ORIGINAL RESEARCH ARTICLE OPEN ACCESS

Yield and Nutrients Uptake of Aerobic Rice (*Oryza sativa* L.) as Influenced by Irrigation and Integrated Weed Management

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Received: 25th September, 2016; Accepted 23th November, 2016

Abstract

The field experiment was conducted in *kharif* of 2013 and 2014 at the College Farm, College of Agriculture, Rajendranagar onclay loam soils to study irrigation and integrated weed management practices i.e., IW/CPE ratios of 0.5, 1.0, 1.5 and 2.0 and six IWM practices with pendimethalin/butachlor as PE followed by (fb) fenoxaprop-p-ethyl/ metsulfuron methyl + chlorimuron ethyl as POE fb MW + HW at 45 DAS, weed free check and unweeded control. Higher grain and straw yields were recorded with higher irrigation levels (2.0 & 1.5) and pendimethalin as PE fb metsulfuron methyl + chlorimuron ethyl as POE fb MW fb HW at 45 DAS. Nutrient uptake by the crop was higher with higher irrigation levels (2.0 & 1.5) and application of pendimethalin/butachlor as PE fb metsulfuron methyl + chlorimuron ethyl as POE fb MW + HW at 45 DAS during both the years and pooled mean.

Key words: Aerobic rice, irrigation levels, IWM practices, grain yield and nutrient uptake

Introduction

In the World, rice is the staple food of half of the population in the world and grown in an area of 158.5 m ha with a production of 470.6 m t and productivity of 4.43 t ha^{-1}. India is second largest (103.5 m t) producer after china (145.7 mt) (USDA, 2016). Generally rice is grown in traditional flooded conditions and rice alone consumes about more than 45% of total fresh water of the world and it requires 3,000-5,000 litre of water to produce 1.0 kg of grain. A new concept of growing rice termed as 'aerobic rice' involves growing rice in well-drained, non-puddled and non-saturated soils (Bouman *et al.*, 2002). The irrigation scheduling in irrigated dry aerobic rice plays major role in obtaining higher yields as well as higher water productivity. Dry tillage and absence of standing water subjected to higher weed competition and may reduce the yield 50-91 %. During critical period of crop-weed competition,there is need of integrated weed management for effective weed control with due consideration of economics, environment and sociological consequences. Hence, an experiment was conducted to evaluate irrigation levels and integrated weed management practices in aerobic rice to make it as successful technology.

Materials and Methods

The present study was conducted during *kharif* season of 2013 and 2014 at College farm, College of Agriculture, Rajendranagar, Hyderabad. The experiment consisted as four main irrigation levels (IW/CPE ratios of 0.5, 1.0, 1.5 and 2.0) and six IWM practices (pendimethalin @ 1.0 kg ha^{-1} as PE + fenoxaprop-p-ethyl @ 60 g ha^{-1} at 15 DAS + mechanical weeding (MW) fb hand weeding (HW) at 45 DAS (T_1), pendimethalin @ 1.0 kg ha^{-1} as PE + metsulfuronmethyl+chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS + MW fb HW at 45 DAS (T_2), butachlor @ 1.0 kg ha^{-1} as PE + fenoxaprop-p-ethyl @ 60 g ha^{-1} at 15 DAS + MW fb HW at 45 DAS (T_3), butachlor @ 1.0 kg ha^{-1} as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS + MW fb HW at 45 DAS (T_4), Weed free check (HW at 25 DAS and MW fb HW at 45 DAS) (T_5) and Unweeded control (T_6) as sub plots with three replications in split plot design. Triple buffer channels were laid at width of one meter for main treatments so as to eliminate the effect of lateral seepage. The soil of the experiment field was clay loam in texture, neutral in reaction, low in organic carbon, available N, medium in P_2O_5 and high in K_2O. Rice variety 'JGL-17004 (Prathyumna)' was sown in 15 x 10 cm spacing using 40 kg ha^{-1} seed rate and fertilized with nitrogen (140 kg ha^{-1}) four equal splits at basal, tillering, panicle initiation and heading stages. The entire dose of phosphorus (60 kg ha^{-1}), 2/3 0f potassium (50 kg ha^{-1}), zinc sulphate and iron sulphate @ 25 kg ha^{-1}each and gypsum @ 500 kg ha^{-1} were applied basally and 1/3rd potassium at panicle initiation stage. Later, foliar spray of 2% $FeSO_4$ was given at tillering and panicle initiation stages as the crop showed iron deficiency symptom. Depth (40 mm) of irrigation water was given when the Cumulative Pan Evaporation (USWB class "A")readings reached the level of 80, 40, 26.6 and 20 mm in order to get IW/CPE ratio of 0.5, 1.0, 1.5 and 2.0, respectively. Soil samples were drawn upto 60 cm of soil depth before each irrigation and moisture content was estimated gravimetrically. The volume of water arrived with multiplying the depth of irrigation (40 mm) and area of the plot (5 X 4.5 m^2) and is measured through water meter. Pendimethalin and butachlor were sprayed as PE one day after sowing and post emergence application offenoxaprop-p-ethyl and metsulfuronmethyl+chlorimuron ethyl was done at 15 and 25 DAS respectively. Hand weeding at 25 DAS in weed free check and at 45 DAS, MW and HW was done in all five treatments. Unweeded condition was maintained in unweeded control during entire crop period. Observations on yield and nutrient uptake by crop and soil nutrient analysis at harvest was done and statistically analysed.

