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Effect of weed and fertilizer management on weed control and productivity of onion (*Allium cepa*)

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ABSTRACT

An experiment was conducted to examine the effect of weed management and plant nutrition practices on weed biomass, growth parameters and bulb yield of onion (*Allium cepa* L.). Weed management practices included alone application of herbicides, *viz.* pendimethalin, oxyfluorfen and fluazipop-p-butyl, their combination with hand weeding, weed free and weedy check. The crop was fertilized with three levels *viz.,* 75% RDF, RDF (100:50:50 NPK kg/ha) and 125% RDF. The results indicated that weed management and fertilizer levels had a significant effect on weed population dynamics and onion bulb crop. The total weed density decreased significantly with application of pendimethalin 1 kg/ha or oxyfluorfen 0.24 kg/ha + one hand weeding at 40 days after transplanting (DAT) during both the seasons of investigation. *Echinochloa ssp., Trianthema portulacastrum, Digera arvensis* Forsk. *Physalis minima* L. and *Cynodon dactylon* (L.) Pers. were found as major weeds in the crop. Higher onion bulb yield (38.0 t/ha) was recorded with pendimethalin 1 kg/ha + one hand weeding at 40 DAT. The increase in yield was 83.7% compared to the yield obtain in weedy check. Increasing level of fertilizer applications increased the total biomass of grassy and broad leaves weeds. Application of 125% RDF significantly improved bulb yield and increase in yield was 19.4 and 10.5 % over 75% RDF and RDF respectively. On the basis of interaction, combination of pendimethalin 1 kg/ha fb 1 hand weeding at 40 DAT and 100 % RDF was most productive (39.8 t/ha) and profitable (Net return ₹2,69,422/ha and benefit: cost ratio 7.85).

Key words: Fertilizer levels, Fluazifop-p-butyl, Onion, Oxyfluorfen, Pendimethalin, Weed management

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Onion has very poor competitive ability with weeds due to its inherent characteristics like short stature, non branching habit, sparse foliage, shallow root system and extremely slow growth during initial stage. Yield losses due to weeds infestation in onion were as high as 82.2% (Tewari *et al.*, 2003). The conventional method of weed control (hoeing or hand weeding) is laborious, expansive, insufficient and some time causes damages to crop. Chemical weed control certainly has its merits over the existing methods. However, it is not so common as it should have been practiced in commercial scale. Under such circumstances, integration of chemical with one hand weeding offers economically suitable alternative. Further, onion requires higher levels of N, P and K fertilizer for maximum yields then most of other vegetable crops. The shallow root and dense population of onion make them responsive to fertilizers. There is a need to develop the most effective and economical weed control and fertilizer management practices for obtaining higher yield as well as profitability. Keeping in view, a field experiment was designed to recommend the best suitable weed management and fertilizer management technique for onion bulb crop.

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MATERIALS AND METHODS

The study was conducted at instructional farm of the Navsari Agriculture University, Navsari, situated between 20º 57' N latitude, 72º 54' E longitude and has an altitude of about 10 m from msl to study effect of weed management and fertilizer levels on onion crop growth, yield and weed flora during 2008-09 and 2009-10. The experiment consisted of total 30 treatment combinations in which ten treatments of weed management *viz.* W_1: Pendimethalin 1 kg/ha as pre-emergence, W_2: Oxyfluorfen 0.24 kg/ha as pre-emergence, W_3: Pendimethalin 1 kg/ha pre-emergence + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_4: Oxyfluorfen 0.24 kg/ha pre-emergence + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_5: Pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT, W_6: Oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT, W_7: Hand weeding at 20 DAT + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_8: 2 hand weeding at 20 and 40 DAT, W_9: Weed free control (hand weeding at 20, 40 and 60 DAT),

