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Weed management in coriander (*Coriandrum sativum* L.) at varying levels of nitrogen

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Abstract

A field experiment was conducted to study the effect of weed control treatments and nitrogen (N) levels on weed dynamics, weed control efficiency, nutrient depletion by weeds, yield of coriander and weed competition index. All the weed control treatments significantly reduced the density and dry weight of weeds and nutrient depletion as compared to weedy check. Oxadiargyl at 0.06 kg ha^{-1} + hand weeding (HW) at 40 days after sowing (DAS) represented the lowest weed density and controlled the weeds to the extent of 94.9%. Two hand weedings done at 20 and 40 DAS and pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS were found to be the most superior treatments in reducing density, intensity and dry weight of weeds and increasing weed control efficiency. These treatments controlled the weeds to the extent of 95.1% and 95.4%, respectively at harvest stage than weedy check and showed lower weed infestation of 17.4 and 18.1%, respectively. The lowest nutrient depletion due to weeds was obtained with pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS treatment which saved 54.80 kg N, 8.31 kg P and 49.22 kg K ha^{-1}, respectively than weedy check. Two HWs at 20 and 40 DAS and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS also reduced the nutrient depletion to the extent of 94.8 and 94.5% of N; 95.0 and 94.7% of P and 94.9 and 94.6% of K, respectively in comparison to weedy check. Two hand weeding treatment gave the highest seed yield (1.37 t ha^{-1}) among all the treatments and was closely followed by pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS which also increased the seed yield by a margin of 0.84 t ha^{-1} over weedy check, and registered the lowest weed competition index of 0.7%.

Keywords: coriander, nitrogen, nutrient depletion, seed yield, weed control

Introduction

Coriander is one of the oldest known seed spices used by mankind as a condiment throughout the world. India is the largest producer (532 thousand tonnes) and acreage holder (557 thousand hectares) of coriander in the world. The average productivity of seed is 955 kg ha^{-1}. Rajasthan is the major state with an acreage of 267 thousand hectares, 329 thousand tonnes production and average productivity of 1229 kg ha^{-1} (GOR 2012). Despite concerted efforts, productivity of this crop is almost stagnant, which is a matter of great concern. Heavy weed growth appears to be the most serious menace in realizing the full yield potential of coriander (Yadav *et al.* 2005). Weed management is virtually important not only to check these

losses but also to increase the fertilizer use efficiency. Manual control of weeds is cumbersome, time consuming and labour intensive. The traditional method of broadcast sowing of coriander further makes manual weeding very difficult. Hence, identification and use of a selective and cost effective herbicide alone or in combination with hand weeding in an integrated manner can be a good alternative for effective weed management. Most of the Indian soils, particularly the light textured ones where most of the coriander cultivation is confined, are deficient in N. Adoption of exhaustive high yielding varieties of crops has led to heavy withdrawal of nutrients especially N from the soil during past few years but fertilizer use remains much below than removal. Removing weeds would supply more N leading to greater use of available N and consequently higher N use efficiency. In view of these constraints in coriander cultivation, this investigation was undertaken.

