Indian J. Weed Sci. **37** (1 & 2) : 36-39 (2005)

Effect of Puddling on Distribution of Rabi Weed Seeds and their Emergence

J. S. Mishra, Roby Mathew and N. T. Yaduraju
National Research Centre for Weed Science, Maharajpur, Jabalpur-482 004 (M. P.), India

ABSTRACT

Puddling of soil significantly influenced the vertical distribution of weed seeds. Weed seeds were observed upto 20 cm depth but their intensity varied. While *Chenopodium album* was distributed mostly upto 5 cm depth, *Medicago hispida* and *Phalaris minor* were found in large numbers upto higher depth (10 cm). *Avena ludoviciana* was mostly abundant from surface to shallow depth (2.5 cm). Maximum emergence of *P. minor* at 2 cm and *A. ludoviciana* at 4 cm depth was recorded upto two weeks. Red light increased the germination of *P. minor* but reduced the germination of *M. hispida*. Lowest germination of *Asphodelus tenuifolius* and *P. minor* was observed in dark but there was no effect of darkness on germination of *M. hispida*. Maximum germination of *A. ludoviciana* was recorded in green light.

INTRODUCTION

Zero-tillage in wheat in the rice-wheat cropping system of the Indo-Gangetic plains of South Asia is currently gaining considerable impetus (Hari *et al.*, 2003). Puddling is the common practice followed for transplanted rice in rice-wheat cropping system. Weed seed distribution pattern (Buhler and Mester, 1991; Yenish *et al.*, 1996) and seedling emergence (Harper *et al.*, 1965) are greatly influenced by tillage practices. Seeds of most weed species are small and contain relatively little food reserves, so germination on or near the soil surface is necessary for seedling survival. The weed seeds placed deep in the soil may not be able to germinate in the subsequent crop. The light requirement is the principal means by which seed germination is restricted to the proximity to the soil surface. Thus, the weed seeds buried by cultivation can germinate only when exposed to light by subsequent cultivation. The seed distribution pattern of different weeds in puddled rice soils is not known and also there is a dearth of information regarding the effect of seeding depth and light on weed seed germination. Hence, the present studies were conducted.

MATERIALS AND METHODS

One pot culture and two laboratory experiments were conducted at the National Research Centre for Weed Science, Jabalpur during 2003-04. The materials used and methods followed in these experiments were as follows :

Experiment-1

Soil samples were collected in semi-dry conditions with core auger from undisturbed puddle rice fields (previously infested with *Chenopodium album, Medicago hispida, Avena ludoviciana* and *Phalaris minor*). There was sufficient water (10-15 cm) in the field at the time of puddling and a continuous submergence of 5-10 cm water was maintained throughout the rice growth period. The sampling was done before 15 days of rice harvest at four depths (0-2.5, 2.5-5, 5-10 and 10-20 cm). Later soils were dried in the shade and ground gently into small pieces. Thereafter, 150 g each of soil samples was weighed, kept in petri dishes (15 cm width and 3 cm depth) under room temperature and watered as and when needed to maintain adequate moisture. After germination, the seedlings were identified, counted and removed. After this the soil was thoroughly stirred and watering continued for another flush of germination. The cycle of operation was repeated after every flush of germination, identification and removal of seedlings. The treatments were replicated thrice in a completely randomized design.

Experiment-2

Pots (size 36 cm x 27 cm) were uniformly filled with soil, sand and farm yard manure in the ratio of 2 : 1 : 1. Twenty-five seeds each of canary grass and wild oat were sown at varying depths (surface, 1, 2, 3, 4, 5, 6, 8, 10 and 12 cm). Pots were irrigated immediately after sowing to ensure proper seed germination. Treatments were replicated four times in a completely randomized design. Observations on seedling emergence were recorded at 30 days after sowing (DAS). Data on per cent emergence of seedlings were analysed by using angular transformation ($\sin^{-1}\sqrt{x}$).

Experiment-3

In this experiment, seeds of four different weed species viz., wild onion (*Asphodelus tenuifolius*), little seed canary grass (*Phalaris minor*), bur clover (*Medicago hispida*) and wild oat (*Avena ludoviciana*) collected from previous season were exposed to four light treatments viz., natural light, green light, red light and complete dark. Twenty-five seeds of test weed species were placed in sterilized petri dishes (10 cm dia.), lined with three layers of Whatman No. 1 filter paper. Ten ml of distilled water per petri plate was added just before exposing them to different light media. In natural light, seeds were kept in petri dishes without any covering, whereas in the other light treatments petri dishes were wrapped with black, red and green thin polyethylenes. The black polyethylene treatment was further kept in the dark chamber. The petri dishes were kept at room temperature. The treatments were replicated thrice in a completely randomized design. The seed germination was recorded 10 DAS.

