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Water Regimes and Soil Depth Influence on Seeds of Blood Grass (*Isahcne miliacea* Roth ex Roem et Schult)

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ABSTRACT

Blood grass (*Isahcne miliacea* Roth ex Roem et Schult) is most dominant perennial weed species in the rice under cultivated and fallow situations belongs to the family *Poaceae*. The laboratory experiment was conducted at the State seed farm, Kottarakkara, Kollam district, Kerala subjecting the weed seeds to varying soil and water depths. Blood grass free soil and water was used for the study. The design was completely randomised design with 3 replications and 25 treatments. Treatments were the combination of two factors (water depth at 5 levels (W_1: 0 cm, W_2: 2.5 cm, W_3: 5.0 cm, W_4: 7.5 cm, W_5:10 cm) and soil depth of 5 levels (S_1: 0 cm, S_2: 2.5 cm, S_3: 5.0 cm, S_4: 7.5 cm, S_5: 10 cm). Depth of water regime showed that the germination, shoot length and vigour index of weed had only limited sensitivity to shallow water column but when the flooding depth was increased further there was significant decline. When the moist seeds were placed on the soil surface > 95 per cent of the seeds germinated and declined their germination and vigour index on increasing the soil depth. All the seeds failed to germinate at 10 cm soil depth under water column of 7.5 cm (W_4S_5) and 10cm (W_5S_5).

Key Words : Blood grass, Depth, Isahcne , Regime, Soil, Vigour index Water.

INTRODUCTION

Blood grass (*Isahcne miliacea* Roth ex Roem et Schult) is a species in the genus *Isachne* which contains 107 species and it belongs to the family Poaceae. Blood grass, locally known as v*alari/ changalipullu/ naringa/ vanchi* is a very troublesome wetland weed infesting vast tracts of wet land rice fields in Kerala. Raj *et al* (2003) observed that *Isachne* genera was having high species diversity and endemism. According to Babu *et al* (2014) it is the most dominant weed species in the rice fields of southern part of Kerala, during the first and second crop seasons as well as under cultivated and fallow situations with a relative density as high as 65 per cent. Propagation of blood grass is through seeds and rooted stem bits (Thomas and Abraham, 1998). Sauda (2015) observed that soil type had an influence on the phenology of blood grass. The weed seeds grown in different soil types showed variation in days to seed germination and took 5-15 days for germination depending on the soil characteristics.

MATERIALS AND METHODS

The laboratory experiment was conducted at the State seed farm, Kottarakkara, Kollam district, Kerala. Mature seeds of blood grass were collected from the sample plants, air dried and packed in airtight polythene bags and germination studies were undertaken at intervals using the same set of seeds. Twenty seeds were kept in petri plates placed under direct sunlight and the number of germinated seeds on the 7th day of sowing was counted and the germination per cent was calculated. Vigour index was estimated as per the procedure given by Abdul-Baki and Anderson (1973)..

Lab studies were conducted using seeds by subjecting the weed seeds to varying soil and water depths. Water levels in the pipes were maintained by periodic addition of water as and when required till the end of the study. In each pipe 20 seeds were placed and their emergence pattern was monitored for a period of 25d. The design was completely

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Table 1. Effect of water regimes (W) and soil depth (S) on propagation of blood grass

Treatment	Seed propagation			
Water depth (W) (cm)	**Germination percentage (%)**	**Shoot length (cm)**	**Root length (cm)**	**Vigour index**
0.0 (W_1)*	6.31 (47.3)	6.19	5.63	23.67 (559)
2.5 (W_2)	6.22 (47.0)	5.99	5.90	23.66 (559)
5.0 (W_3)	5.92 (43.9)	5.53	7.28	23.74 (612)
7.5 (W_4)	5.20 (38.4)	4.96	6.45	20.95 (604)
10.0 (W_5)	5.10 (37.5)	4.75	6.23	20.32 (563)
S Em(+/-)	0.25	0.04	0.05	0.24
CD (0.05)	0.72	0.12	0.13	0.69
Soil depth (S) (cm)				
0.0 (S_1)	9.83 (95.7)	4.32	8.56	35.12(1232)
2.5 (S_2)	8.55 (72.4)	8.57	5.73	32.19 (1035)
5.0 (S_3)	5.93 (35.2)	6.87	6.05	21.35 (455)
7.5 (S_4)	3.11 (10.0)	5.17	6.83	11.00 (120)
10.0 (S_5)	1.32 (0.87)	2.48	4.31	2.63 (5.9)
S Em(+/-)	0.25	0.04	0.05	0.24
CD (0.05)	0.72	0.12	0.13	0.69

