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Influence of Weed Management Practices on Nutrient Uptake and Productivity of Basmati Rice under Different Dates of Transplanting

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Abstract A field experiment was conducted during *kharif* of 2014. The experiment consisted of four transplanting dates (June 15, July 5, July 25 and August 15) in main plots and six weed control treatments in sub plots. Early transplanting resulted lowest weed density, weed dry matter accumulation by weeds at all growth stages. The highest grain yield (4,363 kg/ha) was recorded under June 15 transplanting and among the weed management practices tried, weed free check resulted in the highest values of grain yield which were however, comparable to pre-emergence application of oxadiargyl followed by bispyribac-sodium and pretilachlor followed by bispribac-sodium. The lowest density and dry matter accumulation as well as highest WCE and visual control of total weeds were recorded with pre-emergence application of oxadiargyl followed by bispyribac-sodium applied. The significantly lowest uptake of all nutrients by weeds was recorded under early transplanting (June 15) and among weed management practices, lowest uptake of nutrient by weeds was recorde in weed free check followed by pre-emergence application of oxadiargyl followed by bispyribac-sodium applied at 25 DAT. The highest B:C was registered with pre-emergence application of oxadiargyl followed by bispyribac-sodium.

Keywords Basmati rice, Bispyribac, Oxadiargyl, Pretilachlor, Quality.

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Introduction

Rice is the staple food crop of the tropics, in general and India in particular. "Rice is Life" aptly describes the importance of rice in food and nutritional security for the Asian countries. India is the second largest producer of rice in the world with production of 106 million tonnes from 43.50 million hectares, with a productivity of 2.41 tonnes/ha during 2013. In Haryana, rice occupies an area of 1.2 million hectares with production and productivity of 3.99 million tonnes and

Table 1. Effect of different transplanting dates and weed management practices on weed flora.

Treatments	No. of weeds/m^2	Weed dry matter accumulation (g/m^2)	Weed control efficiency (%) at harvest	Percent visual control at harvest
Main plot (transplanting dates)				
15 -Jun	11.76 (170)	9.61 (114)	61.6	60.6
05-Jul	12.03 (181)	9.82 (122)	61	60.1
25-Jul	12.32 (193)	10.10)129)	58.8	56.9
15-Aug	12.88 (206)	11.20 (151)	56.9	59.4
SEm±	0.08	0.04	0.7	0.1
CD at 5%	0.31	0.3	2.5	0.5
Sub plot (weed control treatments)				
Oxadiargyl 100 g/ha (PE)	12.85 (162)	10.96 (120)	62.5	64.2
Pretilachlor 1000 g/ha (PE)	13.03 (169)	11.30 (128)	60.3	62.5
Oxadiargyl 100 g/ha (PE) *fb* bispyribac-Na 25 g/ha (25 DAT)	12.08 (145)	9.74 (95)	70.4	67.9
Pretilachlor 1000 g/ha (PE) *fb* bispyribac-Na 25 g/ha (25 DAT)	12.40 (153)	10.28 (110)	67.8	66.1
Weed free	1 (0)	1 (0)	100	100
Weedy	22.22 (493)	17.92 (320)	0	0
SEm±	0.13	0.19	1.2	0.9
CD at 5%	0.38	0.54	3.6	1.8

3256 kg/ha, respectively [1]. Timely planting of Basmati rice is an important factor in determining grain yield and quality parameters. Time of transplanting may be one of the agronomic strategies to exploit full potential of a variety and its photoperiod sensitivity so as to harness maximum production with improved quality of grain for high premiums [2]. Selection of proper variety, suitable to the specific ecological situation, may prove to be a boom to the farmers.

Weeds pose major problem in rice production, by diminishing the quantity as well as quality [3]. Hence, the weed management plays an important role in increasing productivity of rice. Hand weeding is effective and the most common method to control weeds. However, it is laborious and tedious in rice growing areas due to increase in labor cost and non-availability of labor during peak periods of other agricultural operations. The use of herbicides offers scope for economical control of weeds right from the beginning.

Therefore, considering the economical weed control and suitability of crop in particular situation there is a need to find out suitable transplanting date and weed management practices of rice to enhance productivity and quality as it is gaining popularity.