Materials and methods

The experiment was carried out during two consecutive *rabi* seasons of 2007–08 and 2008–09 at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Jaipur) situated at 26° 05′ N latitude, 75° 28′ E longitude and an altitude of 427 m above MSL. The soil of the experimental plot was loamy sand in texture, alkaline in reaction (pH 8.1), low in organic C (0.22%), available N (126.6 kg ha^{-1}) and available P (7.37 kg ha^{-1}) and medium in available K (157.5 kg ha^{-1}). The experiment consisted of 28 treatment combinations comprising of seven weed management treatments *viz*., weedy check, one hand weeding (HW) at 20 DAS, two HWs at 20 and 40 DAS, pendimethalin at1.0 kg ha^{-1}, pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS, oxadiargyl at 0.06 kg ha^{-1} (at 20 DAS) and oxadiargyl at 0.06 kg ha^{-1} (at 20 DAS) + HW at 40 DAS allotted to main plots and four levels of N *viz*., 0, 25, 50 and 75 kg ha^{-1} assigned to sub plots in a split plot design with three replications. Coriander variety ′RCr 436′ spaced 30 cm apart was sown in the 1st week of November. A uniform dose of 30 kg P_2O_5 ha^{-1} was drilled in all the plots at the time of sowing. Half dose of N was applied as basal and remaining was top dressed at the time of first irrigation through urea as per treatments. Pendimethalin was applied as pre-emergence, whereas, oxadiargyl as early post-emergence treatment at 20 DAS. In the plots for hand weeding, the operation was done at 20 and 40 DAS as per treatments. Density and dry weight of weeds at specified growth stages of crop were recorded with the help of a quadrat of 0.5 m × 0.5 m size and per cent reduction in dry weight of weeds in comparison to control was expressed as weed control efficiency. To draw a valid conclusion, the weed count data were subjected to square root transformation ($\sqrt{x}$) before statistical analysis. Weed infestation at different stages and intensity of dominant weed species *viz*., *Chenopodium murale* and *C. album* were also calculated with the help of standard formulae. Seed and straw yields were recorded at harvest. Weed competition index (WCI) was also calculated by taking twice hand-weeded plot as weed-free plot. Representative samples of weed dry matter were taken from each plot at harvest stage. They were processed, subjected to chemical analyses for their N, P and K concentration with standard methods and depletion of these nutrients by weeds was estimated by standard formula.

Results and discussion

Effect on weed dynamics

Weedy check plots of coriander were heavily infested by annual dicot weeds *Chenopodium murale* and *C. album* which appeared immediately after crop emergence. *Heliotropium ellipticum, Rumex acetosella, Asphodelus tenuifolius* and *Melilotus alba* were other weed species, which emerged at later stages of crop growth. *Cynodon dactylon* and *Cyperus rotundus* were the most dominating monocot weeds, though, the population was low.

Results showed that weedy check plots recorded the highest density and dry weight of weeds (Table 1). All the weed control treatments resulted in significant reduction in density and dry weight of weeds at all the stages of crop in comparison to weedy check. Two hand weedings done at 20 and 40 DAS was the most effective treatment in reducing

weeds (Table 1 & 2). It recorded the lowest density of 3.68 and 7.42 per 0.25 m^2 at 50 and 80 DAS stages, respectively. Whereas, at harvest, the minimum density (2.61 per 0.25 m^2) was registered under oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS treatment. These two treatments also witnessed huge decline in weed infestation at all the stages than weedy check. Application of pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS was also found at par with these treatments in reducing the density and weed infestation at all the stages. The lowest intensity of *C. murale* and *C. album* at harvest stage (24.6 and 25.6%) was also registered under two hand weeding treatment, which was at par with pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS (25.6 and 26.3%) and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS (29.5 and 29.0%). Two HWs at 20 and 40 DAS, pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS were the most superior treatments in reducing the dry weight of weeds at all the stages than weedy check treatment. HW twice at 20 and 40 DAS recorded weed dry weight of 15.2. 136.0 and 159.2 kg ha^{-1} at 50 DAS, 80 DAS and at harvest stages and thus controlled the weeds to the extent of 95.4, 91.0 and 95.1%, respectively. However, it was statistically on par with pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS treatments which attained the weed control efficiencies of 95.1 and 95.2% at 50 DAS; 90.0 and 91.1.0% at 80 DAS and 95.4 and 94.9% at harvest stage of the crop, respectively. Similar results were also reported by Tiwari *et al.* (2005) and Yadav *et al.* (2005). Progressive increase in N level from 0 to 50 kg ha^{-1} at 50 DAS and up to 75 kg ha^{-1} at 80 DAS and harvest stage resulted in significantly higher accumulation of weed dry weight (Table 1). The highest weed dry weight of 72.7 kg ha^{-1} at 50 DAS, 481.9 kg ha^{-1} at 80 DAS and 924.4 kg ha^{-1} at harvest was recorded with 75 kg N ha^{-1} which was 12.5, 71.1 and 68.0% higher than that observed under control, respectively. However, weed density and intensity of *C. murale* and *C. album* remained unaffected due to N fertilization.