Results and Discussion

Grain, straw yield and harvest index of aerobic rice

Irrigations scheduled at IW/CPE ratios was significantly influenced on grain and straw yield of aerobic rice (Table 1). Higher grain and straw yield was recorded during first year (2013) than second year (2014). Among the different irrigation levels, highest grain and straw yield of aerobic rice was recorded with irrigations given at IW/CPE ratio of 2.0 followed by IW/CPE ratio of 1.5, 1.0 and 0.5 during both the years and pooled mean respectively. The increase in the range of 14.2, 40 and 58 per cent in grain yield, 16.5, 40 and 45.8 per cent of straw yield during 2013 and 14.9, 41.9 and 57.8 per cent of grain yield and 16.3, 40.7 and 46.4 per cent of straw yield during 2014 over IW/CPE ratios of 1.5,1.0 and 0.5 respectively. Lesser irrigations given at IW/CPE ratio of 1.0 and 0.5 were recorded reduced yields of aerobic rice during both the years. The harvest index was higher with IW/CPE ratio of 1.5 and was at par with 1.0 and 2.0 ratio and significantly higher than IW/CPE ratio of 0.5. Similar reports were supported by Ramana Murthy and Reddy (2013).

Among the integrated weed management practices, higher grain and straw yields was recorded with hand weeding at 25 DAS fb mechanical weeding + hand weeding at 45 days after sowing (T_5) which was followed by application of pendimethalin @ 1.0 kgha^{-1} as PE fb metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS (T_2) and at par with application of butachlor @ 1.0 kg ha^{-1} as PE fb metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 days after sowing fb MW+ HW at 45 days after sowing (T_4). Efficient control of grasses, sedges and BLWs with integration of pre, post and cultural practices which ultimately produced higher grain yield (Kumar *et al.*, 2014). Comparatively lower yields were recorded with pendimethalin @ 1.0 kg ha^{-1} as PE fb fenoxaprop-p-ethyl @ 60 g ha^{-1} at 15 DAS fb mechanical weeding + HW at 45 DAS (T_1) and butachlor @ 1.0 kg ha^{-1} as PE fb fenooxyprop-p-ethyl @ 60 g ha^{-1} at 15 DAS fb MW+HW at 45 DAS (T_3) during both years and pooled mean respectively. Harvest index recorded in weed free check showed higher and at par with application of pendimethalin @ 1.0 kg ha^{-1} as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS (T_2). Lower grain and straw yields and harvest index was recorded in unweeded control (T_6) during both the years of study and pooled mean (Sandyarani and Malla Reddy, 2014).