Materials and Methods

The present field experiment was conducted during *kharif* of 2014 at student's farm of CCSHAU, College of Agriculture, Kaul (Kaithal), Hisar (latitude 29^o 51´ N, longitude 76^{o}41´ E and altitude 241 meters above mean sea level). The soil of the experimental field was clay loam in texture, low in organic carbon, low in available nitrogen, medium in phosphorus, high in potash and alkaline in nature. Temperatures recorded average maximum temperature ranged from 32.2 to 36.7^{o}C during the reproductive stage and total rainfall was recorded 336.7 mm.

The experiment was laid out in a split plot design with 4 main plot treatments and 6 sub plot treatments with replicated thrice. The main plot having date of transplanting which were 15th June, 5th July, 25th July and 15th August. In sub plot treatments consisted of pre-emergence application of pretilachlor 1000 g/ha, oxadiargyl 100 g/ha alone and sequential application

Table 2. Effect of different transplanting dates and weed management practices on grain yield and nutrient uptake by weeds.

Treatments	Grain yield (kg/ha)	B:C	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potassium uptake (kg/ha)
Main plot (transplanting dates)					
15-Jun	4346	1.43	5.33 (31.2)	2.48 (5.6)	3.64 (13.7)
05-Jul	4058	1.34	5.40 (32.00	2.56 (6.1)	3.65 (13.8)
25-Jul	3918	1.29	5.47 (32.6)	2.68 (6.8)	3.79 (14.9)
15-Aug	3289	1.1	5.52 (33.0)	2.75 (7.2)	3.91 (16)
SEm±	109		0.03	0.05	0.04
CD at 5%	383		0.12	0.17	0.14
Sub plot (weed control treatments)					
Oxadiargyl 100 g/ha (PE)	3804	1.32	6.32 (38.9)	2.88 (7.0)	4.36 (18.1)
Pretilachlor 1000 g/ha (PE)	3475	1.19	6.35 (39.7)	2.92 (8.0)	4.36 (18.1)
Oxadiargyl 100 g/ha (PE) *fb* bispyribac-Na 25 kg/ha (25 DAT)	4376	1.46	6.12 (36.6)	2.67 (6.7)	3.99 (15)
Pretilachlor 1000 g/ha (PE) *fb* bispyribac-Na 25 kg/ha (25 DAT)	4196	1.38	6.20 (38.2)	2.72 (7)	4.11 (16.6)
Weed free	4516	1.28	1 (0)	1 (0)	1 (0)
Weedy	3151	1.15	6.45 (40.7)	3.23 (9.5)	4.656(19.8)
SEm ±	83		0.03	0.05	0.04
CD at 5%	238		0.09	0.1	0.12

of pre and post emergence herbicides viz., pretilachlor 1000 g/ha *fb* bispyribac 25 g/ha, oxadiargyl 100 g/ha *fb* bispyribac 25 g/ha, weed free check and unweeded check. The required quantities of pre- and post-emergence herbicides were applied uniformly at 4 and 25 DAT, respectively. The crop was raised according to package of practices of CCSHAU, Hisar. Density of weeds was recorded in a 0.50 m^2 quadrat at all growth stages of weed. Dry weight of these weeds was recorded from 0.25 m^2 quadrat at all growth stages of weed. Dry weight of these weeds was recorded from 0.25 m^2 area by destructive sampling. Weed control efficiency (WCE) was calculated based on weed dry weight. The data on weed density and dry weight for all the categories were computed using square root ($\sqrt{x+0.5}$) transformation.

Results and Discussion

Weed flora in the experimental field

During the crop growth period, grasses, sedges and broadleaf weeds were identified in the experimental field. The pre-dominant weed species were *Echinochloa colona, Digitaria sanguinalis, Cyperus rotundus, Cyperus difformis, Eclipta alba* and *Ammania baccifera*.

