International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1594-1597
© 2018 IJCS
Received: 25-05-2018
Accepted: 27-06-2018

Manoj Singh
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

KS Shekhar
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

Ardeep
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

Debarati Datta
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

Correspondence
Ardeep
Department of Agronomy, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand, India

Herbicide combinations for weed management in Urdbean (*Vigna mungo*) under *tarai* condition of Uttarakhand

Manoj Singh, KS Shekhar, Ardeep and Debarati Datta

Abstract
A field experiment was conducted during *kharif* 2015 at N. E. Borlaug Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) to evaluate the sequential and mixture effects of the herbicides pendimethalin, imazethapyr and quizalofop along with manual weeding (MW) on weed dynamics, weed management and crop performance of urdbean (*Vigna mungo***)** grown under *tarai* condition. *Echinochloa colona*, *Cyperus rotundus* and *Trianthema monogyna* were the dominant weeds with percent composition of 30, 29 and 18.5 per cent respectively at 45 DAS. Significantly superior weed control at 45 days after sowing (DAS), in terms of lower weed density, weed dry weight and higher weed control efficiency was obtained under two MW at 20 and 40 DAS (4.5 per m^2, 2.5 g/m^2 and 97% respectively) which was at par with pendimethalin + imazethapyr (ready mix) 1.0 kg/ha + MW at 30 DAS, pendimethalin 1.0 kg/ha + MW at 30 DAS and pendimethalin 1.0 kg/ha + imazethapyr 55g/ha. Significantly higher grain yield (1164 kg/ha) and protein content (22.13 %) was achieved under two MW at 20 and 40 DAS.

Keywords: Pendimethalin, imazethapyr, quizalofop, weed dynamics, weed control efficiency

Introduction
Pulses provide a perfect mixture of vegetarian protein of high biological value when supplemented with cereals. Endowed with unique ability of biological nitrogen fixation, carbon sequestration, soil amelioration, low water requirement and capacity to withstand harsh climate, pulses comprise an integral component of sustainable crop production in India. Among the pulses, urdbean (*Vigna mungo* L. Hepper) is an important *kharif* pulse crop in India which contains protein almost thrice that of cereals (Kanade 2006) [7]. Urdbean contains 24% protein, 60% carbohydrates, 1.3% fat and very rich in phosphoric acid, vitamins and minerals (Islam *et al*. 2011) [6]. Urdbean is the fourth most important crop in India after chickpea, pigeon pea and green gram.

The productivity of urdbean in India is substantially low owing to number of factors governing yield. Hot and humid climate coupled with monsoon rains during *kharif* season result in luxuriant weed population in this crop. It is one of the formidable reasons of low productivity of urdbean in *kharif* season. Weeds are the salient competitors/removers of natural and manmade resources like nutrients, water and light, which could have been otherwise used for boosting up crop productivity (Singh and Sheoran 2008) [13]. The weeds are reported to cause 87% yield reduction of urdbean and the magnitude of reduction depends on the type and intensity of weed flora (Singh *et al*. 2002) [11]. *Echinochloa colona* alone, one of the major weeds in urdbean, may reduce the grain yield to the extent of 49% (Rao and Rao, 2003) [10]. Therefore, removal of weeds at appropriate time using a suitable method is essential to achieve high yields of urdbean.

Integrated weed management has been found to be more effective, easy, eco-friendly and economical than sole application as it prevents seed production of weeds and enrichment of soil seed bank. Besides, it reduces the chance of occurrence of weed flora shift, herbicide-resistant weeds, preponderance of perennial weeds in an agro-ecosystem. Khot *et al*. (2012) [8] from Junagarh (Gujarat) reported that pre-emergence application of pendimethalin @1kg/ha followed by one hand weeding at 40 DAS (days after sowing) was found most effective in reducing weed population, dry weight of weeds and achieving higher weed control efficiency than sole application.

Therefore, proper choice for effective weed control lies in application of pre and post-emergence herbicides either in combination or sequence, or in integration with manual weeding (Gupta *et al.*, 2013) [5].

