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Weed Management in Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]

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Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.], popularly known as guar, is a drought hardy and deep rooted legume grown as feed, fodder, green manure, vegetable and seed in dry habitat of Rajasthan. Being a **kharif** season crop, it suffers from severe infestation of weeds which reduces its seed yield by 47% (Bhadoria *et al.*, 2000). Hand weeding is a common practice of weed control but incessant rains in vertisols and unavailability and high wages of labour at weeding peaks are the major constraints (Vyas and Kushwah, 2008). Under such situations, use of suitable herbicides alone or integrated with hand weeding needs to be explored as an effective and economical method of weed management.

A field experiment was conducted during **kharif** season of 2008 at Udaipur. The soil of the experimental field was clay loam in texture having pH 8.10, organic carbon 0.78% and available N, P and K 301.0, 20.42 and 196.90 kg/ha, respectively. The experiment was laid out in a randomized block design with 16 treatment combinations comprising weedy check, one hand weeding at 20 days after sowing (DAS), two hand weedings at 20 and 35 DAS, weed free upto 50 DAS, pendimethalin at 500 and 750 g/ha alone as pre-emergence and in combinations with hand weeding at 35 DAS, imazethapyr at 75 and 100 g/ha at 20 DAS alone and in combinations with hand weeding at 35 DAS and quizalofop-ethyl at 40 and 60 g/ha at 20 DAS alone and in combinations with hand weeding at 35 DAS. The treatments were replicated thrice. Guar variety 'RGC 936' was sown at 30 x 10 cm spacing on July 5, 2008. The crop was fertilized with uniform dose of 20 kg N and 40 kg P_2O_5 /ha through urea and DAP, respectively, at the time of sowing. Herbicides were applied in 750 litres of water/ha with the help of knapsack sprayer fitted with flat-fan nozzle. Observations on weed count at 50 DAS were recorded by using a quadrate measuring 50 x 50 cm at two randomly selected spots in each plot and converted into one square metre area and these data were subjected to square root transformation $\sqrt{(x+0.5)}$ before analysis. Weed dry matter was recorded at harvest from net plot.

Weed flora of experimental field comprised *Cynodon dactylon*, *Cyperus rotundus*, *Echinochloa colona, Echinochloa crus-galli* among monocot weeds and *Amaranthus viridis*, *Amaranthus spinosus*, *Commelina benghalensis*, *Parthenium hysterophorus* and *Trianthema portulacastrum* among dicot weeds. Overall the experiment was dominated by population of dicot weeds over monocots. All the weed control treatments significantly reduced density and dry matter of weeds 50 DAS and at harvest, respectively, except post-emergent quizalofop at 40 and 60 g/ha which could not control dicot weeds and was comparable to weedy check (Table 1). Two hand weedings at 20 and 35 DAS and imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS were at par but significantly superior to rest of the treatments in minimising weed densities and weed dry matter. However, both of these treatments were found at par. Density of monocot, dicot and total weeds under two hand weedings treatment was 3.0, 10.0 and 13.0 / m^2as against 112, 149 and 261/m^2, respectively, recorded under weedy check. The highest weed control efficiency (90.78%) was recorded under two hand weedings followed by imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS (89.38%), while it was minimum (33.32%) under quizalofop-ethyl 40 g/ha applied at 20 DAS.

Among different treatments, two hand weedings at 20 and 35 DAS as well as imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS recorded maximum yield attributes viz., pods/plant, seeds/pod and test weight and seed, haulm and biological yield (Table 2). The higher yield and yield attributes under these treatments were attributed to lower weed density, weed dry weight and better weed control efficiency. The maximum seed yield (1597 kg/ha) was obtained under two hand weedings which was at par with imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS (1580 kg/ha). Harvest index was not affected significantly with the weed control treatments. The results of study also corroborate with the findings of Singh *et al.* (2006).
Economic evaluation of different weed management treatments (Table 2) indicated that maximum net returns

Table 1. Effect of weed control treatments on weed density*, weed dry matter and weed control efficiency in clusterbean