Weed studies

A close examination of Table 1 revealed that the transplanting dates significantly affected the population of total weeds at all crop growth stages. Crop planted on June 15 (170/m^2) caused a significant reduction in number of weeds than all of the delayed transplanting except July 5 (181/m^2) which was statistically at par to the first transplanting date. The highest dry matter accumulation was recorded at 90 DAT than at all other crop growth stages. At all growth stages, significantly higher dry matter accumulation by weeds was recorded under delayed transplanting (August 15) which was statistically similar to July 25 transplanting. Time of transplanting had significant effect on weed control efficiency as well as visual control of weeds at harvest. At this stage, crop planted on June 15 (61.6%) which was statistically similar to July 5 planting (61%), recorded significantly higher weed control efficiency (WCE) than delayed planting (July 25 and August 15). Nutrients uptake by weeds was

significantly influenced by different transplanting dates. The significantly lowest uptake of all nutrients by weeds was recorded under early transplanting (June 15) which was statistically similar to July 5 transplanting [4].

The density and dry weight of weeds increased up to 60 DAT and then decreased. However, the rate of increase was marginal. This might be due to periodical mortality of some weeds after completion of their life cycle or due to action of herbicides. The application of oxadiargyl (100 g/ha) followed by bispyribac-sodium (25 g/ha) at 25 DAT resulted in significantly lower population of total weeds as well as total weed dry matter accumulation at all stages and remained statistically similar to pretilachlor (1000 g/ha) followed by bispyribac-sodium (25 g/ha) at 25 DAT. This might be due to effective management of all categories of weeds during early stages of crop growth by oxadiargyl and during later stages by post-emergence application of bispyribac-sodium [5]. The highest density and dry weight of all categories of weeds was registered with unweeded check followed by pre-emergence application of pretilachlor applied at 4 DAT. This was due to heavy weed infestation in unweeded check, right from the start of the crop and grew vigorously, as moticed at all the stages of observation [6]. The highest WCE was recorded in pre-emergence application of oxadiargyl followed by bispyribac-sodium at 25 DAT (70.4%) which was at par to the pretilachlor followed by bispyribac-sodium (67.8%), at harvesting stage of crop. This was mainly due to reduction in dry weight of weeds with the above weed management practices, because of effective control of all categories of weeds by pre-emergence herbicide oxadiargyl followed by post-emergence application of bispyribac-sodium [7]. The lowest uptake of nitrogen, phosphorus and potassium by weeds was recorded in weed free check followed by pre-emergence application of oxadiargyl followed by bispyribac-sodium applied at 25 DAT. This can be ascribed to lesser dry matter production of weeds due to effective control of all categories of weeds. It was eviedent that whenever effective control of weeds was observed, significant robbing of nutrients could be avoided. The highest uptake of nutrients was noticed with unweeded check due to heavy weed infestation and increased dry matter production of weeds.

Grain yield

The gtain yield decreased significantly due to delayed transplanting (Table 2). The crop planted on June 15 produced the highest grain yield (4346 kg/ha) which was statistically at par to July 5 planting (4,058 kg/ha). All weed control treatments showed significant increase in grain yield over weedy check. Weed free treatment registered significantly highest grain yield (4.516 kg/ha), than all other treatments except oxadiargyl (100 g/ha) followed by bispyribac-sodium (25 g/ha) at 25 DAT (4,376 kg/ha). This was mainly due to lesser crop weed competition for growth resources during entire crop growth period. The cumulative effect of all growth and yield components resulted in increased grain yield [8].

Economics

Highest gross income, net income and benefit cost ratio was obtained with early transplanting (June 15) and it reduced with each successive delayed in transplanting. The highest net income was recorded with pre-emergence application of oxadiargyl followed by bispyribac-sodium applied at 25 DAT. However, the highest benefit-cost ratio was registered with pre-emergence application of oxadiargyl followed by bispyribac-sodium applied at 25 DAT (1.46). The lowest gross and net returns as well as benefit-cost ratio were recorded with weedy check.

Conclusion

From the results of the present field experiment on response of *Basmati* rice variety (Pusa *Basmati* 1509) to time of transplanting conducted during *kharif* of 2014, it can be concluded that transplanting of *Basmati* rice from June 15 to July 5 is optimum as it not only gave significantly higher grain yield but also fetched additional income than late planting (August 15). Among the weed control treatments, the highest grain yield and economic returns were found in pre-emergence application of oxadiargyl followed by bispyrioac-sodium applied at 25 DAT.

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