W_{10}: Weedy check and three treatments of fertilizer levels (*viz.* F_1: 75% recommended dose of fertilizer (RDF) (75:37.50:37.50, N:P_2O_5:K_2O kg/ha), F_2: RDF (100:50:50, N:P_2O_5:K_2O kg/ha), F_3: 125% RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha)) were evaluated in factorial randomized block design with three replications. The soil was clay in texture, medium in available nitrogen (212 and 224 kg/ha, respectively) and phosphorus (43 and 40 kg/ha, respectively) and fairly rich in available potassium (318 and 362 kg/ha, respectively) during the years of 2008-09 and 2009-10. The soil was slightly alkaline in reaction (pH 7.8 and 7.6, respectively) with normal electrical conductivity (0.212 and 0.371, respectively). Well decomposed FYM 10 t/ha was applied before transplanting along with phosphorus and potassium as per treatment. Nitrogen was applied in two equal splits as basal and at 30 DAT. Onion were harvested when the tops begin to fall and the bulbs were mature. Onion tops were rolled, onions were undercut, pilled, clipped, graded and weight on 21 May, 2009 and 23 May, 2010. Data were recorded on weed density/m^2, weeds biomass at 40 DAT (g/m^2) and harvest (g/m^2), plant height (cm), neck thickness (cm), dry matter accumulation (g/plant) and yield (kg/ha).

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RESULTS AND DISCUSSION

Effect on weeds

Weed management treatments under investigation significantly influenced total weed populations at 20 and 40 DAT as well as dry weight of weeds at 40 DAT and at harvest of the crop (Table 1). Significantly the lowest weed population at 20 and 40 DAT and dry weight at 40 DAT (gm/m^2) and at harvest (gm/m^2) were noted under pendimethalin 1 kg/ha + one hand weeding at 40 DAT and highest with weedy check during both the years of experiment. It clearly indicated that pre emergence application of herbicides significantly reduced the total weed population during initial period of crop growth. Further, pendimethalin is used in various field crops for selective control of many annual broad leaf weeds and grasses. Effectiveness of various herbicides against different weed species in onion bulb crop has been earlier reported by Angiras and Suresh (2005) and Tripathi *et al*. (2008).

Weed competition index is the indicator of losses in yield due to presence of weeds was the lowest with pendimethalin 1.0 kg/ha + one hand weeding at 40 DAT, followed by oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT. Maximum weed control efficiency was also recorded with application of pendimethaline 1.0 kg/ha + one hand weeding at 40 DAT and closely followed by Oxyflurfen 0.24 kg/ha + one hand weeding at 40 DAT and weed free. This is due to lower weed population and reduce dry matter production of weeds during initial stage by pre emergence application of pendimethalin and effective control of later emerged weeds through hand weeding which ultimately provided weeds free environment to onion. This finding is in line with those of Ghadage *et al.* (2006).

Different fertilizer levels had significant effect on total weed population counted at 20 and 40 days after transplanting. With increased rates of fertilizer simultaneously increased the total weeds population being lowest with 75% RDF and highest with 125% RDF during both the years of experimentation. Similarly, dry weight of weeds was significantly influenced by fertilizer levels at 40 DAT and at harvest being minimum and maximum with 75% RDF and 125% RDF respectively. Data clearly indicated that increasing the fertilizer rate, increased the availability of nutrients for growth and development of weeds ultimately dry weight of weeds increased.

Growth attributes

Higher plant height, neck thickness and dry matter accumulation per plant were observed under pendimethalin 1.0 kg/ha + hand weeding at 40 DAT, while lowest values of all these growth parameters were observed with unweeded control. The plant growth is the function of photosynthetic activity of the plant and their capacity to utilize available nutrients. It was due to favourable environment in the root zone resulting in absorption of more water and nutrients from soil and good control of weeds which ultimately resulted in less crop-weed competition throughout the growth stages of crop. This finding corroborates those of Murthy *et al*. (2007). Growth parameters increased significantly with each successive increased in RDF from 75 to 125%, being maximum with 125% RDF and minimum with 75% RDF. The better growth of plant in terms of plant height, number of leaves per plant and neck thickness with the application of 125% RDF, consequently resulted into higher dry matter accumulation per plant throughout the life span of the onion crop as compared to RDF and 75% RDF. Such positive and beneficial effects of higher levels of RDF on plant height and neck thickness of onion bulb crop are in accordance with those reported earlier by Gethe *et al*. (2006).