RESULTS AND DISCUSSION

Effect of Puddling on Distribution of Rabi Weeds

Puddling of rice field significantly influenced the vertical distribution of winter season weeds (Table 1). Irrespective of the weed species, maximum weeds were present at 2.5-5.0 cm depth, which was at par with 0-2.5 cm depth. Further increase in depth significantly reduced the weed seed distribution. The lowest number of seeds was noticed at 10-20 cm depth. Among the different weed species, *M. hispida* had significantly higher number of seeds followed by *C. album*, *A. ludoviciana* and *P. minor*. The interaction effect of depth and weed species was significant. *C. album* was maximum and uniformly distributed upto 5 cm depth, whereas higher population of *M. hispida* and *P. minor* was recorded at 2.5-5.0 cm depth. Contrary to this, the population of *A. ludoviciana* was maximum at 0-2.5 cm depth and decreased gradually with increasing depths. Higher emergence of *C. album* and *A. ludoviciana* from upper soil layer might be due to

Table 1. Effect of puddling on distribution of weed seeds (No. 150 g^{-1} soil) at different soil depths

Depth (cm)	*Chenopodium album*		*Medicago hispida*		*Avena ludoviciana*		*Phalaris minor*		Mean	
	1 WAE	4 WAE	1 WAE	4 WAE	1 WAE	4 WAE	1 WAE	4 WAE	1 WAE	4 WAE
0-2.5	7.0	8.0	9.3	10.0	3.0	3.3	0.3	0.3	4.9	5.4
2.5-5	7.0	7.3	12.3	13.0	1.3	2.0	1.0	1.0	5.4	5.8
5-10	4.0	4.0	11.0	13.0	0.7	1.0	1.0	1.0	4.2	4.8
10-20	1.0	1.0	3.7	4.0	0.3	0.3	0.3	0.3	1.3	1.4
Mean	4.7	5.1	9.1	10.0	1.3	1.7	0.7	0.7		

LSD (P=0.05)	Depth	Weed species	Interaction
1 WAE	1.2	1.2	2.4
4 WAE	1.6	1.6	3.2

WAE–Weeks after experimentation.

Table 2. Effect of light quality on germination of different weeds

Treatment	*Asphodelus tenuifolius*	*Phalaris minor*	*Medicago hispida*	*Avena ludoviciana*	Mean
Natural light	97.3	93.3	68.0	17.3	69.0
Dark	57.3	70.7	68.0	25.3	55.3
Green light	89.3	89.3	68.0	34.7	70.0
Red light	92.0	98.7	56.0	28.0	68.7
Mean	84.0	88.0	65.0	26.3	

LSD (P=0.05) : Light=8.19, Weed species=7.09, Interaction=14.18.

their lighter seed weight which would have enabled them to float on the surface during puddling operation.

Effect of Seeding Depth on Emergence of Canary Grass and Wild Oat

Seedlings of canary grass started emerging one week after sowing (WAS) from 0 (surface) to 4 cm depth (Fig. 1). Irrespective of the depth of seeding, maximum emergence was recorded upto two weeks. Maximum seedling emergence was recorded at 2 cm depth closely followed by 1 and 3 cm. Seedling emergence significantly declined with increase in seeding depths exceeding 4 cm. Seeding at 6 to 8 cm depths and at surface showed poor emergence as compared with other depths and there was no emergence at 10 cm and beyond. Seedlings of wild oat also started emerging 1 WAS from 0-3 cm depth (Fig. 2) but their number was very less as compared to canary grass. Irrespective of the depth of seeding, maximum emergence was recorded upto two weeks. Seedlings of wild oat though emerged even upto 12 cm depth, but the maximum emergence was recorded at 4 cm depth closely followed by 3 and 5 cm. Delayed and decreased seedling emergence in deeper zones (beyond 4 cm) seems to be due to mechanical impedance, poor aeration and shorter length of coleoptile of the weed. Decreased emergence from surface may be due to poor seed-soil contact. These results confirm the findings of Mishra *et al.* (2002).

Effect of Light on Germination of Rabi Weeds

Different light exposures significantly influenced the germination of various weed seeds (Table 2). Green light (70.0%) being at par with natural (69.0%) and red (68.7%) lights recorded significantly higher germination as compared to dark (55.3%). Maximum germination (97.3%) of *A.*