The interaction effect between irrigation schedules and integrated weed management practices on grain and straw yield and harvest index was significant during 2013, 2014 and pooled mean and presented pooled interaction effect (Table 1a, b & c). During 2013, irrigation scheduled at IW/CPE ratio of 2.0 along with weed free check (I_4T_5) produced significantly higher grain, straw yield and harvest index over other combination. Followed to this, same irrigation schedule (2.0) along with application of pendimethalin @ 1.0 kg ha^{-1}as pre emergence (PE) followed by (fb) metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS + MW fb HW at 45 DAS (I_4T_2) and application of butachlor@ 1.0 kg ha^{-1}as pre emergence (PE) followed by (fb) metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS + MW fb HW at 45 DAS (I_4T_4). The better performance of crop in the above combinations might be due to adequate availability of water and nutrients and effective control of all kind of weeds during both early and later crop growth stages in turn recorded higher yield and harvest index through (Narolia *et al.*, 2014).

Nutrient uptake by aerobic rice

Nutrients uptake by crop at harvest was significantly influenced by the irrigation levels. Uptake of the nitrogen, phosphorus and potassium was higher with irrigation scheduled at IW/CPE ratio of 2.0 than other treatments during two years of study and it followed by IW/CPE ratio of 1.5 during 2013, but the uptake of nitrogen, phosphorus and potassium at IW/CPE ratio of 1.5 was at par with 2.0 during 2014. Same nutrients uptakes by the crop reported by Pandey *et al*. (2010). Irrigations applied at IW/CPE ratio of 2.0 recorded higher nutrients (N, P & K) uptake by the crop and were followed by irrigation level of IW/CPE ratio of 1.5, 1.0 and 0.5 respectively. Potassium uptake during 2014 in IW/CPE ratio of 1.5 was significantly at par with IW/CPE ratio of 2.0. Nutrient status of soil (N, P & K) at harvest was influenced significantly by the irrigation levels during 2013 and 2014 with higher nutrient status at lower irrigation level (0.5). The maximum crop growth at IW/CPE ratio of 2.0 showed higher uptake of nutrients hence there may be lower soil available nutrients in this treatment and it was on par with IW/CPE ratio of 1.5 in available soil potassium during both the years and in available phosphorus during 2013.

Weed free check recorded higher nutrients (N, P & K) uptake by the crop and was followed by application of pendimethalin @ 1.0 kg ha^{-1} applied as PE + metsulfuron methyl + chlorimuron ethyl@ 4.0 g ha^{-1} at 25 DAS fb MW

+ HW at 45 DAS (T_2) in uptake of nitrogen and potassium. Phosphorus uptake by the application of pendimethalin as PE fb metsulfuron methyl + chlorimuron ethyl as post emergence + MW fb HW at 45 DAS was significantly at par with weed free check (T_5) during both years. Lower nutrient uptake was observed with unweeded control during both the years and pooled mean Similar findings were observed with Kumar *et al*., 2010.

Interaction between irrigation levels and integrated weed management practices was influenced significant effect on uptake of nutrients during both the years and pooled over two years. Nitrogen uptake by the crop was higher (92.9 & 89.6) with irrigation scheduled at IW/CPE ratio of 2.0 along with weed free check (I_4T_5) and it was followed by same irrigation level along with pendimethalin/butachlor @ 1.0 kg ha^{-1} applied as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS fb MW + HW at 45 DAS in I_4T_2 (88.7) and I_4T_4 (84.9) during 2013 and it on par with I_4T_2 (85.7) and I_4T_4 (81.9) during 2014 (Table 2a & b).

Uptake of phosphorus in irrigations given at IW/CPE ratio of 2.0 along with weed free check (I_4T_5) was higher (27.0 & 25.0) during two years and it on par with pendimethalin/ butachlor @ 1.0 kg ha^{-1} applied as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS fb MW + HW at 45 DAS in I_4T_2 (25.8 & 24.3) during both the years and in I_4T_4 (23.0) during 2014, further it was followed by butachlor @ 1.0 kg ha^{-1} applied as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS fb MW + HW at 45 DAS in I_4T_4 (25.0) during 2014 respectively (Table 2 c & d).