Bulb yield

The highest onion bulb yields of 39.3 t/ha during 2008-09, 36.6 t/ha during 2009-10 were obtained under pendimethalin 1 kg/ha supplement with one hand weeding, followed by Oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT and weed free control (hand weeding at 20, 40 and 60 DAT) during both the years as well as in pooled analysis. Increase in bulb yield with these treatments was because of the fact that the weed

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Table 1. Weed population, dry weight of weeds, weed control efficiency and weed competition index as influenced by weed management and fertilizer levels

Treatment	Weed population/m^2				Dry weight of weeds (g/m^2)				WCE (%)		WCI (%)	
	At 20 DAT		At 40 DAT		At 40 DAT		At harvest		08-09	09-10	08-09	09-10
	08-09	09-10	08-09	09-10	08-09	09-10	08-09	09-10				
Weed management												
Pendimethalin 1.0 kg/ha as PE	2.3 (4.6)	2.3 (4.4)	5.6 (30.2)	5.8 (32.33)	10.7	11.5	42.7	67.7	51.8	46.3	15.0	13.1
Oxyfluorfen 0.24 kg/ha as PE	2.7 (6.6)	2.6 (5.8)	5.5 (30.0)	6.2 (36.78)	11.0	13.7	51.8	76.8	41.6	39.1	17.1	16.5
Pendimethalin 1.0 kg/ha as PE+ Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	2.4 (4.9)	2.2 (3.9)	5.5 (30.0)	5.7 (30.89)	10.5	11.0	23.9	38.9	73.0	69.1	2.5	5.3
Oxyfluorfen 0.24 kg/ha as PE + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	2.5 (5.6)	2.4 (4.7)	5.7 (32.0)	5.7 (31.78)	11.5	11.6	28.1	40.1	68.3	68.2	2.7	6.2
Pendimethalin 1.0 kg/ha as PE + 1 hand weeding at 40 DAT	2.2 (3.9)	2.1 (3.9)	5.6 (30.0)	5.5 (28.89)	10.5	10.7	17.2	32.2	80.6	74.5	-5.2	-4.2
Oxyfluorfen 0.24 kg/ha as PE + 1 hand weeding at 40 DAT	2.4 (4.9)	2.4 (5.0)	5.7 (31.3)	5.9 (34.22)	11.1	12.5	23.6	35.9	73.4	71.5	-4.1	-1.7
Hand weeding at 20 DAT + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	7.9 (60.8)	9.0 (80.2)	7.5 (57.9)	8.4 (70.67)	19.8	24.5	63.7	91.8	28.2	27.2	3.0	8.2
Two hand weedings at 20 and 40 DAT	8.0 (62.6)	9.3 (86.2)	7.3 (53.3)	8.8 (77.11)	18.2	27.0	55.5	85.5	37.3	32.2	11.7	16.5
Weed free control (Hand weeding at 20, 40 and 60 DAT)	7.9 (61.0)	9.3 (86.6)	7.5 (55.7)	8.6 (73.78)	19.6	26.0	25.5	37.7	71.2	70.1	-	-
Weedy check	8.1 (64.1)	9.4 (87.8)	10.2 (103.2)	11.9 (142.0)	32.6	44.9	88.6	126.1	-	-	36.7	52.0
SEm±	0.15	0.22	0.24	0.19	1.24	3.81	1.14	4.43				
CD (P=0.05)	0.41	0.63	0.67	0.54	3.51	10.78	3.21	12.55				
Fertilizer level												
75% RDF (75:37.50:37.50, N:P_2O_5:K_2O kg/ha)	4.5 (27.4)	4.8 (33.3)	6.2 (39.10)	6.9 (50.2)	13.5	17.5	36.8	56.7				
RDF (100:50:50, N:P_2O_5:K_2O kg/ha)	4.5 (26.9)	5.1 (37.4)	6.5 (43.3)	7.3 (57.0)	14.7	19.5	42.0	64.8				
125% RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha)	4.8 (29.4)	5.4 (39.9)	7.1 (53.7)	7.5 (60.3)	18.5	21.0	47.4	68.3				
SEm±	0.08	0.12	0.13	0.11	0.68	0.62	2.08	2.42				
CD (P=0.05)	0.23	0.35	0.36	0.30	1.92	1.76	5.91	6.87				

