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Effect of monsoon and weed management on growth and yield of direct-seeded rice

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ABSTRACT

A field study was conducted during 2008 and 2009 at G.B. Pant University of Agriculture and Technology, Pantnagar to evaluate the effect of two seeding time (before and after onset of monsoon) and six methods of weed control in direct dry seeded rice. Among the weed control treatments, butachlor applied 1.5 kg/ha in year 2008 and broadcasting of *Sesbania* knocked down by the application of 2, 4-D (brown manuring) at 30 days after sowing in 2009 recorded lowest weed dry weight. Pre-emergence application of butachlor 1.5 kg/ha yielded highest followed by the application of pretilachlor 0.5 kg/ha and broadcasting of *Sesbania* knock down with 2,4-D 0.5 kg/ha at 30 DAS which were at par with each other during both the year of experimentation.

Key words: Brown manuring, Chemical control, Direct dry-seeded rice, Sowing time, Weed control

Rice (*Oryza sativa* L.) is a major food grain crop of the world and more than half of the population subsists on it. It is the main livelihood of rural population living in subtropical and tropical Asia and hundreds of millions people living in Africa and Latin America. In India wheat, rice is the second important food crop next to. India is the second largest rice producing country in the world. The area and production under rice is 44.1 m/ha and 99.5 mt, respectively (http.//ffymag com/admin/issuepdf/Rice.pdf). The common method of rice cultivation in India is transplanting of the seedlings from nursery to main field which is very tedious and time consuming job. The higher cost and unavailability of farm labours invariably delay transplanting and often leads to transplanting of aged seedlings. The method of direct seeding escapes the transplanting and puddling operations which is an attractive and sustainable alternative to traditional transplanting of rice. DSR covers 26 and 28% of the total rice area in South Asia and India, respectively (Pandey and Velasco 1999).

Direct dry seeding offers such advantages as faster and easier planting, reduced labour, earlier crop maturity by 7–10 days, more efficient water use and higher tolerance of water deficit, less methane emission and often higher profit in areas with an assured water supply (Balasubramanian and Hill 2002). Early seeding of rice plays vital role in improving its growth and increasing the yield. The delayed sowing results in the poor emergence and reduced heading panicle per meter square and spikelets per panicle and ultimately yield is affected (Hayat *et al*. 2003). Due to poor emergence of crop, the weeds cause drastic reduction in crop productivity since they get sufficient space and time for vigourous growth. Therefore, the present study was undertaken to evaluate the effect of sowing time and weed control method on the density and productivity of direct seeded rice.

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MATERIALS AND METHODS

A field experiment was conducted at N. E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture &Technology, Pantnagar (Uttarakhand) during *Kharif* 2008 and 2009. The experiment was stipulated in split plot design with three replications. Rice crop was established by direct dry seeding method at the rate of 60 kg/ha. The treatment comprised of two seeding time (pre and post-monsoon) of direct seeded rice in main plot and six methods of weed control, *viz*. pretilachlor 0.5 kg/ha, butachlor 1.5 kg/ha each applied as pre-emergence and fenoxaprop 0.06 kg/ha as post-emergence, broadcasting of *Sesbania* and knocked down with application of 2-4-D 0.5 kg/ha at 30 DAS, weedy and weed free. Soil at the site was a heavy silt loam with pH 7.1, organic carbon 0.73%, low in available N, medium in available P_2O_5 and high in available K_2O.

In 2008, rice variety '*Sarjoo 52*' was sown on 19th June and 8th July, while in 2009, rice variety '*Govind*' was sown on 4th June and 1st August in rows 20 cm apart. The

crop was harvested on 17th October and 5th November in 2008 and 26th September and 30th October in 2009. All the herbicides were sprayed by using water 500 l/ha with the help of Maruti foot sprayer fitted with flat fan nozzle. Weed density were recorded at 60 DAS by placing a quadrate of 0.25 x 1.0 m randomly in the experimental plot. The samples taken out were oven dried for about one week and dry weight was recorded. All the other recommended package of practices except weed control was followed to raise the direct dry seeded crop.

RESULTS AND DISCUSSION

The experimental field was mainly infested with *Eleusine indica* and *Echinochloa* spp. among grasses, *Celosia argentia* and *Cleome viscosa* among broad-leaved weeds and *Cyperus* spp. among sedges, both before and after monsoon during both the years. However, *Panicum* spp, *Digitaria sanguinalis* and *Alhagi camelorum* were found only in before monsoon seeded crop.

