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Lovekesh Kumar Gilhare
S.G. College of Agriculture & Research Station, IGKVV, Jagdalpur, Chhattisgarh, India

A Pradhan
S.G. College of Agriculture & Research Station, IGKVV, Jagdalpur, Chhattisgarh, India

Rahul Jaiswal
D.T.C College of Agriculture & Research Station, IGKVV, Bilaspur, Chhattisgarh, India

Satya Narayan Singh
S.G. College of Agriculture & Research Station, IGKVV, Jagdalpur, Chhattisgarh, India

Corresponding Author:
Lovekesh Kumar Gilhare
S.G. College of Agriculture & Research Station, IGKVV, Jagdalpur, Chhattisgarh, India

Effect of water impending on weed control efficiency in rice

Lovekesh Kumar Gilhare, A Pradhan, Rahul Jaiswal and Satya Narayan Singh

Abstract
A field experiment was conducted during the *Kharif* 2017 at S.G. College of Agriculture and Research Station, Jagdalpur on sandy loam soil with five treatments *viz.*, water imponding of 15, 30 and 45 days 10 days after transplanting, bispyribac sodium 25 g ha^{-1} as post-emergence and without water imponding (Control) in factorial randomized block design with four replications. The data on weed control efficiency at 60 DAT were more important and noticed significant change in weed control efficiency regardless grassy, sedges and broad leaved weed due to imponding water and herbicide application. The maximum weed control efficiency was recorded under 30 days water imponding 10 days after transplanting (64.93, 81.25, 93.96, 72.07, 94.23, 75.28, 63.54, 62.66 and 82.09% for *Panicum repens*, *Brachiaris reptans*, *Cyperus difformis*, *Eleocharis indica*, *Fimbristylis miliacea*, *Dopatrium junceum*, *Ammania baccifera*, *Rotala indica* and other, respectively).

Keywords: Water imponding, weed control, herbicide, rice

Introduction
Rice (*Oryza sativa* L.) is one of the world's most important food crops. Currently, more than one third of the human population relies on rice for their daily sustenance. Rice is the vital food for more than two billion people in Asia and four hundred million people in Africa and Latin America (IRRI, 2006) [4]. In country scenario, rice is grown in nearly 44 million ha of land with the productivity of 2.2 t ha^{-1} which is less than the productivity of many countries. Annual population growth rate of the country is nearly 1.8 % and if per capita consumption of rice is expected to be 400 gm per day then the demand for rice in 2025 will be 130 m. tonnes. In Chhattisgarh, rice occupies average of 3.6 million ha with the productivity of the state ranging between 1.2 to 1.6 t ha^{-1} depending upon the rainfall. The state is comprised with three agro-ecological zones *i.e. Chhattisgarh plain, Bastar plateau and Northern hill* region of Surguja. Various method of rice production on different land farms of farming situation. Rice is typically grown in bunded fields that are continuously flooded up to before harvesting. Continuous flooding helps ensuring sufficient water which control weeds and rice is an aquatic crop and mostly grown under submergence or variable imponding conditions.

Rice being adapted to submerged environments, the seed germination and emergence would take place even at some water depths. This would provide opportunities to suppress weeds by direct seeding rice in plots impounded with water. Imponding has the potential to eliminate weeds, and thereby avoiding rice-weed competition, and help rice farmers to avoid extra costs incurred on early weed removal. Management of water imponding in rice field is one of the most successful methods used by the rice farmers. Williams (1987) [2] in California reported that the level of water in rice field to 5-7 cm prevented the growth of major weeds in rice, but yields were only about 70% compared to herbicide methods. He reported that flooding was the most effective cultural control method of weeds in rice, and flooding to a depth of 10cm had prevented germination of most weed seeds and killed majority of weed seedlings.

Bastar plateau is situated southernmost part of state with cultivating rice in all farming situations like *uplamd, midland* and *lowland*. Mostly midland and low land farming is very unique system of compartmentation, in which water ponding is very common during rainy days but stagnation of water in their compartments provide small aquatic ecosystem of the field restricted many activities and supports many practices. The imponding system creates anaerobic condition leading to grow limited number of weeds up to some extend and reduces floral composition, but it is not known exact timing even not reported by various workers, so, this has targeted under experiment by extending time of water imponding. The substitution of rice crops in low lying region becomes more difficult due to continuous rains and development of perched water table at the surface of the soil for short duration during rice growing season.

Keeping that view in mind of all fact the present experiment was undertaken to find out the effect of different water imponding periods on weed control efficiency in rice.

