergence ($P<0.05$) of seedlings in both species.

The two species did well in all light conditions, but *S. pallidefusca* showed only 28.1% germination under continuous dark condition (Table 3).

TABLE 1

Influence of temperature on the germination of seeds of Setaria pallidefusca *and* Pennisetum pedicellatum. *Data in means of five replicates*

Temperature (°C)	Germination (%)	
	S. pallidefusca	*P. pedicellatum*
10	0.0	0.0
15	2.5a	11.0ad
20	18.8bf	41.4b
25	83.8c	78.9c
30	61.3d	70.1c
35	48.3e	14.0d
40	25.0b	5.3a
45	13.5f	0.0
50	0.0	0.0

Means within a vertical column followed by the same letter are not significantly different at $P < 0.05$.

TABLE 2

Influence of sowing depth on germination and emergence of seeds of Setaria pallidefusca *and* Pennisetum pedicellatum. *Data in means of five replicates*

Sowing depths (cm)	Germination (%)	
	S. pallidefusca	*P. pedicellatum*
0	90.0a	95.2a
1	62.5b	73.5b
2	60.1b	52.4c
3	52.5b	39.7d
4	31.3c	30.0d
5	17.4d	29.1d
6	0.0	18.2e
7	0.0	1.3f
8	0.0	0.0
9	0.0	0.0

Means within a vertical column followed by the same letter are not significantly different at $P<0.05$

DISCUSSION

The establishment of weed seedlings is contigent not only upon successful production of a high number of viable seeds, but on seed germination. With the high viabilities of 97% and

TABLE 3

Influence of light on seed germination of Setaria pallidefusca *and* Pennisetum pedicellatum. *Data in means of five replicates. Temperature at 30±2°C*

Light conditions	Germination (%)	
	S. pallidefusca	*P. pedicellatum*
Alternating day and night	91.6a	86.4a
Continuous light	46.8b	51.5b
Continuous dark	28.1c	50.0b

Means within a vertical column followed by the same letter are not significantly different at P<0.05

94% in *S. pallidefusca* and *P. pedicellatum* respectively, seed germination and establishment in the two species would be ensured in suitable habitats.

The ability of the seeds of the grass species to germinate over a broad temperature range is an indication that they would be expected to present problems as weeds throughout the year, most especially *S. pallidefusca,* about 80% of whose seeds can be expected to germinate at temperatures above 15°C and below 45°C. Another characteristic of the two grass weeds to perpetuate themselves is their ability to emerge from deep soil layers. About 17% of *S . pallidefusca* can emerge from soil depth of 5 cm while more than 1% of *P. pedicellatum* can emerge from a depth of 7 cm. This character also gives them the potential for successful competition with a wide range of crops. Based on this same ability to emerge from deep soil layer, *P. pedicellatum* is expected to have an edge over *S. pallidefusca* when the two are in competiton among other weeds.

The fact that *S. pallidefusca* and *P. pedicellatum* have very small seeds, 1.14 mg and 1.5 mg respectively, may explain the higher establishment at and near soil surface than when buried in the soil, where food reserves are inadequate to allow extension of plumule. Similar observations have been reported for *Eleusine indica* and *Sporobolus pyramidalis* (Sharma 1984) and *Tridax procumbens* (Ogbonnaya 1988). Additionally, fluctuating temperatures usually promote germination (Russell 1973, Berrie 1984). Diurnal fluctuations in temperature, in this case 24-35°C might have promoted more seed germination at the uppermost few centimeters of the soil.

The trend of germination of the two species in different light conditions showed that they performed better in alternating day and night than the rest conditions. The sharp reduction in germination percentages from alternating day and night to continuous light condition shown by the two grass species could be a response of the two weeds to R/FR ratio. However, a continuous light condition is not realized for days in nature, especially in Nigeria. Hence, the apparent inhibitory effect of the condition on germination of these grasses is removed by the natural alternating day and night. Also, any possible inhibitory effect of continuous darkness on seeds that were buried might probably have been removed by diurnal fluctuations in temperature, as explained earlier. *P. pedicellatum* did well in all light conditions while *S. pallidefusca* showed only 28.1% germination in continuous darkness. This might again, give *P. pedicellatum* an advantage over *S. pallidefusca* when in competition in their natural habitats.

RESUMEN

En condiciones de laboratorio, se determinaron el peso, la viabilidad, la germinación y la "emergencia" en semillas de *Setaria pallidefusca* y *Pennisetum pedicellatum.* Respectivamente, la viabilidad fue de 97 y 94%. La germinación óptima se dio a los 25 °C y la máxima emergencia en la superficie del suelo, con una disminución progesiva a mayor profundidad. La profundidad máxima emergencia fue 5 cm *(S. pallidefusca)* y 7 cm *(P. pedicellatum).* Las semillas de ambas especies germinaron bien en varias condiciones de iluminación. Sin embargo, hubo menos germinación con luz y oscuridad contínuas, que cuando se alternaban luz y oscuridad.

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