Nutrient concentration in weeds and their depletion

N and K concentration in weeds at harvest stage was significantly influenced due to weed control treatments (Table 3). All the treatments except one HW at 20 DAS and pendimethalin at 1.0 kg ha^{-1} registered significantly higher concentration of N and K in weed dry matter than weedy check. The highest N concentration of 1.94% was noted under pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS treatment. Whereas, K concentration was maximum (1.71%) in weed dry matter obtained from oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS treated plots. However, P concentration remained unaffected due to different weed control treatments. Weedy check treatment recorded the highest depletion of 57.72 kg N, 8.73 kg P and 51.76 kg K ha^{-1} due to weeds which were significantly higher over the other treatments. The lowest depletion of 2.92 kg N, 0.42 kg P and 2.54 kg ha^{-1} was obtained with pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS treatment thereby reducing their depletion by magnitude of 54.80, 8.31 and 49.22 kg ha^{-1}, respectively over weedy check. However, it was found to be on par with 2 HWs at 20 and 40 DAS and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS which also reduced the nutrient depletion to the extent of 94.8 and 94.5% of N; 95.0 and 94.7% of P and 94.9 and 94.6% of K, respectively, in comparison to weedy check. One HW at 20 DAS, pendimethalin at 1.0 kg ha^{-1} and oxadiargyl at 0.06 kg ha^{-1} were noted to be the next superior treatments in reducing nutrient depletion. These treatments saved 48.32, 47.65 and 47.40 kg of N; 7.33, 7.21and 7.17 kg of P and 43.38, 42.62 and 42.39 kg of K ha^{-1}, respectively in comparison to weedy check. Reduction in nutrient depletion under aforesaid superior treatments is directly associated with lower weed dry matter obtained under these treatments. These results are in accordance with the findings of Mehriya *et al.* (2008).

Nutrient concentration in weeds was not significantly influenced due to N fertilization. Whereas, every increase in level of N up to its highest level significantly enhanced the

Table 1. Effect of weed control and N levels on density, intensity and dry weight of weeds at different stages (pooled over two years)

Treatments	Weed density* (%)			Weed intensity (%)		Dry weight of weeds (kg ha^{-1})		
	50 DAS	80 DAS	At harvest	*C. album*	*C. murale*	50 DAS	80 DAS	At harvest
Weed control								
Weedy check	8.32 (68.99)	8.53 (72.87)	6.23 (38.51)	44.7	43.8	317.9	1505.5	3242.2
One HW at 20 DAS	3.32 (10.57)	3.92 (14.92)	3.24 (10.06)	34.8	33.4	87.4	274.4	510.9
Two HW at 20 & 40 DAS	2.04 (3.68)	2.81 (7.42)	1.78 (2.68)	24.6	25.6	15.2	136.0	159.2
Pendimethalin at 1.0 kg ha^{-1}	3.63 (12.69)	4.14 (16.64)	3.43 (11.28)	36.5	35.3	43.1	293.2	549.9
Pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS	2.13 (4.04)	2.98 (8.38)	1.88 (3.05)	25.6	26.3	15.5	151.7	150.0
Oxadiargyl at 0.06 kg ha^{-1}	3.61(12.58)	4.10 (16.35)	3.38 (10.97)	38.0	36.4	41.7	291.3	559.3
Oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS	2.06 (3.74)	2.82 (7.45)	1.76 (2.61)	29.5	29.0	14.6	133.8	164.6
SEm±	0.06	0.07	0.05	0.5	0.6	1.8	8.8	16.9
CD (P<0.05)	0.17	0.19	0.14	1.4	1.8	5.2	25.4	49.3
Nitrogen levels (*kg ha^{-1}*)								
0	3.53 (16.07)	4.09 (19.67)	2.96 (10.21)	34.0	32.4	64.6	281.7	550.4
25	3.60 (16.60)	4.18 (20.40)	3.07 (11.06)	34.0	32.8	68.7	387.3	726.9
50	3.63 (16.83)	4.23 (20.85)	3.16 (11.71)	37.8	33.0	71.4	441.2	847.5
75	3.59 (16.93)	4.23 (21.37)	3.22 (12.26)	33.6	33.3	72.7	481.9	924.4
SEm±	0.03	0.04	0.03	0.3	0.4	0.9	4.2	8.3
CD (P<0.05)	NS	NS	NS	NS	NS	2.5	11.7	23.3