randomised design with 3 replications and 25 treatments. Treatments were the combination of two factors (water depth at 5 Levels (W_1: 0 cm - seeds kept moist only with no standing water column, W_2: 2.5 cm, W_3: 5.0 cm, W_4: 7.5 cm, W_5:10 cm) and Soil depth of 5 Levels (S_1: 0 cm, S_2: 2.5 cm, S_3: 5.0 cm, S_4: 7.5 cm, S_5: 10 cm).

RESULTS AND DISCUSSION

Effect of water regime on seed propagation of blood grass seeds

The blood grass seed germination was significantly influenced by the water regimes (Table 1). The germination percentages recorded under zero and 2.5 cm water column were 47.3 and 47 per cent, respectively which were on par and significantly higher than that under the higher water regimes. The percentage was found to decline with increasing water depth and at 10 cm it was only 37.5 per cent. The shoot length of the emerged seedlings was reduced significantly with increasing water depth. At zero water depth, where the seeds were kept moist with no standing water column, the shoot length was the highest (6.19 cm) and the lowest was under 10 cm submergence (4.75cm). The vigour index of the blood grass seedlings was significantly influenced by water depth. At 0, 2.5 cm and 5 cm the values were on par and significantly higher than that at 7.5 cm and 10cm water depth. These results showed that the germination of this weed had only limited sensitivity to shallow water column but when the flooding depth was increased further there was significant decline in seed germination. Increasing the standing water leads to low concentration of dissolved oxygen at lower

Table 2. Interaction effect of water regime (W) and soil depth (S) on propagation of blood grass.

Treatment	Seed propagation			
	Germination percentage (%)	Shoot length (cm)	Root length (cm)	Vigour index
T_1-w_1s_1	9.45(88.3)	3.80	4.23	26.65 (710)
T_2-w_1s_2	8.68(75.0)	9.10	5.10	32.52 (1066)
T_3-w_1s_3	7.23(51.3)	7.37	5.53	25.75 (662)
T_4-w_1s_4	4.36(18.0)	5.77	6.40	14.83 (219)
T_5-w_1s_5	1.82(2.3)	4.93	6.90	5.32 (28)
T_6-w_2s_1	9.78 (94.7)	4.17	4.60	28.82 (830)
T_7-w_2s_2	9.00(80.0)	8.73	5.37	33.60 (1128)
T_8-w_2s_3	6.86(46.0)	7.13	5.97	24.56 (602)
T_9-w_2s_4	3.95(14.7)	5.73	6.47	13.41 (179)
T_{10}-w_2s_5	1.52 (1.3)	4.17	7.10	3.95 (15)
T_{11}-w_3s_1	9.88(96.7)	4.43	10.03	37.41 (1398)
T_{12}-w_3s_2	8.70(74.7)	8.50	5.77	32.65 (1065)
T_{13}-w_3s_3	5.94(34.3)	6.23	6.17	20.65 (426)
T_{14}-w_3s_4	3.78(13.3)	5.17	6.87	12.69 (160)
T_{15}-w_3s_5	1.41 (1.0)	3.30	7.57	3.45 (11)
T_{16}-w_4s_1	10.02 (99.3)	4.53	12.73	41.42 (1715)
T_{17}-w_4s_2	8.27(67.3)	8.37	6.13	31.26 (976)
T_{18}-w_4s_3	4.90(23.0)	6.97	6.17	17.40 (302)
T_{19}-w_4s_4	1.82(2.3)	4.93	7.20	5.39 (28)
T_{20}-w_4s_5	1.00 (0.0)	0.00	0.00	1.00 (0)
T_{21}-w_5s_1	10.02 (99.3)	4.67	11.20	39.71 (1576)
T_{22}-w_5s_2	8.12(65.0)	8.17	6.30	30.68 (941)
T_{23}-w_5s_3	4.72(21.3)	6.67	6.43	16.73 (279)
T_{24}-w_5s_4	1.62(1.7)	4.23	7.23	4.44 (19)
T_{25}-w_5s_5	1.00 (0.0)	0.00	0.00	1.00 (0)
S Em(+/-)	0.13	0.09	0.10	0.54
CD (0.05)	0.39	0.26	0.23	1.54

