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Time of Start of Irrigation and Weed Management Practices on Nutrient Uptake of Crop and Weed in Dry Seeded Irrigated (Semi Dry) Rice

G. Sreenivas*, D. Raji Reddy, N. Mahesh and P. Leela Rani

Agro Climate Research Centre, Prof. JayashankarTelangana State Agricultural University, Telangana
*Corresponding author: gsreenivas2002@gmail.com

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Abstract

An experiment was conducted at College farm, College of Agriculture, Rajendranagar, Hyderabad to find out ideal time for start of irrigation and best weed management practice under dry seeded irrigated condition. Scheduling of irrigation from 45 DAE resulted in significantly higher crop drymatter production, nutrient uptake and grain yield than irrigating from 60 DAE which inturn resulted in significantly higher yield than that of irrigation scheduled from 75 DAE. Among the weed management treatments, interculture at 20 DAE fb HW at 40 and 60 DAE recorded significantly lower weed drymatter production, and higher crop dry matter, nutrient uptake and grain yield than rest of the weed management practices.

Key words: Dry seeded irrigated rice, Time of start of irrigation, Drymatter, Nutrient uptake, Grain yield

Introduction

Weeds are endemic in crops and a constant problem in crop production because of their dynamic nature (Blackshaw *et al.*, 2005). Despite modern control practices aimed at weed elimination, weed continues to be a ubiquitous and recurrent threat for crop production due to its ability to shift in response to management practices and environmental conditions (Buhler *et al.*, 2000). Aerobic rice systems, wherein the crop is established via direct-seeding in non-puddled, non-flooded fields, are among the most promising approaches for saving water. Aerobic rice systems can substitute the conventional rice cultivation system in the wake of water shortage and energy crises. However, aerobic systems are subject to much higher weed pressure than conventionally puddled transplanted rice. The major constraint in the success of aerobic rice is high weed infestation. Weed management continues to be a huge challenge in aerobic rice which is highly vulnerable to weed infestation because of dry ploughing and aerobic soil conditions (Balasubramanian and Hill, 2002). Proper weed management is considered to be one of the most important prerequisites to ensure satisfactory yield of rice. High weed pressure in direct seeded rice lowers the economic return, and in extreme cases rice cultivation results in a losing concern

In dry seeded rice ecosystems, weeds and rice emerge simultaneously, and weeds compete with rice plant for light, nutrients and moisture resulting in reduction of grain yield upto 80 per cent (Sinha Babu *et al.,* 1992). Manual weeding of dry seeded rice fields is labour oriented and expensive. The traditional hand weeding practice needs to be substituted by herbicides to control weeds timely and economically. There is a need to develop integrated weed management for effective weed control in irrigated dry seeded rice.

Considering the above facts, the present investigation was carried out to identify ideal time for start of irrigation and best weed management practice under dry seeded irrigated condition to realize higher nutrient uptake and yield.

Material and Methods

An experiment was carried out during *Kharif* season 2003 at College farm, College of Agriculture, Rajendranagar, Hyderabad situated at an altitude of 542.6 m above mean sea level on 17^{o}19’ N latitude and 78^{o}23’ E longitude. During the crop growth season, the mean weekly maximum temperature during cropping period ranged from 27.5 to 35.2^{o}C. The weekly mean minimum temperature varied between 9.5 to 24.0^{o}C during the same period. The mean relative humidity fluctuated between 26.3 to 93.9 per cent. Rainfall of 810.2 mm was received in 45 rainy days during cropping period.The experimental soils are clayey with pH 7.7, low in organic carbon (0.72%), available nitrogen (275.9 kg/ha) and available phosphorus (10.8 kg/ha) and low in available potassium (128.9 kg/ ha). The experiment was conducted with three irrigation schedules (starting of irrigation from 45 DAE, 60 DAE and 75 DAE) as main plots and five weed management treatments (pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE, pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE, interculture at 20 DAE fb HW at 40 DAE, interculture at 20 DAE fb HW at 40 and 60 DAE and unweeded check) as sub plots in split plot design replicated thrice. Sowing was done with dry seed in solid rows at 20 cm spacing between two rows.A uniform level of 140 kg ha^{-1} N as urea, 60 kg ha^{-1} P_2O_5 as single super phosphate, 40 kg ha^{-1} K_2O as muriate of potash was applied to all the treatments. The entire P_2O_5, K_2O and $ZnSO_4$ @ 50 kg ha^{-1} were applied at sowing. The nitrogen was applied in three splits -1/3 each at sowing, active tillering and panicle initiation stages. Irrigation was applied as per the treatment details. The depth of irrigation was 5 cm till 01.10.2003 and later 4 cm depth of irrigation was given.