*Weed density data were square root transformed; DAS=Days after sowing; HW=Hand weeding; Data in parentheses indicate the original weed density per 0.25 m^2

Table 2. Effect of weed control treatments on weed infestation and weed control efficiency at different stages (mean of two years)

Treatments	Weed infestation (%)			Weed control efficiency (%)		
	50 DAS	80 DAS	At harvest	50 DAS	80 DAS	At harvest
Weedy check	48.4	51.0	44.9	-	-	-
One HW at 20 DAS	26.6	30.8	27.9	88.2	81.8	84.2
Two HW at 20 & 40 DAS	18.0	24.2	17.4	95.4	91.0	95.1
Pendimethalin at 1.0 kg ha^{-1}	27.3	32.1	29.1	86.5	80.5	83.0
Pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS	18.8	25.6	18.1	95.1	90.0	95.4
Oxadiargyl at 0.06 kg ha^{-1}	27.7	31.5	29.2	86.9	80.7	82.7
Oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS	18.3	24.8	17.5	95.2	91.1	94.9
SEm±	0.69	0.83	0.74	2.43	2.38	2.18
CD (P<0.05)	2.32	2.71	2.39	7.06	6.84	6.68

DAS=Days after sowing; HW=Hand weeding

Table 3. Effect of weed control and nitrogen levels on nutrient concentration in weeds, their depletion, seed yield of coriander and weed competition index (pooled over two years)

Treatments	Nutrient conc. in weeds (%)			Nutrient depletion (kg ha^{-1})			Seed yield (t ha^{-1})			Mean WCI
	N	P	K	N	P	K	2007–08	2008–09	Pooled	(%)
Weed control										
Weedy check	1.76	0.269	1.59	57.72	8.73	51.76	0.51	0.53	0.52	62.2
One HW at 20 DAS	1.83	0.274	1.64	9.40	1.40	8.38	1.08	1.32	1.20	12.3
Two HW at 20 & 40 DAS	1.90	0.276	1.67	3.03	0.44	2.66	1.23	1.51	1.37	-
Pendimethalin @1.0 kg ha^{-1}	1.82	0.276	1.66	10.07	1.52	9.14	1.07	1.28	1.17	14.4
Pendimethalin @1.0 kg ha^{-1} + HW at 40 DAS	1.94	0.279	1.69	2.92	0.42	2.54	1.23	1.49	1.36	0.7
Oxadiargyl @0.06 kg ha^{-1}	1.84	0.279	1.67	10.32	1.56	9.37	0.79	0.89	0.84	38.9
Oxadiargyl @0.06 kg ha^{-1} + HW at 40 DAS	1.92	0.281	1.71	3.17	0.46	2.81	0.93	1.09	1.01	26.3
SEm±	0.03	0.004	0.02	0.46	0.07	0.44	0.03	0.03	0.02	-
CD (P<0.05)	0.07	NS	0.07	1.35	0.20	1.28	0.08	0.09	0.06	-
Nitrogen levels (kg ha^{-1})										
0	1.78	0.271	1.62	9.35	1.48	8.70	0.67	0.79	0.73	-
25	1.84	0.276	1.65	12.94	1.98	11.69	0.92	1.10	1.01	-
50	1.88	0.278	1.67	15.46	2,32	13.84	1.09	1.30	1.20	-
75	1.93	0.279	1.70	17.47	2.52	15.29	1.23	1.45	1.34	-
SEm±	0.02	0.002	0.02	0.30	0.04	0.25	0.02	0.02	0.01	-
CD (P<0.05)	NS	NS	NS	0.83	0.11	0.69	0.05	0.06	0.04	-

DAS=Days after sowing; HW=Hand weeding; WCI=Weed competition index

nutrient depletion over preceding levels. Application of N at 75 kg ha^{-1} registered the highest depletion of 17.47, 2.52 and 15.29 kg of N, P and K ha^{-1} which was higher by 2.01, 0.20 and 1.45 kg ha^{-1} over 50 kg N ha^{-1}; 4.53, 0.54 and 3.60 kg ha^{-1} over 25 kg N ha^{-1} and 8.12, 1.04 and 6.59 kg ha^{-1} over control, respectively. Similar results were also reported by Yadav & Sharma (2004).