Data in parenthesis indicates actual value and outside parenthesis indicates ($\ddot{O}x+1$) transformed value**;** DAT: days after transplanting, PE: Pre-emergence

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population and weed growth remain low from initial crop growth as compared to weedy check. The reduced crop-weed competition provide proper development of growth characters, *viz.* plant height, leaves/plant, neck thickness and dry matter accumulation, which enhanced the yield attributes, *viz.* bulb diameter, bulb volume and bulb weight. This might be due to good weed control, reduced the competition to a greater extent and thus helped in faster growth and development of onion bulb crop, resulting in obtaining higher values of all characters. It is also reflected from the significant positive correlation between bulb yield and plant height, leaves/plant, neck thickness, dry matter accumulation as well as weight, volume and diameter of onion bulb. The increase in yield with these treatments was because of the fact that the weed population and weed growth remained low during the entire crop growth period, which markedly improved the yield attributes. This is also clear from the negative correlation between most of the growth and yield attributes and dry matter of weeds at final harvest.

Yield obtained from weed free treatment (W_9) was lower as compared to pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT and Oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT due to disturbance of shallow root system by repeated hand weeding, being narrow spacing crop, manual hand weeding also damaged the leaves and plant parts, ultimately reduced the photosynthetic actively of plants which was carried out ones' only in Pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT and Oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT. This finding is in conformity with those of Singh *et al*. (2001).

Significantly the highest onion bulb yield of 37.2, 34.2 and 35.7 t/ha in respective season and pooled data was recorded when crop received fertilizer at 125:62.5:62.5 kg NPK/ha (125% RDF). The onion bulb yield on pooled basis increased to the tune of 19.43 and 10.52% under 125% RDF, respectively over RDF and 75% RDF. The increase in bulb yield could be attributed to increase in growth and yield parameter under higher level of fertilizer 125% RDF and thereby increased the yield of onion. Higher dose of N promoting growth parameters might be due to fact that the net assimilation rate of the N fed to plants was accelerated due to increase in chlorophyll content and the absorbed N helped in formation of food reservoir due

Table 2. Growth parameters of onion bulb crop as influenced by weed management and fertilizer levels

Treatment	Plant height (cm)				Neck thickness (cm)				Dry matter (g/plant)			
	2008-09		2009-10		2008-09		2009-10		2008-09		2009-10	
	At 60 DAT	At 90 DAT	At 60 DAT	At 60 DAT	At 60 DAT	At 90 DAT	At 60 DAT	At 90 DAT	At 60 DAT	At 90 DAT	At 60 DAT	At 90 DAT
Weed management												
Pendimethalin 1.0 kg/ha as PE	53.4	56.0	51.6	53.2	1.20	1.27	1.08	1.2	7.8	12.9	7.2	11.4
Oxyfluorfen 0.24 kg/ha as PE	53.9	56.5	52.1	54.5	1.17	1.28	1.08	1.19	7.7	12.9	7.3	11.8
Pendimethalin 1.0 kg/ha as PE + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	59.7	63.6	57.5	60.6	1.21	1.34	1.14	1.33	9.1	15.2	9.2	14.8
Oxyfluorfen 0.24 kg/ha as PE+ Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	58.8	62.8	56.8	60.3	1.20	1.33	1.13	1.33	9.0	15.0	8.9	15.0
Pendimethalin 1.0 kg/ha as PE + 1 hand weeding at 40 DAT	61.8	66.8	59.8	64.8	1.26	1.36	1.16	1.41	10.5	18.2	10.3	16.6
Oxyfluorfen 0.24 kg/ha as PE + 1 hand weeding at 40 DAT	61.0	66.0	59.3	63.8	1.24	1.36	1.16	1.36	10.3	17.4	10.1	16.1
Hand weeding at 20 DAT + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	57.7	61.4	55.6	57.5	1.19	1.31	1.11	1.24	8.7	13.4	8.4	11.7
Two hand weeding at 20 and 40 DAT	56.7	59.7	55.0	59.5	1.18	1.30	1.10	1.26	8.6	13.0	8.2	11.9
Weed free control (Hand weeding at 20, 40 and 60 DAT)	56.5	62.7	54.7	59.8	1.20	1.31	1.11	1.35	9.1	15.3	8.2	12.6
Weedy check	48.9	51.5	47.1	48.7	0.91	1.17	1.01	0.96	6.2	10.3	5.6	9.7
SEm±	1.76	1.77	1.74	1.70	0.04	0.03	0.03	0.04	0.23	0.34	0.27	0.37
CD (P=0.05)	4.98	5.01	4.94	4.81	0.11	0.09	0.09	0.11	0.64	0.95	0.76	1.04
Fertilizer level												
75% RDF (75:37.50:37.50, N:P_2O_5:K_2O kg/ha)	54.9	58.8	53.0	56.6	1.13	1.26	1.06	1.21	7.75	12.9	7.4	11.9
RDF (100:50:50, N:P_2O_5:K_2O kg/ha)	57.0	60.8	55.1	58.3	1.17	1.30	1.11	1.28	8.61	14.5	8.3	13.0
125% RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha)	58.5	62.4	56.7	60.0	1.22	1.35	1.15	1.32	9.74	15.7	9.4	14.6
SEm±	0.96	0.97	0.96	0.93	0.02	0.02	0.02	0.02	0.12	0.18	0.15	0.20
CD (P=0.05)	2.73	2.74	2.70	2.64	0.06	0.05	0.05	0.06	0.35	0.52	0.41	0.57