Results and Discussion

Weed drymatter production

At all the growth stages, time of start of irrigation did not influence the weed DMP (Figure 1) while it was significantly influenced by weed management treatments. At harvest, weed DMP recorded in interculture at 20 DAE fb HW at 40 and 60 DAE and interculture at 20 DAE fb HW at 40 DAE was comparable with each other and significantly lower than that observed with pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE and pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE. The weed DMP in latter two weed management treatments was comparable with each other and significantly lower than that of unweeded check (Figure 2).

Crop drymatter production

Time of start of irrigation and weed management treatments significantly influenced the DMP of rice. At maturity, the irrigation started at 45 DAE resulted in significantly higher DMP over that of 60 and 75 DAE. The DMP recorded with start of irrigation at 60 DAE was significantly higher than that observed with 75 DAE (Figure 3).

Significantly higher DMP was recorded in interculture at 20 DAE fb HW at 40 and 60 DAE than that of interculture at 20 DAE fb HW at 40 DAE. The DMP recorded in latter treatment was significantly higher than that observed with pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE and pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE. The DMP noticed in latter two treatments was comparable with each other and significantly higher than that of unweeded check (Figure 4).

Nutrient uptake by weeds

Time of starting irrigation significantly influenced the phosphorus uptake by weeds. The phosphorus uptake at harvest in former irrigation treatment 45 DAE was significantly higher than that of irrigation scheduled from 75 DAE. Phosphorus uptake of weeds recorded in irrigation scheduled from 60 and 75 DAE was comparable with each other. However nitrogen and potassium uptake by weeds was not influenced by time of start of irrigation.

Nitrogen, phosphorus and potassium uptake at harvest recorded in interculture at 20 DAE fb HW at 40 and 60 DAE and interculture at 20 DAE fb HW at 40 DAE was comparable with each other and significantly lower than that of pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE. Nitrogen uptake recorded in pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE and pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE was comparable with each other and significantly lower than that of unweeded check (Table 2).

Nutrient uptake by crop

Time of starting of irrigation and weed management practices significantly influenced the nutrient uptake by rice. Significantly higher nitrogen, phosphorus and potassium uptakeat harvest was recorded in the crop that received irrigation from 45 DAE than that of irrigation from 60 DAE which inturn recorded comparable nitrogen uptake as that of irrigation from 75 DAE.

Nitrogen, phosphorous and potassium uptake at harvest recorded with interculture at 20 DAE fb HW at 40 and 60 DAE and interculture at 20 DAE fb HW at 40 DAE was comparable with each other and significantly higher than that of pre-em pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE. The nitrogen uptake recorded in latter weed management treatment was significantly higher than that of pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE (Table 2).

Grain and straw yield

Significantly higher grainyieldand straw yield was observed by starting of irrigation at 45 DAE than irrigation started at 60 DAE. The grain yield obtained in latter treatment was significantly higher than that of 75 DAE. The higher grain yield and straw yield with irrigation scheduled from 45 DAE was mainly due to higher amount of total water input (effective rainfall + irrigation) during crop growth period than with irrigation scheduled from 60 DAE and 75 DAE.

Among weed management treatments, interculture at 20 DAE fb HW at 40 and 60 DAE recorded significantly higher grainyield and straw yield than that of interculture at 20 DAE fb HW at 40 DAE. Grainyieldand straw yield noticed in the latter treatment was significantly higher than that of pre-em application of pretilachlor @ 0.75 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE and pre-em application of butachlor @ 1 kg ha^{-1} fb 2, 4-D Na salt @ 1 kg ha^{-1} at 30 DAE. The grain yield and strawyieldobserved in latter two treatments was comparable with each other and significantly higher than that of unweeded check (Table 2).

Conclusion

From these results, it is concluded that, higher nutrient uptake and grain yield and straw yield can be obtained by scheduling irrigation from 45 DAE with adoption of IC at 20 DAE fb HW at 40 and 60 DAE.