Figure in original scale is given in parenthesis. Data subjected to transformation

strata leads to poor germination, root length, shoot length and resulted in lower vigour index of seeds of blood grass.

Effect of soil depth on seed propagation of blood grass seeds

The soil depth had significant influence on the seed germination (Table 1). The highest germination percentage (95.7) was recorded when the seeds were kept on the soil surface (S_1). The germination was found to come down drastically with incremental soil depth and was only 0.87 per cent under the 10 cm soil column. When seeds of blood grass placed on the soil surface the vigour index was as high as 1232 which decreased with increasing soil depth. The decrease was drastic at 5 cm (455) onwards and the lowest value of 5.9 was registered at 10cm soil depth. The study showed that when moist seeds were placed on the soil surface more than 95 per cent of the seeds germinated. From the results it was clear that the effect of soil depth on germination and establishment of the weed propagules was more drastic. When the moist seeds were placed on the soil surface > 95 per cent of the seeds germinated. The results are in agreement with Sauda (2015) in blood grass and Loddo *et al* (2016) in green foxtail(*Setaria viridis)*. Chauhan and Johnson (2012) opined that small sized seeds germinated better from the soil surface and the ability of seedlings to emerge from deeper depths depended on the energy reserves in the seeds. In blood grass the minute seed size as well as the cutting off of direct sunlight in the deeper soil layers must have contributed to the establishment failure of blood grass.

Combined influence of water regimes and soil depth on weed propagation

The results showed that the interaction effect of water regime (W) x soil depth (S) on germination percentage of blood grass seeds was statistically significant (Table 2). When placed on the soil surface in water columns of 2.5 (W_2S_1), 5 (W_3S_1), 7.5(W_4S_1) and 10 cm(W_5S_1) the germination percentage recorded were 94.7, 96.7, 99.3 and 99.3 respectively which were on par with each other and significantly superior to other treatment combinations. All the seeds failed to germinate at 10 cm soil depth under water column of 7.5 cm (W_4S_5) and 10cm (W_5S_5) while under 0 (W_1S_5), 2.5 (W_2S_5) and 5 cm (W_3S_5) water column, the values were 2.3, 1.3 and 1 per cent respectively. Shoot length of the seedlings was found significant and the highest value (9.10cm) was recorded with seeds placed under 2.5 cm of soil column with zero column of water (W_1S_2). The interaction effect of water regime x soil depth on seedling vigour index was found significant and the highest value (1715) was recorded when the seeds were placed on soil surface under a water column of 7.5 cm (W_4S_1). All the other combinations were inferior and the lowest index (11) was recorded by seeds placed on 10 cm soil depth with 5 cm standing column of water (W_3S_5) which in turn was on par with W_5S_4. There was no seed germination under W_4S_5 and W_5S_5 .

CONCLUSION

It was concluded from the study that increasing water regime to 7.5cm and soil depth of 10 cm lead to drastic reduction of germination percentage, shoot length , root length and vigour index of blood grass. When the moist seeds were placed on the soil surface > 95 per cent of the seeds germinated and declined their germination and vigour index on increasing the soil depth. The combined effect showed that All the seeds failed to germinate at 10 cm soil depth under water column of 7.5 cm.

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