Treatments	Weed density/m^2 at 50 DAS			Weed dry matter (kg/ha) at harvest			Weed control efficiency (%) at harvest		
	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total
Weedy check	10.59 (112)	12.21 (149)	16.15 (261)	2792.9	2874.0	5667.0	-	-	-
One HW 20 DAS	5.79 (33)	5.54 (30)	7.99 (63)	513.0	610.6	1123.6	81.52	78.52	79.96
Two HW 20 & 35 DAS	1.87 (3)	3.24 (10)	3.67 (13)	216.0	306.0	522.0	92.26	89.35	90.78
Weed free upto 50 DAS	0.71 (0)	0.71 (0)	0.71 (0)	40.6	48.8	89.5	98.54	98.25	98.41
Pendimethalin 500 g/ha	5.75 (33)	6.76 (45)	8.85 (78)	600.8	660.4	1261.2	78.42	76.78	77.57
Pendimethalin 500 g/ha+HW 35 DAS	4.60 (21)	4.05 (16)	6.09 (37)	379.2	389.4	768.7	86.36	86.15	86.42
Pendimethalin 750 g/ha	5.12 (26)	5.91 (34)	7.78 (60)	486.0	596.3	1082.4	82.55	78.99	80.82
Pendimethalin 750 g/ha+HW 35 DAS	3.50 (12)	3.88 (15)	5.18 (26)	353.6	378.5	732.2	87.28	86.77	87.05
Imazethapyr 75 g/ha	3.58 (12)	4.49 (20)	5.70 (32)	441.0	550.3	991.3	84.11	80.67	82.42
Imazethapyr 75 g/ha+HW 35 DAS	2.60 (6)	3.20 (10)	4.06 (16)	299.2	334.6	633.8	89.225	88.41	88.77
Imazethapyr 100 g/ha	3.54 (12)	4.17 (17)	5.43 (29)	423.0	523.9	946.9	84.881	81.58	83.22
Imazethapyr 100 g/ha+HW 35 DAS	2.55 (6)	2.74 (7)	3.68 (13)	294.5	308.6	603.2	89.41	89.12	89.38
Quizalofop-ethyl 40 g/ha	6.16 (37)	12.05 (145)	13.51 (183)	973.0	2826.0	3799.0	66.30	1.58	33.32
Quizalofop-ethyl 40 g/ha+HW 35 DAS	5.59 (31)	11.07 (122)	12.38 (153)	808.5	557.0	1365.6	70.72	80.38	75.60
Quizalofop-ethyl 60 g/ha	5.95 (35)	11.96 (143)	13.35 (178)	874.6	2817.0	3691.6	68.61	1.92	34.53
Quizalofop-ethyl 60 g/ha+HW 35 DAS	5.41 (29)	11.03 (121)	12.26 (150)	754.8	536.6	1291.5	72.84	81.15	77.04
LSD (P=0.05)	0.434	0.451	0.486	116.38	205.92	298.90	-	-	-

HW–Hand weeding, Values in parentheses are original values, *Transformed values $\sqrt{(x+0.5)}$.
DAS–Days after sowing.

Table 2. Effect of different weed control treatments on yield attributes, yield and economics in clusterbean

Treatments	Pods/ plant	Seeds/ pod	Test weight (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Net return	B : C ratio
Weedy check	13.65	5.00	25.85	490	1470	1960	24.93	1628	0.22
One HW 20 DAS	22.35	7.50	28.74	1010	2859	3869	26.12	8669	0.86
Two HW 20 & 35 DAS	29.52	8.70	32.40	1596	4192	5789	27.94	17631	1.53
Weed free upto 50 DAS	31.50	8.90	32.70	1685	4297	5982	28.13	17087	1.26
Pendimethalin 500 g/ha	21.80	7.30	27.21	820	2320	3140	25.63	6531	0.75
Pendimethalin 500 g/ha+ HW 35 DAS	25.15	8.15	30.49	1120	2945	4066	27.52	9813	0.92
Pendimethalin 750 g/ha	23.20	7.80	28.04	970	2638	3608	26.88	8824	0.98
Pendimethalin 750 g/ha+HW 35 DAS	25.80	8.34	31.31	1190	3141	4332	27.47	10753	0.98
Imazethapyr 75 g/ha	26.20	8.20	30.56	1230	3161	4391	28.13	13242	1.45
Imazethapyr 75 g/ha+HW 35 DAS	27.75	8.45	32.20	1462	3698	5161	28.40	15899	1.49
Imazethapyr 100 g/ha	27.00	8.30	32.10	1350	3496	4847	27.92	15061	1.58
Imazethapyr 100 g/ha+HW 35 DAS	28.90	8.57	32.35	1580	4044	5625	28.11	17697	1.60
Quizalofop-ethyl 40 g/ha	18.50	7.10	26.20	625	1825	2450.	25.49	2497	0.27
Quizalofop-ethyl 40 g/ha+HW 35 DAS	23.00	7.70	29.65	860	2347	3208	6.83	4675	0.42
Quizalofop-ethyl 60 g/ha	21.50	7.20	27.10	760	2158	2918	26.07	4339	0.44
Quizalofop-ethyl 60 g/ha+HW 35 DAS	23.50	8.00	30.50	1020	2703	3723	27.52	6919	0.59
S. Em±	1.04	0.19	0.42	70	178	196	1.67	-	-
LSD (P=0.05)	3.00	0.55	1.23	203	515	565	NS	-	-

HW–Hand weeding, DAS–Days after sowing.
NS–Not Significant.

of Rs. 17697/ha were obtained with imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS which was followed by Rs. 17631/ha under two hand weedings at 20 and 35 DAS. Benefit : cost ratio of (1.60 : 1) was also recorded maximum under this treatment followed by application of imazethapyr 100 g/ha at 20 DAS (1.58 : 1).

It can be concluded that maximum net returns and benefit : cost ratio in clusterbean could be realized with the integrated application of imazethapyr 100 g/ha at 20 DAS+one hand weeding at 35 DAS under sub-humid southern plain and Aravalli hills zone of Rajasthan.

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