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Integrated Effect of Land Configurations and Weed Management Regimes on Weed Dynamics and Performance of Urdbean (*Vigna mungo L. Hepper*) in an Alluvial Soil

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Abstract

A field experiment was carried out during *kharif* seasons of 2012 at CRC of SVPUA and T, Meerut to evaluate the weed dynamics and performance of urdbean under integrated effect of land configurations and weed management regimes. The experiment was laid out in split plot design with three replications. In main plot factor, four land configuration *i.e.* Line sowing (30 cm), Ridge method, Broad bed method (30 cm) and Broadcast sowing and in sub plot factor, four method of weed management practices, *i.e.* Pendimethalin @ 1.5 kg *a.i*/ha as pre-emergence, two hand weedings at (20 and 40 DAS), and Quizalofop ethyl @50 gm *a.i*/ha as post emergence and control were tested by using F test. The study on weeds and crop growth parameters was made on quadrate (1 m^2) basis, whereas the yield attributes and yield were calculated on net plot area basis (12 m^2). The economical studies were done on the basis of prevailing market prices of input and output. The results indicated that weed population and dry weight of weeds were significantly reduced with the application of Quizalofop ethyl @50 gm *a.i*/ha as post emergence over Pendimethalin @ 1.5 kg *a.i*/ha as pre-emergence, Two hand weedings at (20 & 40 DAS) and control. Plant population, growth parameters *viz.,* plant height, number of trifoliate leaves and dry matter accumulation and yield attributes *viz.,* number of pod $plant^{-1}$, 100 seed weight, biological yield, harvest index found superior by using Quizalofop ethyl @50 gm *a.i*/ha as post emergence than Pendimethalin @ 1.5 kg *a.i*/ha as pre-emergence, Two hand weedings at (20 & 40 DAS) and control. This treatment also fetched Rs. 40631 and 53753 net and gross return, respectively. Moreover, under land configurations, Broad bed method (30 cm) showed highest values of above parameters followed by Ridge method, Line sowing (30 cm), and Broadcast sowing. Apart from above it also bring significantly reduction in weed population and dry weight of weeds. Thus, broad bed method in combination with Quizalofop ethyl @50 g *a.i.*/ha as post emergence may be suggested for effective control of weeds in urdbean with maximum net return.

Keywords: Alluvial Soil, Land Configurations, Urdbean, Weed Dynamics, Weed Management Regimes

1. Introduction

Despite increase in production, pulses availability have declined drastically from 69 g/capita/day in 1960 to 37 g/capita/day in 2004 as against the "World Health organization" norms of 80 g/capita/day. Thus there is a wide gap between production and demand of pulses in the country to make up this shortfall in supply besides of course further demand from burgeoning population at least 23.88 m tones of pulses are required by 2015 which is expected to touch 29.30 m tones by 2020 A.D. to meet out the requirement of pulses[1]. Food security being India's major

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concern under changing climatic scenario, the reasons for slow down in food grain production in recent past have been looked into with a major emphasis on rice and wheat crops[2]. Hand weeding significantly affected all the measured traits of corn. The best herbicide treatment was the highest application dose (3.5 li/ha) applied at the third trifoliate stage which significantly affected the number of kernels/pod and kernels weight.

The dominant weeds in blackgram were *Cleome viscosa, Corchorus aestuans, Croton bonplandianum [Croton bonplandianus], Cyperus rotundus, Merremia emarginata, Phyllanthus niruri, Trianthema portulacastrum,* and *Urocloa panicoides [Urochloa panicoides]* in both years[3].

Hand weeding significantly affected all the measured traits of corn[4]. The best herbicide treatment was the highest application dose (3.5 l/ha) applied at the third trifoliate stage which significantly affected the number of kernels/pod and kernels weight[5].