Weed density and dry weight

The total weed density and dry weight recorded at 60 days after sowing were not influenced significantly due to sowing dates, except total weed density in 2009. The total weed density and dry weight reduced in post monsoon sown crop, but the differences were non significant. In 2009, post monsoon sown crop recorded significantly lower total weed density (63.8/m^2) than pre monsoon (74.1/m^2) sown crop. The reduction in weed density and dry weight in post monsoon seeded crop was due to emergence of most of the weeds after monsoon showers and the emerged weeds were controlled through tillage operations at final field preparation before seeding of rice seed.

Both, total weed density and dry weight recorded at 60 DAS were influenced significantly due to weed management practices during both the years (Table1). Among the weed control treatments, broadcasting of *Sesbania* knocked down by the application of 2,4-D 0.5 kg/ha at 30 DAS recorded the lowest weed density and was at par with application of other herbicidal treatments except application of fenoxaprop 60 g/ha applied as post-emergence which was found at par with weedy check in the years of 2008. Same trend was also noticed during 2009, however, broadcasting of *Sesbania* integrated with 2,4-D 0.5 kg/ha at 30 DAS was found significantly superior over application of pretilachlor 0.5 kg/ha and fenoxaprop 60 g/ha against weed population during this season. All the treatments gave significantly superior dry matter accumulation of rice over weedy plot. On an average heavier biomass of weeds were recorded during *Kharif* 2008 in weedy plot which might be due to late seeding of pre-monsoon crop compared to *Kharif* 2009 which results in heavy flush of weeds in the direct dry seeded rice field. Among the herbicidal treatments, butachlor applied 1.5 kg/ha recorded significantly lowest weed biomass which was followed by *Sesbania* knocked out with 2,4-D 0.5 kg/ha at 30 DAS, pretilachlor 0.5 kg/ha and fenoxaprop 0.06 kg/ha which were at par with each other in 2008. Similar trend in weed dry accumulation was noticed during *Kharif* 2009 except then *Sesbania* knocked out with 2,4-D 0.5 kg/ha which resulted significantly lower weed dry weight over the application of other herbicides. No significant difference recorded with application of butachlor 1.5 kg/ha and pretilachlor 0.5 kg/ha fenoxaprop 0.06 kg/ha. However, the significant differences on weed dry weight was ob-

Table 1. Effect of sowing time and weed control measures on total weed density and dry weight at 60 DAS and grain yield of rice

Treatment	Total weed density (no./m^2)		Total weed dry weight (g/m^2)		Grain yield (t/ha)	
	2008	2009	2008	2009	2008	2009
Time of sowing						
Before onset of monsoon	69	74.1	431.9	371.2	1.53	1.39
After onset of monsoon	69	63.8	307.8	300.3	1.64	1.14
LSD (P=0.05)	NS	8.3	NS	NS	NS	0.13
Weed control treatments						
Pretilachlor	78	78.8	459.9	408.2	0.95	0.74
Butachlor	70	70.0	86.1	358.2	3.04	2.18
Fenoxaprop	97	88.5	504.2	440.6	0.32	0.34
Sesbania + 2,4-D	64	63.0	455.9	325.6	0.84	0.64
Weedy	106	113.2	713.1	483.0	0.29	0.19
Weed free	0	0.0	0.0	0.0	4.06	3.49
LSD (P=0.05)	27	8.8	114.8	24.5	0.43	0.15

tained between these herbicides in the year 2009. Significant reduction in weed dry matter accumulation due to broadcasting of *Sesbania* knocked out with 2,4-D 0.5 kg/ha was also reported by Dhyani *et al*. (2009).

Grain yield

Higher grain yield was recorded in post-monsoon compared to pre-monsoon seeded crop during *Kharif* 2008, however, just reverse trend was obtained during *Kharif* 2009, while the difference was significant only in 2009 (Table 1). None of the weed management treatments could reach up to the higher level of weed free treatment in respect to grain yield of rice. Among the different weed control treatments application of butachlor (1.5 kg/ha), produced the highest grain yield followed by pretilachlor 0.5 kg/ha, broadcasting of *Sesbania* knock down with 2,4-D 0.5 kg/ha which were at par during both the year of experimentation. Highest grain yield with application of butachlor was found might be due to better control of heavy flush of weeds as early stage of crop growth whereas broadcasting of *Sesbania* knock down with 2,4-D 0.5 kg/ha recorded the lower weed dry weight at 60 days stage of crop yet it recorded the lower grain yield might be due to re-growth of some of the weeds and also suppression of same rice seedlings by *Sesbania* in early stage. Fenoxaprop 0.06 kg/ha was found poor control of weeds, thus produced the lowest grain yield during both the years. In 2008, application of fenoxaprop 0.5 kg/ha was at par with weedy check