Materials and Methods

The field experiment was conducted at S.G. College of Agriculture and Research Station, Jagdalpur during the rainy (*Kharif*) seasons of 2017. The normal average annual rainfall of the area is 1400 mm but its distribution is very erratic. Major amount of precipitation occurs between June and September (about 3-4 Months). The soil was sandy loam, low in organic carbon (0.53%), available N (245.24 kg/ha) and available P (7.00 kg/ha) and medium in available K (238.41 kg/ha), EC (ds m^{-1}) 0.30 with acidic (pH 5.80) in reaction. 100 kg N: 60 kg P_2O_5: 40 kg K_2O ha^{-1}. The whole quantity of P and K was applied as basal dressing, while nitrogen was applied in two equal splits at basal and active tillering stages (40 DAT). Transplanting was done on 6th July 2017 with 25 days old seedlings keeping distance of 20x10 cm in each plot of replications and harvesting of rice was done on 18th November 2017. The plot consisted of five treatments *viz.*, 15, 30 and 45 days water imponding 10 days after transplanting, bispyribac sodium 25 g ha^{-1} as post-emergence and without water imponding (Control). The water drained out from the field through drain channels opening to down side of experimental fields, for maintaining water level refilling was also done when water needed.

Observation method

Weed control efficiency was worked out on the basis of the following formula: WCE (%) = DWC-DWT/ DWC×100, Where, WCE = Weed control efficiency, DWC = Dry matter production of weeds in control plot and DWT = Dry matter production of weeds in treated plot.

Water management

After Transplanting, the soil was kept wet until the crop harvesting. 15 cm water level was maintained in following treatment *viz.* T_1**:** 15 Days water imponding 10 days after transplanting, T_2**:** 30 Days water imponding 10 days after transplanting and T_3: 45 Days water imponding 10 days after transplanting making bund around individual plots by mud in semi circular shape of 20 cm height with 15cm width. The water drained out from the field through drain channels opening to down side of experimental site. For maintaining water level refilling was also done when rainfall received or imponding through irrigation water.

Weed management practices

The weed management practices were adopted as per treatment. In first three treatment weed managed by imponding water, in fourth treatment herbicide Bispyribac-sodium @ 25 g h^{-1} was used and fifth treatment used as a control plot.

Results and discussion

Weed control efficiency (%)

The effects of various treatments on weed control efficiency are presented in Table 4.18 and 4.19. The major weed flora in the experimental field was remarkably influenced by application of water imponding and weed management treatments at 60 and 90 DAT. The weed control efficiency of grasses, sedges and broad leaved weed in the treatment 30 day water imponding 10 days after transplanting plot had higher than remaining treatments during observation. The data pertaining to weed control efficiency at 60 and 90 DAT were recorded significant variation in weed control efficiency regardless grassy, sedges and broad leaved weed due to imponding water for different period and herbicide application. The maximum weed control efficiency was recorded under 30 days water imponding 10 days after transplanting (64.93, 81.25, 93.96, 72.07, 94.23, 75.28, 63.54, 62.66 and 82.09 % for *Panicum repens*, *Brachiaris reptans*, *Cyperus difformis*, *Eleocharis indica*, *Fimbristylis miliacea*, *Dopatrium junceum*, *Ammania baccifera Rotala indica* and other, respectively) being at par to application of bispyribac-sodium @ 25 g ha^{-1} as post emergence at 15 DAT.

Hussain *et al*. (2008) [1] also reported about higher weed control efficiency of bispyribac-sodium and imponding water reduced growth of grasses and sedges than saturate condition (Ismaila *et al*., 2015)

Table 1: Effect of water imponding period on Weed control efficiency at 60 DAT

Treatment	Weed control efficiency (%)									
	Grassy weed		Sedge weed			Broad leaved weed			Others	Overall
	Panicum repens	*Brachiaris reptans*	*Cyperus difformis*	*Eleocharis indica*	*Fimbristylis miliacea*	*Dopatrium junceum*	*Ammania baccifera*	*Rotala indica*		
T_1	21.98	27.52	55.51	13.49	16.28	66.99	30.42	31.33	78.62	38.02
T_2	64.93	81.25	93.96	72.07	94.23	75.28	63.54	62.66	82.09	76.67
T_3	49.54	57.34	26.14	11.95	6.10	62.36	17.71	38.19	90.15	39.94
T_4	61.32	65.79	85.69	50.12	25.51	69.68	44.17	61.83	84.34	60.94
T_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±	1.21	5.13	2.74	6.23	6.12	1.97	6.25	2.27	0.75	3.11
CD (P=0.05)	3.68	15.52	8.32	NS	NS	6.12	NS	0.85	2.28	NS

*Figures in parenthesis are original values.

T_1= 15 Days water imponding 10 days after transplanting, T_2= 30 Days water imponding 10 days after transplanting, T_3= 45 Days water imponding 10 days after transplanting, T_4= Bispyribac -sodium @ 25g ha^{-1} post emergence at 15 DAT and T_5= Without water imponding (Control).