Weed suppression effect (78.4%) weed control efficiency (46.5%) were significantly higher by the adoption of complete local practice namely local variety of blackgram, broadcasting method of sowing and delayed weed control measures[9]. Weed population and weed dry weight were 16 and 12% lower, respectively, in line sowing than broadcast sowing of blackgram[6]. The pre-emergence application of pendimethalin @ 1 kg ha^{-1} reduced the dry matter of weeds in urdbean significantly than mechanical weed control treatments[7]. Broad bed furrows had greater positive influence on the plant height and root length over farmers practices. The yield and yield attributes were higher under line sowing than broadcast. Seed yield of urdbean in line sowing was 8% higher than in broadcast sowing[6]. Number of pods per plant and 1000-grain weight increased but the number of seeds per pod was not affected by the weed control treatments. The interaction effects of fertilizer rates and weed control treatments on the grain yield of green gram were significant. However, under present investigation efforts were made to explore the feasibility of growing blackgram on ridges and raised beds by keeping almost the recommended spacing. Therefore, the present study was carried out to investigate integrated effect of land configuration and weed management regimes on weed dynamics, vis-a-vis performance of blackgram.

2. Materials and Methods

A field experiment was conducted during *kharif* season 2012 at Crop Research Centre (Chirauri) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), located at a latitude of 29^0 40' North and longitude of 77^0 42' East with an elevation of 237 metres above mean sea level, the mean annual rainfall was about 650 mm. The area lies in the heart of Western Uttar Pradesh. The experimental field was well drained, sandy loam in texture and slightly alkaline in reaction (pH 7.8), It was medium in organic carbon (0.570 %), available nitrogen (222.6 kg/ha) and available phosphorus (16.6 kg/ha) but high in available potassium (249.0 kg/ha) with an electrical conductivity (1:2, soil: water suspension) and a bulk density of 1.6 dS/m and 1.42 Mg/m^3, respectively. The treatments comprised of two-factor study, in first factor, four method of sowing *i.e.* Line sowing (30 cm), Ridge method, Broad bed method (30 cm) and Broadcast sowing and the second factor, four method of weed management practices, *i.e.* Pendimethalin @ 1.5 kg *a.i*/ha as pre-emergence, Two hand weedings at (20 and 40 DAS), and Quizalofop ethyl @ 50 gm *a.i*/ha as post emergence and control, replicated thrice in a split plot design. Varieties PU 35 grown with recommended agronomic package of practices. The seeds were placed manually in the furrows at a plant to plant distance of 10 cm with a seed rate of 15 kg/ha, and sown on 09.08.2011. The 100 per cent NPK is characterized by 20 kg N, 60 kg P_2O_5 and 40 kg K_2O/ ha. Irrigation was provided as per need of crop. Crops were kept weed free by Pre emergence application of pendimethalin after the sowing of crop but before the emergence of weeds (2 DAS) as well as post emergence herbicide Quizalofop-ethyl was applied at 20 DAS, by spraying on crop with a knapsack sprayer using a spray volume of 500 liters of water/ha. Care was taken to ensure uniform application of herbicides in each plot as per treatment. The data on weed studies, growth parameters, yield attributes, biological yield per hectare, harvest index were recorded as per the standard procedure and economical studies were done on the basis of prevailing market prices of input and output. The data recorded on different observations were tabulated and analyzed statistically by using the Analysis of Variance (ANOVA) techniques as suggested by Gomez and Gomez[8].

3. Results and Discussion

3.1 Effect of Different Treatments on Weed Dynamics

Table 1 revealed that the sowing methods had significant effect on weed population and dry weight of weeds at 20,

Table 1. Weed population and dry weight of weeds as influenced by weed management practices and sowing method

Treatments	Weed population No m^{-2}			Dry weight of weed g m^{-2}			
Sowing methods	**20 DAS**	**40 DAS**	**60 DAS**	**20 DAS**	**40 DAS**	**60 DAS**	**WCE (%) at 60 DAS**
Line sowing (S_1)	12.91	11.58	19.75	3.32	3.88	6.08	-
Ridge method (S_2)	11.16	9.41	17.00	2.87	3.07	4.93	-
Broad bed method(S_3)	9.50	7.58	14.00	2.30	2.15	3.76	-
Broadcast sowing(S_4)	18.08	16.00	23.58	4.52	5.07	6.69	-
SEm±	0.36	0.56	1.41	0.08	0.16	0.17	-
CD at 5%	1.26	1.99	4.98	0.29	0.55	0.61	-
Weed management practices							
Weedy check (W_1)	16.00	23.75	30.58	4.14	6.10	8.38	-
Two hand weeding (W_2)	15.41	2.66	13.50	3.81	2.84	3.55	57.63
Pendimethalin@1.5kg *a.i*/ha (W_3)	5.91	14.75	22.33	1.47	3.77	3.42	59.18
Quizalofopethyle@50gm*a.i*/ha(W_4)	14.33	3.41	7.91	3.58	1.46	2.12	74.70
SEm±	0.42	0.66	0.77	0.13	0.18	0.20	-
CD at 5%	1.23	1.94	2.25	0.37	0.53	0.59	-