Removal of potassium by the crop in irrigations applied at IW/CPE ratio of 2.0 along with weed free check (I_4T_5) was maximum (141.2 & 136.9) and it at par with pendimethalin/butachlor @ 1.0 kg ha^{-1} applied as PE + metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} at 25 DAS fb MW + HW at 45 DAS in I_4T_2 (138.1 & 133.4) and followed by I_4T_4 (131.7 & 127.3) during both the years respectively (Table 2 d&e). Lower uptake of nutrients (N, P & K) by the crop obtained in irrigations applied at IW/CPE ratio of 2.0 along with weed free check (I_4T_5) (18.2 & 16.9), (8.3 & 6.4) and (38.6 & 35.9) during two years of study respectively.

Conclusion

From the present study, it can be concluded that higher irrigation level (IW/CPE ratio of 2.0) and application of pendimethalin/butachlor @ 1.0 kg ha^{-1} as PE fb metsulfuron methyl + chlorimuron ethyl @ 4.0 g ha^{-1} fb MW+HW at 45 DAS were shown significant in production of higher yields and nutrient uptakes by aerobic rice.

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Table 1: Influence of irrigation levels and integrated weed management practices on crop yield and harvest index in aerobic rice during 2013, 2014 and pooled

Treatment	Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})			Harvest index (%)		
	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
Irrigation levels (IW/CPE ratios)									
I_1 (IW/CPE =0.5)	1137	1101	1119	2663	2526	2595	29.9	30.5	30.2
I_2 (IW/CPE =1.0)	1637	1515	1576	2950	2795	2872	35.9	35.1	35.5
I_3 (IW/CPE =1.5)	2341	2219	2280	4104	3947	4026	36.3	36.0	36.2
I_4 (IW/CPE =2.0)	2729	2607	2668	4914	4713	4814	35.9	35.8	35.8
S.Em ±	64	70	67	95	82	88	0.4	0.7	0.5
CD (P=0.05)	221	243	231	330	285	305	1.4	2.3	1.7
CV (%)	15	17	16	12	11	11	5.2	8.3	6.4
Integrated weed management									
T_1	1846	1743	1795	3293	3148	3221	35.4	34.7	35.0
T_2	2146	2048	2097	4244	3998	4121	33.1	33.7	33.3
T_3	1771	1669	1720	3169	3009	3089	35.1	35.2	35.1
T_4	2081	1982	2032	3925	3827	3876	34.4	33.9	34.1
T_5	2292	2190	2241	4441	4318	4380	33.7	33.3	33.5
T_6	788	706	747	1711	1589	1650	29.8	29.4	29.6
S. Em ±	32	33	32	46	52	47	0.4	0.5	0.4
CD (P=0.05)	92	96	91	133	148	134	1.1	1.4	1.2
CV (%)	6	7	6	5	5	5	3.9	5.2	4.3
Interaction	I x T	I x T	I x T	I x T	I x T	I x T	I x T	I x T	I x T
S. Em ±	64	67	64	93	103	94	0.8	1.0	0.8
CD (P=0.05)	184	191	182	265	296	267	2.2	2.9	2.4
Interaction	T x I	T x I	T x I	T x I	T x I	T x I	T x I	T x I	T x I
S. Em ±	87	93	89	128	125	123	0.8	1.1	0.9
CD (P=0.05)	276	298	283	407	391	389	2.4	3.5	2.8

Table 1a. Interaction effect on pooled grain yield (kg ha^{-1}) of rice as influenced by irrigation levels and integrated weed management practices

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	1008	1292	935	1241	1450	309	1119
I_2 (IW/CPE =1.0)	1446	1748	1442	1666	1856	598	1576
I_3 (IW/CPE =1.5)	2122	2494	2087	2416	2600	894	2280
I_4 (IW/CPE =2.0)	2602	2853	2416	2803	3056	1187	2668
Mean	1795	2097	1720	2032	2241	747	
Interaction		I x T	T x I				
S. Em ±		64	89				
CD (P=0.05)		182	283				

Table 1b. Interaction effect on pooled straw yield (kg ha^{-1}) of rice as influenced by irrigation levels and integrated weed management practices