Seed yield and weed competition index

Coriander seed yield was influenced to a great extent due to different weed control treatments during individual years as well as in pooled analysis (Table 3). All the treatments recorded significantly higher seed yield than weedy check. Pooled results showed that two hand weedings done at 20 and 40 DAS resulted in the maximum seed yield (1.37 t ha^{-1}) of coriander and thus registered increase of 14.2, 17.1, 35.6. 63.1 and 163.5% over one HW at 20 DAS, pendimethalin at 1.0 kg ha^{-1}, oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS, oxadiargyl alone and weedy check, respectively. The corresponding increase in seed yield due to pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS was 13.3, 16.2, 34.7, 61.9 and 161.5% and thus was found to be on par with two HW treatment. It also recorded the lowest weed competition index of 0.7% in comparison to two HW treatment which was considered as weed free treatment. One HW at 20 DAS and pendimethalin at 1.0 kg ha^{-1} recorded 130.8 and 125.0% higher seed yield than weedy check and registered weed competition indices of 12.3 and 14.4%, respectively. Application of oxadiargyl at 0.06 kg ha^{-1} with subsequent HW at 40 DAS and oxadiargyl alone attainded weed competition indices of 26.3% and 38.9%, respectively. Superiority of aforesaid treatments might be due to be lower weed dry matter accumulation and minimum crop-weed competition. These results corroborate with the findings of Singh *et al.* (2001) and Patel *et al.* (2004) in coriander. It was further noted that every addition in level of N upto 75 kg ha^{-1} brought significantly higher seed yield of coriander over preceding levels during both the years as well as in pooled analysis (Table 3). It produced a mean seed yield of 1.34 t ha^{-1}, that was higher by 10.4, 11.7 and 32.7% over 50 and 25 kg N ha^{-1} and control, respectively. Increase in seed yield of coriander due to N fertilization has also been reported by Datta *et al.* (2008).

Interaction

Interactive effect of weed control treatments and N levels significantly influenced the dry weight of weeds at 80 DAS and at harvest, nutrient depletion by weeds and seed yield of coriander (Table 5). Two HWs at 20 and 40 DAS combined with no N and pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS without N were the most superior treatment combinations which registered 94.9% and 91.0% lower weed dry weight at 80 DAS and 97.0% and 97.3% at harvest stage, respectively than weedy check plots fertilized with 75 kg N ha^{-1}. Oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS without N also recorded 94.5% and 96.9% lower dry weight of weeds than weedy check combined with 75 kg N ha^{-1} and thus proved equally effective to the above treatment combinations. Pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS without N fertilization recorded the lowest depletion of 2.02 kg N, 0.34 kg P and 1.84 kg K ha^{-1} which was 97.3%, 96.9% and 97.2% lower than weedy check plots fertilized with 75 kg N ha^{-1}, wherein the highest nutrient depletion was recorded (Table 4). Two HWs at 20 and 40 DAS along with 0 kg N ha^{-1} and oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS without N were the next better and statistically similar treatment combinations in reducing nutrient depletion by weeds. Pooled data further revealed that pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS along with 75 kg N ha^{-1} provided the highest seed yield (1.73 t ha^{-1}) of coriander among all the treatment combinations but was found statistically at par with two HW treatment along with N fertilization at 75 kg ha^{-1} (1.71 t ha^{-1}).