40 and 60 DAS. At early stage (20 DAS), the highest weed population and dry weight of weeds was found under broadcast sowing (18.08 m^{-2} and 4.52 gm^{-2}), respectively and the lowest under broad bed method (9.50 m^{-2} and 2.30 gm^{-2}), respectively. Weed population and dry weight of weeds in ridge method was 11.16 m^{-2} and 2.87gm^{-2}, respectively and line sowing 12.91 m^{-2} and 3.32 gm^{-2}, respectively. At 40 DAS, the highest weed population and dry weight of weeds was found under broadcast sowing (16.00 m^{-2} and 5.07 gm^{-2}) and the lowest under broad bed method (7.58 m^{-2} and 2.15 gm^{-2}). Weed population and dry weight of weeds in ridge and line sowing was 9.41 m^{-2} and 3.07 gm^{-2} and 11.58 m^{-2} and 3.88 gm^{-2}, respectively. At 60 DAS, similar trend was observed. The reduction in weed population and less dry matter production of weeds may be due to an appreciable smoothing effect on weed as broad bed method leaving very little space weed to grow offered better crop weed competition in favour of crop resulting higher grain yield of urdbean than ridge method, line sowing and broadcast sowing. These finding are confirmed by the result of Sarajuoghi *et al.*[4] and Singh and Singh[6].

The data presented in Table 1 indicates that the effect of weed management practices on weed population and dry weight of weeds recorded at 20, 40 and 60 DAS was significant. At early stage (20 DAS), the highest weed population and dry weight of weeds was found under weedy check treatments (16.00 m^{-2} and 4.14 m^{-2}) followed by two hand weedings and quizalofop ethyl as post emergence (15.41 m^{-2} and 3.81 gm^{-2} and 14.33 m^{-2} and 3.58 gm^{-2}), respectively and the lowest under treatment pendimethalin (5.91 m^{-2} and 1.47 gm^{-2}) as pre-emergence application. At 40 DAS, the highest weed population and dry weight of weeds was found under weedy check (23.75 m^{-2} and 6.10 g/m^2) and the lowest weed population was found under two hand weedings (2.66) and in case of dry weight of weeds, the lower weight was found under quizalofop ethyl (1.46 gm^{-2}). At 60 DAS, the highest weed population and dry weight of weeds was counted under weedy check (30.58 and 8.38 g/m^2) followed by pendimethalin and two hand weedings (22.33 m^{-2} and 3.42 gm^{-2} and 13.50 m^{-2} and 5.55 gm^{-2}), respectively and the lowest weed population w as counted under quizalofop ethyl (7.91 m^{-2} and 2.12 gm^{-2}). These finding are supported by the result of Srivastava and Srivastava[9].

Table 1 also revealed that all the weed management treatments resulted in improved weed control efficiency over the weedy check. The highest weed control efficiency was observed under treatment quizalofop ethyl (74.70) followed by treatment pendimethalin and two hand weedings 59.18 and 33.77 percent, respectively.

3.2 Significant Interaction of Dry Weight of Weeds

The data presented in Table 2 indicates that the interaction effect between sowing methods and weed management practices in relation to weed dry weight was significant. Crop grown under line sowing with the application of quizalofop ethyl @ 50 g/ha treated plot recorded lowest weed dry weight (2.41 gm^{-1}) followed by broad bed method (3.76 gm^{-2}) and ridge method with quizalofop ethyl (4.93 gm^{-2}). The highest weed dry weight 10.33 was recorded under broadcast sowing with weedy check plot.