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	2419	3198	2153	2608	3266	1152	2595
I_2 (IW/CPE =1.0)	2554	3187	2536	3212	3681	1468	2872
I_3 (IW/CPE =1.5)	3625	4554	3568	4356	4894	1891	4026
I_4 (IW/CPE =2.0)	4284	5543	4100	5327	5677	2090	4814
Mean	3220	4121	3089	3876	4380	1650	
Interaction		I x T	T x I				
S. Em ±		94	123				
CD (P=0.05)		267	389				

Table 1c. Interaction effect on pooled harvest index (%) in rice as influenced by irrigation levels and integrated weed management practices

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	29.4	28.7	30.3	32.2	30.8	21.1	30.2
I_2 (IW/CPE =1.0)	36.1	35.4	36.2	34.1	33.5	29.0	35.5
I_3 (IW/CPE =1.5)	36.8	35.3	36.9	35.7	34.7	32.2	36.2
I_4 (IW/CPE =2.0)	37.8	34.0	37.1	34.5	35.0	36.3	35.8
Mean	35.0	33.3	35.1	34.1	33.5	29.6	
Interaction			I x T	T x I			
S. Em ±			0.8	0.9			
CD (P=0.05)			2.4	2.8			

Table 2: Nutrient uptake by crop (kg ha^{-1}) at harvest in rice as influenced by irrigation levels and integrated weed management practices

Treatments	Nitrogen		Phosphorous		Potassium	
	2013	2014	2013	2014	2013	2014
Irrigation levels (IW/CPE ratios)						
I_1 (IW/CPE =0.5)	43.5	39.8	14.5	11.6	78.8	73.8
I_2 (IW/CPE =1.0)	46.3	43.2	15.4	12.7	85.1	80.7
I_3 (IW/CPE =1.5)	80.0	76.9	23.0	20.3	113.6	109.2
I_4 (IW/CPE =2.0)	82.6	79.6	24.4	21.5	125.2	120.8
S.Em ±	0.4	0.3	0.3	0.2	4.9	4.7
CD (P=0.05)	1.2	1.1	0.9	0.7	16.8	16.2
CV (%)	2.7	2.6	6.5	5.8	22.7	22.9
Integrated weed management						
T_1	60.4	57.2	18.5	15.7	96.9	92.5
T_2	68.2	65.2	20.7	18.3	109.3	104.7
T_3	58.8	55.3	18.0	14.7	91.4	86.7
T_4	65.0	61.8	20.1	17.3	105.1	100.5
T_5	71.2	67.9	21.6	18.9	114.3	109.9
T_6	13.6	12.3	5.5	4.0	29.3	26.2
S.Em ±	0.5	0.7	0.3	0.4	1.5	1.6

CD (P=0.05)	1.5	1.9	0.9	1.0	4.3	4.5
CV (%)	3.3	4.4	6.0	8.6	5.8	6.3
Interaction	I x T	I x T	I x T	I x T	I x T	I x T
S. Em ±	1.1	1.4	0.6	0.7	3.0	3.2
CD (P=0.05)	3.0	3.9	1.7	2.1	8.7	9.1
Interaction	T x I	T x I	T x I	T x I	T x I	T x I
S. Em ±	1.0	1.3	0.6	0.7	5.6	5.5
CD (P=0.05)	3.0	3.7	1.8	2.0	18.5	18.2

Table 2a. Interaction effect on nitrogen uptake by crop (kg ha^{-1})at harvest as influenced by irrigation levels and integrated weed management practices in 2013

Treatments	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	41.2	47.6	39.6	45.7	49.6	8.7	38.7
I_2 (IW/CPE =1.0)	43.7	50.8	42.3	48.3	52.7	10.7	41.4
I_3 (IW/CPE =1.5)	77.2	85.8	75.8	81.0	89.6	17.0	71.1
I_4 (IW/CPE =2.0)	79.6	88.7	77.4	84.9	92.9	18.2	73.6
Mean	60.4	68.2	58.8	65.0	71.2	13.6	
Interaction		I x T	T x I				
S. Em ±		1.1	1.0				
CD (P=0.05)		3.0	3.0				

Table 2b. Interaction effect on nitrogen uptake by crop (kg ha^{-1}) at harvest as influenced by irrigation levels and integrated weed management practices in 2014