Table 2: Effect of water imponding period on Weed control efficiency at 90 DAT

Treatment	Weed control efficiency (%)									
	Grassy weed		Sedge weed			Broad leaved weed			Others	Overall
	Panicum repens	*Brachiaris reptans*	*Cyperus difformis*	*Eleocharis indica*	*Fimbristylis miliacea*	*Dopatrium junceum*	*Ammania baccifera*	*Rotala indica*		
T_1	20.29	90.25	93.23	31.46	49.07	40.01	53.91	46.94	55.68	53.43
T_2	38.06	100.00	100.00	47.58	89.83	100.00	72.12	62.27	92.86	78.08

T_3	8.95	87.24	79.02	25.53	33.64	39.36	40.83	38.65	32.61	42.87
T_4	20.77	100.00	89.79	27.23	88.52	88.33	44.46	49.52	74.15	64.75
T_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±	5.76	4.11	4.02	5.93	1.02	4.01	2.09	4.01	8.15	7.11
CD(P=0.05)	NS	13.05	12.16	NS	3.48	13.04	NS	12.37	NS	NS

*Figures in parenthesis are original values.

T_1= 15 Days water imponding 10 days after transplanting, T_2= 30 Days water imponding 10 days after transplanting, T_3= 45 Days water imponding 10 days after transplanting, T_4= Bispyribac -sodium @ 25g ha^{-1} post emergence at 15 DAT and T_5= Without water imponding (Control).

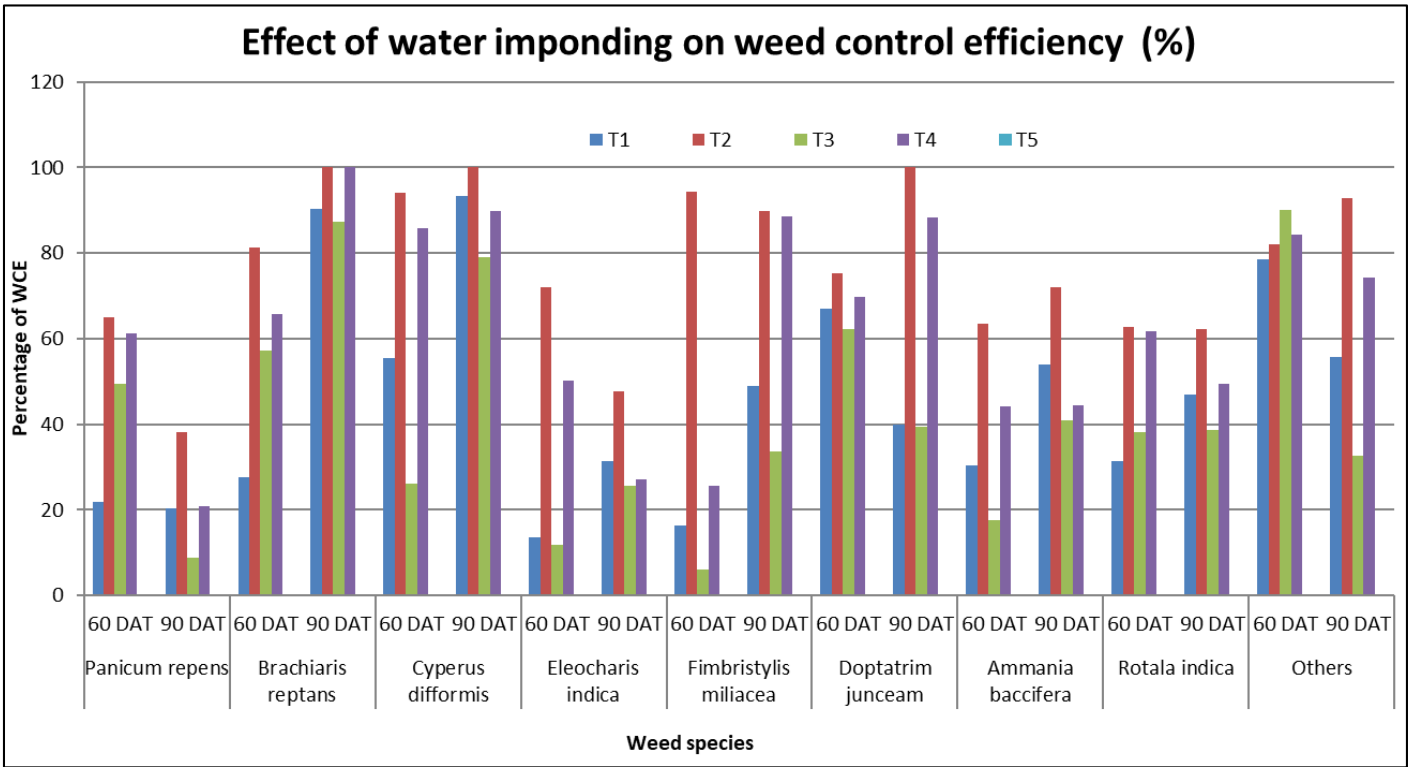

Fig 1: Effect of water imponding on weed control efficiency (%)

Conclusion

The maximum weed control efficiency was recorded under 30 days water imponding 10 days after transplanting with bio-efficacy of 62.66 to 93.96 % controlling weed flora.

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