3.3 Effect of Different Treatments on Performance of Urdbean

At harvest, the Table 4 show that the significantly highest plant population (25.34 m^2), growth parameters *viz*., plant height (72.91 cm), number of trifoliate leaves (8.27) and dry matter accumulation (23.75 g/plant), yield attributes *viz*., pod per plant (19.33) and 100 grain weight (5.31 g) and yield *viz*., biological yield (30.28 q/ha^{-1}) and harvest index (36.16) were measured under broad bed method followed by ridge method and line sowing and significantly lowest plant population (22.07 m^2), growth parameters *viz*., plant height (60.5 cm), number of trifoliate leaves (6.34) and dry matter accumulation (19.58 g/plant), yield attributes *viz*., pod per plant (17.96) and 100 grain weight (3.85 g) and yield *viz*., biological yield (25.11 q/ha^{-1}) and harvest index (30.02) were measured under broadcast sowing. Broad bed method resulted in better availability of nutrients and moisture to the crop and less competition for natural resources as evident from the beneficial effects on the crop growth in term of number of trifoliate and plant height of crop and yield contributing character *viz*. number of pod per plant, number of grain per pod and seed weight.

At harvest, the Table 4 also show that the significantly highest plant population (25.85 m^2), growth parameters *viz*., plant height (71.5 cm), number of trifoliate leaves (7.49) and dry matter accumulation (24.00 g/plant), yield attributes *viz*., pod per plant (19.12) and 100 grain weight (5.42 g) and yield *viz*., biological yield (30.08 q/ha^{-1}) and harvest index (36.46) under quizalofop ethyl followed by pendimethalin and two hand weedings and significantly lowest plant population (20.45 m^2), growth parameters *viz*., plant height (62.91), number of trifoliate leaves (7.24) and dry matter accumulation (18.83 g/plant), yield attributes *viz*., pod per plant (18.5) and 100 grain weight (3.98 g) and grain yield *viz*., biological yield (25.63 q/ha^{-1}) and harvest index (28.71) were measured under weedy check. The higher biological yield obtained under the application of quizalofop ethyl were substantiated by the generation of all the growth, development and yield attributes which produced significantly higher grain yield energy count and plant height. These findings are in conformity with the results of Yadav *et al.*[10] and Pal[11].

3.4 Significant Interaction of Biological Yield

The data presented in Table 3 indicates that the interaction effect between sowing methods and weed management practices in relation to biological yield was significant. Crop grown under broad bed method with two hand weedings plot recorded higher biological yield (31.49 q ha^{-1}) followed by line sowing with quizanofop ethyle (31.29 q ha^{-1}) and broad bed method with quizanofop ethyle

Table 2. Interaction effect of methods of sowing and weed management practices on dry weight of weeds (gm^{-1}) at 60 DAS

Sowing methods	Weed management practices				
	W_1	W_2	W_3	W_4	Mean
S_1	9.12	6.37	6.42	2.41	6.08
S_2	8.33	4.74	5.00	1.66	4.93
S_3	5.75	3.74	4.25	1.33	3.76
S_4	10.33	7.36	6.01	3.08	6.69
Mean	8.38	5.55	3.42	2.12	
SEm±	0.35				
CD at 5%	1.24				

Table 3. nteraction effect of sowing methods and weed management practices on biological yield of urdbean.

Sowing methods	Weed management practices				
	W1	W2	W3	W4	Mean
S1	25.55	28.38	29.08	31.29	28.57
S2	25.98	29.20	30.58	30.00	28.94
S3	27.48	31.49	31.03	31.13	30.28
S4	23.53	24.37	24.63	27.92	25.11
Mean	25.63	28.36	28.83	30.08	
SEm±	0.65				
C.D at 5%	1.93				

Table 4. Plant population, growth parameters at (harvest), yield attributes, biological yield ha^{-1} and harvest index as influenced by weed management practices and sowing method