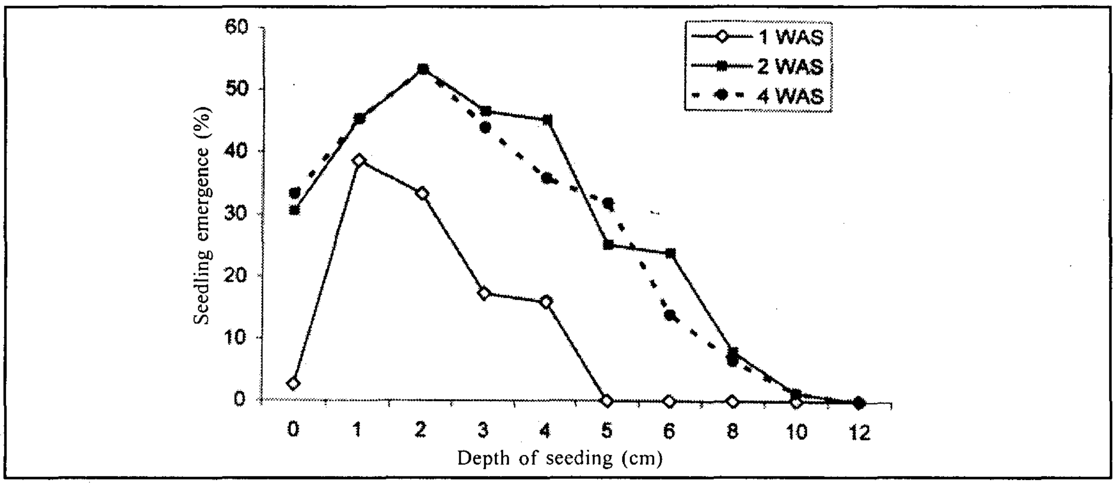

Fig. 1. Effect of seeding depth on emergence of *Phalaris minor.*

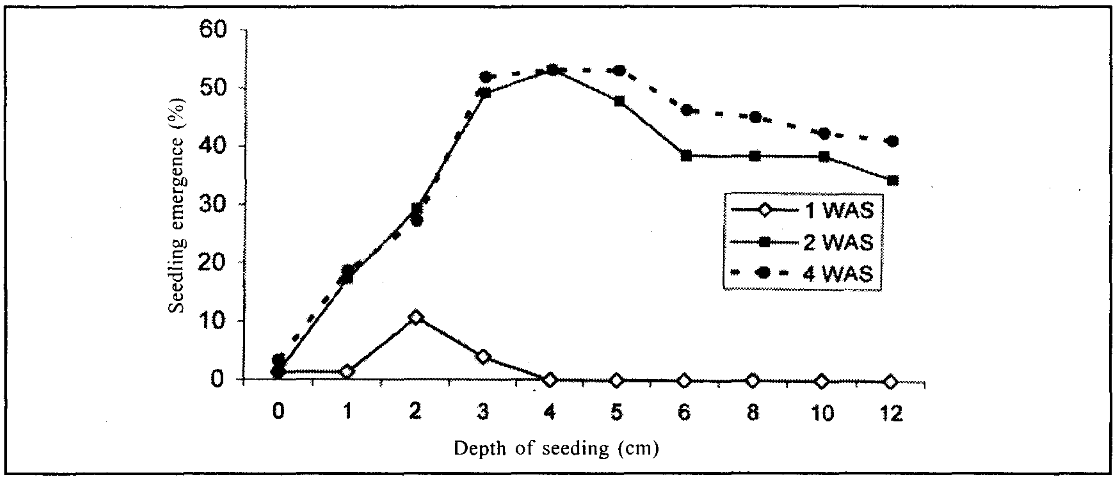

Fig. 2. Effect of seeding depth on emergence of *Avena ludoviciana*.

tenuifolius was obtained in natural light, which was at par with red (92.0%) and green lights (89.3%). Keeping seeds in the absence of light (dark) significantly reduced germination of *A. tenuifolius* (57.3%). Red light treatment significantly increased the germination of *P. minor* (98.7%) followed by natural (93.3%) and green light (89.3%). Keeping seeds under dark significantly reduced the germination of *P. minor* (70.7%). Cisneros and Zedler (2001) also obtained the highest percentage of germination of *P. arundinacea* under white and red light and there was no germination in dark. In general, the germination of *A. ludoviciana* was low. Green light favoured the germination of *A. ludoviciana* (34.7%), which was at par with red (28.0%) but significantly higher than dark (25.3%). The lowest germination (17.3%) was recorded in natural light.

REFERENCES

Buhler, D. D. and T. C. Mester, 1991. Effect of tillage on the emergence depth of giant grass (*Setaria faba*) and green foxtail (*Setaria viridis*). *Weed Sci.* **39** : 200-203.

Cisneros, R. and J. Zedler, 2001. Effect of light on germination in *Phalaris arundinacea* L. (red canary grass). *Plant Ecol.* pp. 75-78.

Hari, O. M., S. D. Dhiman, K. Hemant and K. Sajjan, 2003. Biology and management of *Phalaris minor* in wheat under a rice-wheat system. *Weed Res.* **43** : 59-67.

Harper, J. L., J. T. Williams, and G. R. Sagar, 1965. The behaviour of seeds in soil. The heterogeniety of soil surface and its role in determining the establishment of plants from seed. *J. Ecol.* **53** : 273-286.

Mishra, J. S., V. P. Singh and N. T. Yaduraju, 2002. Germination, growth and seed production of onion weed (*Asphodelus tenuifolius*) as influenced by dates of sowing and seeding depths. *Indian J. agric. Sci.* **72** : 298-300.

Yenish, J. P., T. A. Fry, B. R. Durgan and D. L. Wyse, 1996. Tillage effects on seed distribution of common milkweed (*Asclepias syriaca*) establishment. *Weed Sci.* **44** : 815-820.