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Table 1. Nutrient uptake (kg ha^{-1}) by weeds and rice at harvest as influenced by time of start of irrigation and weed management treatments in dry seeded irrigated rice

Treatment	Nutrient uptake by weeds			Nutrient uptake by rice		
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
Time of irrigation (I)						
45 DAE	12.7	3.5	12.5	81.6	13.1	74.0
60 DAE	10.4	3.2	12.5	68.5	12.3	69.6
75 DAE	9.2	2.8	12.2	64.5	10.9	60.4
SEm±	0.9	0.2	0.1	2.3	0.5	0.4
CD (P=0.05)	NS	0.7	NS	9.0	1.8	1.5
Weed management (W)						
W_1	12.4	3.3	11.8	60.1	10.9	70.5
W_2	10.4	3.1	12.3	70.0	12.1	73.5
W_3	7.1	1.8	11.2	100.1	16.3	86.4
W_4	5.3	1.4	10.9	105.8	18.3	97.0
W_5	18.5	6.3	15.9	21.5	3.0	12.6
SEm±	1.0	0.3	0.3	3.0	0.4	0.6
CD (P=0.05)	2.9	0.9	0.6	8.6	1.0	1.7
Interaction (IxW)						
SEm±	1.8	0.5	0.5	5.1	0.6	1.0
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Table 2. Grain and straw yield and harvest index as influenced by time of start of irrigation and weed management treatments in dry seeded irrigated rice

Treatment	Grain yield (t ha $^{-1}$)	Straw yield (t ha $^{-1}$)
Time of irrigation (I)		
45 DAE	2.79	5.06
60 DAE	2.56	4.84
75 DAE	2.01	4.05
SEm$\pm$	0.06	0.05
CD (P=0.05)	0.23	0.21
Weed management (W)		
W_1	2.21	4.48
W_2	2.32	4.67
W_3	2.89	5.58
W_4	3.66	6.04
W_5	1.19	2.47
SEm$\pm$	0.12	0.10
CD (P=0.05)	0.35	0.29
Interaction (IxW)		
SEm$\pm$	0.21	0.17
CD (P=0.05)	NS	0.6

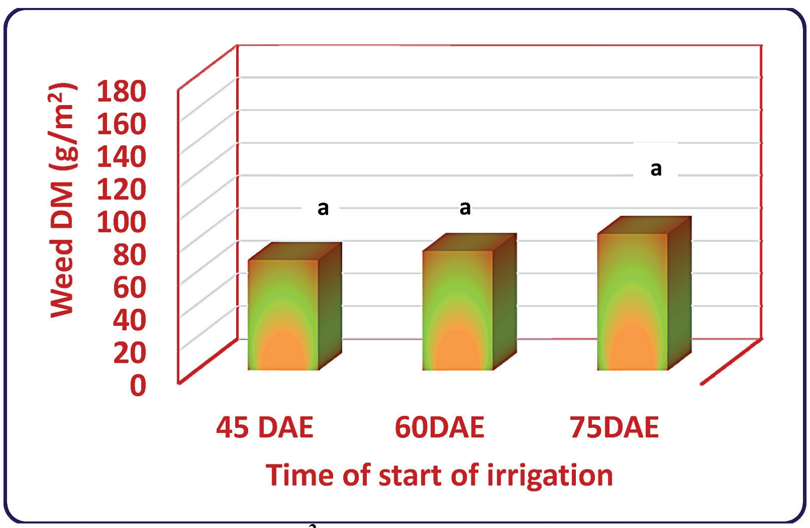

Fig. 1.Weed dry matter (g m-2) at crop physiological maturity as influenced by time of start of irrigation in dry seeded irrigated rice