to higher photosynthetic activity, which increases the diameter of bulb. Further, P also influences the cellular activity in the roots and leaves which resulted in to increased yield. Similarly, the increase in growth and yield attributes may be due to encourageous effect of potassium on root development, formation of carbohydrates, regulation of water and translocation of photosynthates (Singh et *al*. 2004).

Economics

From the economics point of view, the highest net profit of ₹2,69,422/ha was obtained with pendimethalin 1 kg/ha + 1 hand weeding at 40 DAT with benefit: cost 7.85, followed by Oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT (₹ 2,63,410/ha) and weed free control (hand weedings at 20, 40 and 60 DAT) (₹2,51,910/ha) with CBR values of 7.83 and 6.87, respectively. Different levels of fertilizer produced significant effect on economics of onion and the maximum net return of ₹ 251317/ha with B: C ratio of 7.31 registered with 125 % RDF. The 75% RDF the lowest monitory return (₹2,06,300/ha and BCR (6.28).

Interaction effect

The interaction between weed management and fertilizer levels had significantly influenced on weight and volume of onion bulb during both the years except volume of bulb during second years. Significant increase in onion bulb yield was observed with increasing levels of fertilizers applied to onion bulb crop coupled with weed management treatment of pre emergence application of pendimethalin at 1.0 kg/ha supplemented with one hand weeding at 40 DAT. On pooled basis, the treatment combination of pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT and 125% RDF recorded higher onion bulb yield over rest of the treatment combinations except treatment combinations of oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT +125% RDF, weed free control (hand weedings at 20, 40 and 60 DAT) + 125% RDF and pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT + 125% RDF. From economic point of view, maximum net realization and B:C ratio was recorded with pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT and 125% RDF, which was closely followed by oxyfluorfen 0.24 kg/ha pre-emergence + 1 hand weeding at 40 DAT+125% RDF and weed free control+125% RDF and pendimethalin 1 kg/ha pre-emergence + 1 hand weeding at 40 DAT+125% RDF. Whereas, minimum net realization and B: C ratio was recorded with weedy check + RDF.

It is inferred that the application of pendimethalin 1.0 kg/ha followed by one hand weeding at 40 DAT and application of RDF (100:50:50 kg NPK/ha) found most appropriate and profitable for bulb crop of onion.