Interaction effect

Significant differences were observed in weed dry weight at 60 DAS due to different weed management practices and dates of sowing during both the years. Application of fenoxaprop 60g/ ha and broadcasting of *Sesbania fb* by 2,4-D 0.5 kg/ha at 60 DAS were proved effective against weeds as it recorded significantly lower weed dry matter in post monsoon seeded crop as compared to before seeding monsoon crop during both the years. During *Kharif* 2009, significantly lower weed dry weight was recorded among all the weed control treatments in post monsoon seeding crop whereas in *Kharif* 2008, higher weed dry weight was recorded with the application of butachlor 1.5 kg/ha in post monsoon seeded crop compared to pre monsoon seeded crop, however, the differences was non-significant (Fig. 1 and 2). It might be due

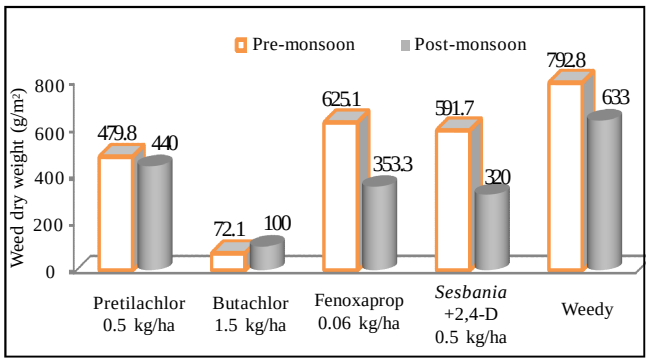

Fig. 1. Interaction effect of sowing time and weed control treatments on total weed dry weight at 60 DAS (2008)

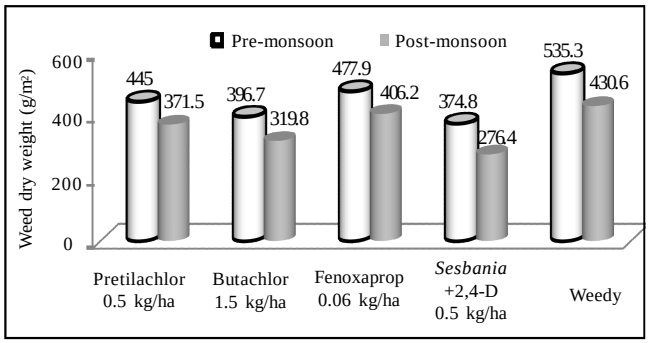

Fig. 2. Interaction effect of sowing time and weed control treatments on total weed dry weight at 60 DAS (2009)

Table 2. Interaction effect of sowing time and weed control treatments on grain yield (t/ha) of rice

Date of sowing	Pretilachlor 0.5 kg/ha		Butachlor 1.5 kg/ha		Fenoxaprop 0.06 kg/ha		*Sesbania* + 2,4-D 0.5 kg/ha		Weedy		Weed free	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Pre-monsoon	0.41	0.88	3.31	2.24	0.20	0.38	0.59	0.74	0.13	0.21	4.52	3.77
Post-monsoon	1.48	0.60	2.76	2.12	0.44	0.30	1.10	0.53	0.44	0.17	3.60	3.21
LSD (P= 0.5)											2008	2009
To compare time of sowing at same or different weed control											0.60	0.21
To compare wed control at same or different time of sowing											0.83	0.22

to late emergence of weeds in monsoon season. Application of butachlor 1.5 kg/ha recorded 84 and 25% lower weed dry weight, respectively during 2008 and 2009, compared to weedy check when the crop was seeded after monsoon.

On an average higher rice grain yield was recorded in pre-monsoon seeded compared to post-monsoon seeded crop in weed free treatment during both the years. Weed free recorded 20.3 and 14.9% higher grain yield in pre-monsoon sown compared to post-monsoon crop during 2008 and 2009, respectively. Pre-monsoon seeded crop recorded higher grain yield due to better growth and development of crop. Better growth in *Kharif* 2008 as compared to 2009 was mainly due to availability of more rainfall, proper distribution of rain and congenial temperature in pre-monsoon season (30.7^0C average maximum temperature) compared to post- monsoon season (33.4^0C average maximum temperature). Complete failure of the crop (about 90%) was found due to absence of weed control methods (weedy check) during both the years and seeding dates also. Application of butachlor 1.5 kg/ha gave higher grain yield compared to other herbicidal treatments during both the years. However, it was followed by broadcasting of *Sesbania* knocked down with 2,4-D at 0.5 kg/ha in pre-monsoon seeding of rice and with application of pretilachlor 0.5 kg/ha in post monsoon seeding in the year of 2008. During *Kharif* 2009, application of pretilachlor 0.5 kg/ha was the second highest grain yield producer after application of butachlor 1.5 kg/ha. Application of fenoxaprop 0.5 kg/ha was found inferior against weeds as it recorded lowest grain yield during both the dates of sowing and years, among the herbicidal treatments.

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