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	MEAN
I_1 (IW/CPE =0.5)	37.2	44.6	35.5	42.0	46.3	7.3	35.5
I_2 (IW/CPE =1.0)	40.7	47.8	39.0	45.3	49.3	9.3	38.6
I_3 (IW/CPE =1.5)	74.2	82.8	72.5	78.0	86.2	15.7	68.2
I_4 (IW/CPE =2.0)	76.6	85.7	74.1	81.9	89.6	16.9	70.8
Mean	57.2	65.2	55.3	61.8	67.9	12.3	
Interaction		I x T	T x I				
S. Em ±		1.4	1.3				
CD (P=0.05)		3.9	3.7				

Table 2c. Interaction effect on phosphorus uptake by crop (kg ha^{-1}) at harvest as influenced by irrigation levels and integrated weed management practices in 2013

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	MEAN
I_1 (IW/CPE =0.5)	13.5	15.8	13.2	15.4	16.3	2.4	12.8
I_2 (IW/CPE =1.0)	14.3	16.5	14.3	16.3	17.8	3.7	13.8
I_3 (IW/CPE =1.5)	22.1	24.5	21.7	23.8	25.6	7.3	20.8
I_4 (IW/CPE =2.0)	23.9	25.8	22.8	25.0	27.0	8.3	22.1
Mean	18.5	20.7	18.0	20.1	21.7	5.5	
Interaction		I x T	T x I				
S. Em ±		0.6	0.6				
CD (P=0.05)		1.7	1.8				

Table 2d. Interaction effect on phosphorus uptake by crop (kg ha^{-1}) at harvest as influenced by irrigation levels and integrated weed management practices in 2014

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	11.5	12.8	10.5	11.5	13.0	2.1	10.2
I_2 (IW/CPE =1.0)	12.0	13.8	11.3	13.5	14.1	2.3	11.2
I_3 (IW/CPE =1.5)	19.1	22.3	18.3	21.4	23.5	5.3	18.3
I_4 (IW/CPE =2.0)	20.2	24.3	18.8	23.0	25.0	6.4	19.6
Mean	15.7	18.3	14.7	17.3	18.9	4.0	
Interaction		I x T	T x I				
S. Em ±		0.7	0.7				
CD (P=0.05)		2.1	2.0				

Table 2e. Interaction effect on potassium uptake by crop (kg ha^{-1}) at harvest as influenced by irrigation levels and integrated weed management practices in 2013

Treatment	T_1	T_2	T_3	T_4	T_5	T_6	Mean
I_1 (IW/CPE =0.5)	77.6	84.2	72.4	81.0	91.0	20.4	71.1
I_2 (IW/CPE =1.0)	81.2	92.8	77.9	88.6	97.3	24.2	77.0
I_3 (IW/CPE =1.5)	110.5	122.2	102.5	119.3	127.5	34.0	102.7
I_4 (IW/CPE =2.0)	118.2	138.1	112.8	131.7	141.2	38.6	113.4
Mean	96.9	109.3	91.4	105.1	114.3	29.3	
Interaction		I x T	T x I				
S. Em ±		3.0	5.6				
CD (P=0.05)		8.7	18.5				

Table 2f. Interaction effect on potassium uptake by crop (kg ha^{-1}) at harvest as influenced by irrigation levels and integrated weed management practices in 2014

Treatments	T_1	T_2	T_3	T_4	T_5	T_6	MEAN
I_1 (IW/CPE =0.5)	73.3	79.5	66.7	75.7	86.7	15.9	66.3
I_2 (IW/CPE =1.0)	76.9	88.2	73.5	84.2	93.0	21.5	72.9
I_3 (IW/CPE =1.5)	106.2	117.6	98.2	114.9	123.1	31.3	98.6
I_4 (IW/CPE =2.0)	113.9	133.4	108.4	127.3	136.9	35.9	109.3
Mean	92.5	104.7	86.7	100.5	109.9	26.2	
Interaction		I x T	T x I				
S. Em ±		3.2	5.5				
CD (P=0.05)		9.1	18.2				