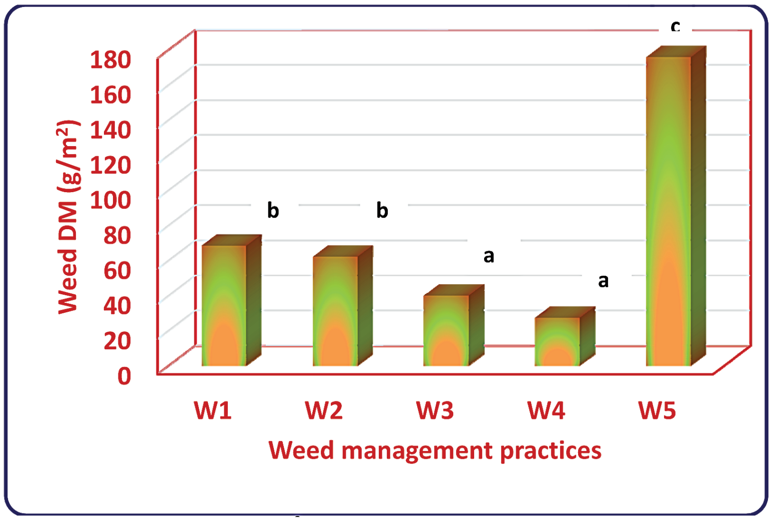

Fig. 2. Weed dry matter (g m^{-2}) at crop physiological maturity as influenced by weed management treatments in dry seeded irrigated rice

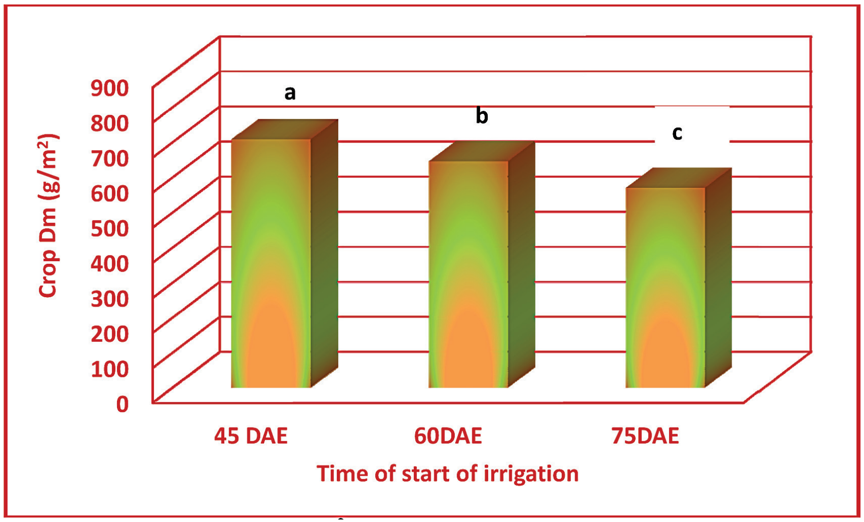

Fig. 3. Crop dry matter (g m-2) crop physiological maturity as influenced by time of start of irrigation in dryseeded irrigated rice

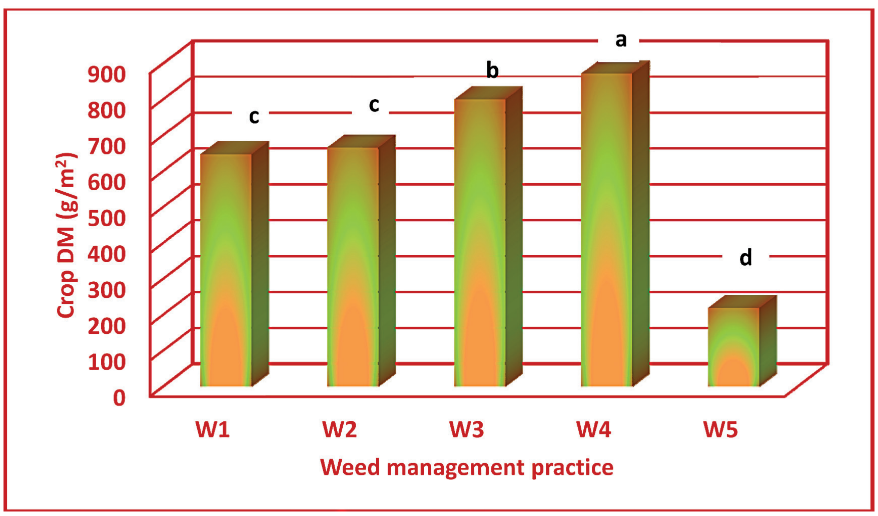

Fig. 4. Crop dry matter (g m-2) crop physiological maturity as influenced by weed management treatments in dry seeded irrigated rice