It is concluded that two HW done at 20 and 40 DAS combined with 75 kg N ha^{-1} was the most effective treatment combination for controlling weeds, reducing nutrient depletion and obtaining significantly higher seed yield of coriander. Pendimethalin at 1.0 kg ha^{-1} + HW

Table 4. Combined effect of weed control treatments and nitrogen levels on nutrient depletion by weeds (Pooled over two years)

Treatments	Nitrogen levels (kg ha^{-1})											
	N depletion (kg ha^{-1})				P depletion (kg ha^{-1})				K depletion (kg ha^{-1})			
	0	25	50	75	0	25	50	75	0	25	50	75
Weedy check	37.71	53.98	64.35	74.96	6.14	8.39	9.70	10.85	35.51	48.9	57.60	65.09
HW once at 20 DAS	6.45	8.92	10.65	11.78	1.06	1.40	1.64	1.70	5.99	8.00	9.45	10.28
HW twice at 20 & 40 DAS	2.12	2.86	3.44	3.73	0.37	0.49	0.56	0.57	1.93	2.57	3.04	3.37
Pendimethalin at 1.0 kg ha^{-1}	7.43	9.41	11.33	12.17	1.20	1.48	1.76	1.89	6.85	8.57	10.26	11.03
Pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS	2.02	2.74	3.36	3.78	0.34	0.47	0.57	0.55	1.84	2.42	2.93	3.26
Oxadiargyl at 0.06 kg ha^{-1}	7.52	9.87	11.67	12.41	1.10	1.55	1.89	1.97	6.97	8.95	10.64	11.05
Oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS	2.37	3.08	3.66	3.90	0.36	0.40	0.57	0.65	2.00	2.63	3.27	3.40
For N at same level of W												
SEm±				0.78				0.11				0.65
CD (P<0.05)				2.19				0.30				1.82
For W at same or different levels of N												
SEm±				0.59				0.08				0.52
CD (P<0.05)				1.68				0.24				1.49

DAS=Days after sowing; HW=Hand weeding; N-Nitrogen levels; W-Weed control treatment

Table 5. Combined effect of weed control and N levels on weed dry weight and seed yield of coriander (pooled over two years)

Treatments	N levels (kg ha^{-1})											
	Weed dry weight at 80 DAS (kg ha^{-1})				Weed dry weight at harvest (kg ha^{-1})				Seed yield (t ha^{-1})			
	0	25	50	75	0	25	50	75	0	25	50	75
Weedy check	1039.2	1481.4	1657.3	1844.3	2292.8	3092.2	3591.1	3992.6	0.34	0.48	0.56	0.69
HW once at 20 DAS	192.1	285.4	305.8	314.4	371.9	492.8	570.8	608.0	0.80	1.12	1.33	1.56
HW twice at 20 & 40 DAS	93.7	124.7	150.9	165.7	117.8	151.7	176.4	190.8	0.91	1.29	1.58	1.71
Pendimethalin at 1.0 kg ha^{-1}	224.2	269.7	326.2	352.5	421.4	519.1	611.9	647.1	0.79	1.11	1.31	1.49
Pendimethalin at 1.0 kg ha^{-1} + HW at 40 DAS	106.2	146.4	169.9	184.4	107.5	141.6	168.0	182.9	0.90	1.29	1.52	1.73
Oxadiargyl at 0.06 kg ha^{-1}	215.6	275.0	327.5	347.3	419.5	535.1	628.7	654.0	0.61	0.80	0.94	1.00
Oxadiargyl at 0.06 kg ha^{-1} + HW at 40 DAS	100.6	128.4	150.7	164.3	121.8	155.4	185.6	195.5	0.74	0.97	1.14	1.20
For N at same level of W												
SEm±				11.66				21.96				0.04
CD (P<0.05)				30.97				61.6				0.10
For W at same or different levels of N												
SEm±				9.58				18.76				0.03
CD (P<0.05)				27.44				53.7				0.08

DAS=Days after sowing; HW=Hand weeding; N-Nitrogen levels; W-Weed control treatment

at 40 DAS along with with 75 kg N ha^{-1} was equally effective and most suitable option among herbicide combinations for the areas where availability of labour is a problem.

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