Treatments	Plant population (No.m^{-2})	Plant height (cm)	Number of trifoliate leaves	Dry matter accumulation (g plant^{-1})	Number of pod plant^{-1}	100 seed weight (g)	Biological yield (q ha^{-1})	Harvest index (%)
Sowing methods								
Line sowing (S_1)	22.33	67.41	7.22	20.83	18.92	4.66	28.57	34.05
Ridge method (S_2)	23.74	69.75	7.62	22.08	19.09	4.91	28.94	36.07
Broad bed method(S_3)	25.34	72.91	8.27	23.75	19.33	5.31	30.28	36.16
Broadcast sowing(S_4)	22.07	60.50	6.34	19.58	17.96	3.85	25.11	30.02
SEm±	0.27	0.74	0.02	0.366	0.009	0.076	0.32	0.49
CD at 5%	0.95	2.62	0.08	1.290	0.032	0.270	1.15	1.75
Weed management practices								
Weedy check (W_1)	20.45	62.91	7.24	18.83	18.50	3.98	25.63	28.71
Two hand weeding (W_2)	22.20	66.58	7.347	20.58	18.75	4.42	28.36	34.30
Pendimethalin@1.5kg*a.i*/ ha(W_3)	25.02	69.58	7.407	22.83	18.94	4.91	28.83	36.80
Quizalofopethyle@50gm*a.i*/ ha(W_4)	25.85	71.50	7.479	24.00	19.12	5.42	30.08	36.46
SEm±	0.46	0.68	0.003	0.264	0.008	0.060	0.22	0.49
CD at 5%	1.34	1.99	0.010	0.774	0.023	0.177	0.65	1.44

(31.13) as compared to rest of the treatment combination except treatment combination ridge with pendimethalin and the lowest biological yield was recorded 23.53 q ha^{-1} under broad bed with weedy check plot.

4. Economics

The data presented in Table 5 reported that highest cost of cultivation (15057 Rs. ha^{-1}), gross return (53655 Rs. ha^{-1}), net returns (38598 Rs. ha^{-1}) and benefit: cost ratio (2.56) were found under broad bed method followed by ridge method and line sowing and the lowest cost of cultivation (13337 Rs. ha^{-1}), gross return (36946 Rs. ha^{-1}) net returns (23609 Rs. ha^{-1}) and benefit: cost ratio (1.79) were recorded under broadcast sowing. Among the weed management treatments, maximum, gross return (53753 Rs. ha^{-1}), net returns (40663 Rs. ha^{-1}) and benefit: cost ratio (3.09) recorded under quizalofop ethyl followed by pendimethalin, whereas, two hand weedings recorded highest cost of cultivation (15297 Rs. ha^{-1}) and the lowest gross return (36064 Rs.ha^{-1}), net returns (23167 Rs.ha^{-1}) and benefit: cost ratio (1.79) were recorded under weedy check, whereas, quizalofop ethyl recorded lowest cost of cultivation (13122 Rs. ha^{-1}) similar result was also put forward by Kumar and Tiwari[12].

Table 5. Economics as influenced by sowing method and weed management in different treatments

Treatments	Total cost of cultivation	Gross return	Net return	B:C
Line sowing (S_1)	14097	47677	33580	2.38
Ridge Method(S_2)	15050	51156	36099	2.39
Broad Bed Method(S_3)	15057	53655	38598	2.56
Broadcasting(S_4)	13337	36946	23609	1.77
SEm±	-	-	-	-
C.D at 5%	-	-	-	-
Weedy check (W_1)	12897	36064	23167	1.79
Two hand Weeding (W_2)	15297	47677	32380	2.11
Pendimethalin (W_3)	13797	51989	38192	2.76
Quizalofop ethyl (W_4)	13122	53753	40631	3.09
SEm±	-	-	-	-
C.D at 5%	-	-	-	-

5. Conclusion

Based on the results of one year experimentation, it seems quite logical to conclude that performance, potential production, profit, efficient and economics on sowing method and weed management practices on urdbean crop Broad bed sowing proved its superiority over ridge method, line sowing and broadcast sowing by producing (4.88%), (12.53%) and (45.22%) higher grain yield respectively. Application of quizalofop ethyl @ 50 g *a.i.*/ha as post emergence was found to be more effective for controlling weeds in urdbean field than all over rest of the treatments. Thus broad bed method in combination with quizalofop ethyl @50 g *a.i.*/ha as post emergence may be suggested for effectively control of weeds in urdbean and also for obtaining maximum economical yield of urdbean.

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