Table 3. Bulb yield and economics of onion bulb crop as influenced by weed management and fertilizer levels

Treatment	Bulb yield (t/ha)			Net returns ($\times 10^3$ ₹/ha)	B:C ratio
	2008-09	2009-10	Pooled		
Weed management					
Pendimethalin 1.0 kg/ha as PE	31.8	30.2	31.0	215.6	6.67
Oxyfluorfen 0.24 kg/ha as PE	31.0	29.0	30.0	208.4	6.59
Pendimethalin 1.0 kg/ha as PE+ Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	36.5	32.9	34.7	242.0	6.83
Oxyfluorfen 0.24 kg/ha as PE + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	36.4	32.6	34.5	2,40.0	6.72
Pendimethalin 1.0 kg/ha as PE + 1 hand weeding at 40 DAT	39.3	36.6	38.0	269.4	7.85
Oxyfluorfen 0.24 kg/ha as PE + 1 hand weeding at 40 DAT	38.9	35.3	37.1	263.4	7.83
Hand weeding at 20 DAT + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT	36.3	31.9	34.1	236.8	6.63
Two hand weeding at 20 and 40 DAT	33.0	29.0	31.0	213.4	6.16
Weed free control (Hand weeding at 20, 40 and 60 DAT)	37.4	34.8	36.1	251.9	6.87
Weedy check	23.7	16.7	20.2	130.7	4.26
SEm±	0.92	0.83	0.6		
CD (P=0.05)	2.60	2.35	1.76		
Fertilizer level					
75% RDF (75:37.50:37.50, N:P_2O_5:K_2O kg/ha)	31.9	27.9	29.9	206.3	6.28
RDF (100:50:50, N:P_2O_5:K_2O kg/ha)	34.1	30.5	32.3	224.8	6.69
125% RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha)	37.3	34.2	35.7	251.3	7.31
SEm±	0.50	0.46	0.34		
CD (P=0.05)	1.42	1.29	0.94		

Prevailing price of inputs and outputs FYM ₹1/kg; Labour 100/day; Onion bulb ₹8/kg; Pendimethalin ₹360/litre; Oxyfluorfen ₹480/litre; Fluazifop-p-butyl1₹330/litre; Urea ₹5.57/Kg; SSP ₹4.21/Kg; MOP₹5.34/Kg

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Table 4. Interaction effect of weed management and fertilizer levels on onion bulb yield (t/ha)

Fertilizer level	Weed management									
	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9	W_{10}
					2008-09					
75% RDF	31.47	26.54	35.86	33.34	33.57	36.34	33.10	31.57	33.59	23.60
RDF	27.74	29.67	36.48	36.21	41.24	39.38	36.92	31.27	38.63	23.26
125% RDF	36.14	36.73	37.03	39.52	43.19	41.04	38.77	36.20	39.92	24.09
SEm±					1.59					
CD (P=0.05)					4.50					
					2009-10					
75% RDF	28.63	25.42	32.80	29.93	31.48	31.24	28.01	26.12	28.92	16.59
RDF	27.91	27.69	32.23	32.48	38.47	36.47	32.13	27.01	36.17	16.17
125% RDF	34.13	34.02	33.71	35.38	40.09	38.31	35.58	33.92	39.18	17.30
SEm±					1.44					
CD (P=0.05)					4.07					
					Pooled					
75% RDF	30.05	25.98	34.33	31.63	32.52	33.79	30.55	28.84	31.26	20.10
RDF	27.83	28.68	34.35	34.34	39.86	37.93	34.53	29.14	37.40	19.72
125% RDF	35.14	35.37	35.37	37.45	41.64	39.67	37.17	35.06	39.55	20.70
SEm±					1.02					
CD (P=0.05)					2.85					

W_1: Pendimethalin 1 kg/ha as PE, W_2: Oxyfluorfen 0.24 kg/ha as PE, W_3: Pendimethalin 1 kg/ha PE + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_4: Oxyfluorfen 0.24 kg/ha PE + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_5: Pendimethalin 1 kg/ha PE+ 1 hand weeding at 40 DAT, W_6: Oxyfluorfen 0.24 kg/ha PE + 1 hand weeding at 40 DAT, W_7: Hand weeding at 20 DAT + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_8: 2 hand weedings at 20 and 40 DAT, W_9: Weed free control (hand weedings at 20, 40 and 60 DAT), W_{10}: Weedy check.

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