Material and Method

A field experiment was conducted during *kharif* season of 2015 at N. E. Bourlag Crop Research Centre of Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) to evaluate sequential and mixture effects of the herbicides pendimethalin, imazethapyr and quizalofop along with manual weeding (MW) on weed dynamics, weed management and crop performance of urdbean (*Vigna mungo***)** grown under tarai situation.. The experimental soil was neutral (pH 7.2), medium in available nitrogen (282.7 kg ha^{-1}), available potassium (232.4 kg ha^{-1}) and organic carbon (0.73%) but high in available phosphorus (30.7 kg ha^{-1}). The experiment, comprised ten treatments *viz*; Pendimethalin 1.0 kg/ha (PE), Pendimethalin + Imazethapyr (ready mix) 1.0 kg/ha (PE), Pendimethalin 1.0 kg/ha (PE) + Quizalofop-ethyl 100 g/ha (POE), Pendimethalin + Imazethapyr (ready mix) 1.0 kg/ha (PE) + Quizalofop-ethyl 100g/ha PoE (20 DAS), Pendimethalin 1.0 kg/ha (PE) + Imazethapyr 55g/ha (POE), Pendimethalin 1.0 kg/ha (PE) + MW at 30 DAS, Pendimethalin + Imazethapyr (Ready mix) 1.0 kg/ha + MW at 30 DAS, two MW at 20 and 40 DAS, weed free and weedy check and was laid out in Randomized Block Design (RBD) with three replications. The seeds of urdbean variety 'Pant U-31' were sown on July 24, 2015. Pre emergence and post emergence application was done at 1 DAS and 20DAS respectively. The data recorded for each parameter were subjected to analysis for variance for Randomized Block Design with the help of statistical programme OPSTAT developed by CCSHAV, Hissar. The data on density and dry matter of weeds were subjected to square-root [$\sqrt{(x+0.5)}$] transformation prior to statistical analysis to normalize their distribution. All the data obtained from the experiment were statistically analyzed using the *F*-test procedure given by Gomez and Gomez (1984).

Weed control efficiency was worked out with the help of following formula:

$$\text{WCE (\%)} = \frac{\text{Dry matter of weeds in control plot- Dry matter of weeds in treated plot}}{\text{Dry matter of weeds in control plot}} \times 100$$

Protein content in grains at maturity was worked out by multiplying nitrogen percentage of grains at maturity with 6.25. After getting protein content, protein yield was calculated by multiplying with corresponding oven dried grain yield (kg/ha).

$$\text{Protein yield (kg/ha)} = \frac{\text{Grain weight x Protein content}}{100}$$

Results and Discussion

Effect on Weed

Weed control treatments significantly reduced the weed density and dry matter as compared to weedy check. Weed dry weight reflects the growth potential of the weeds and was better indicator of its competitive ability with the crop plants. Two MW at 20 & 40 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @1.0 kg/ha (Ready mix) + manual weeding at 30 DAS and Pendimethalin 30 EC @1.0 kg/ha + Imazethapyr @55 g/ha POE, 20 DAS recorded the lowest density and dry matter of grassy, broad leaved weeds and sedges. This result is in conformity with that of Singh *et al.* 2013.

The highest weed control efficiency was obtained in weed free treatment which was significantly higher than all other treatments except hand weeding twice at 20 and 40 DAS and lowest was recorded in Pendimethalin 30 EC @1.0 kg/ha after weedy check. Two manual weedings 20 and 40 DAS had significantly higher weed control efficiency over all the herbicidal treatments and was at par with Pendimethalin 30 EC @1.0 kg/ha + manual weeding at 30 DAS and Pendimethalin 30 EC + Imazethapyr 2 EC @1.0 kg/ha (Ready mix) + manual weeding at 30 DAS. Weed suppression by integrated approach have higher WCE due to minimum dry matter production by weeds. The results are in conformation with Chhodavadia *et al.* (2013) who reported that WCE was observed highest in case of two hand weedings (20 and 40 DAS). Aggarwal *et al.* (2014) [1] from Ludhiana (Punjab) observed highest weed control efficiency (WCE) and minimum dry weight of weeds was recorded under two hand weedings at 20 and 40 days after sowing in black gram crop.

The Nitrogen removal by weeds in treated plots varied from 0.00 to 38.77 kg /ha. Two manual weedings at 20 and 40 DAS resulted in lowest nutrient uptake by weeds after weed free. It might be due to complete removal of undesirable vegetation at critical period (20 to 40 DAS). This finding is also supported by the work of Yadava, 2002 [14].

Effect on Crop

Dry matter accumulation in individual plant is result of metabolic processes occurring inside the plant and is considered as an important indicator for increasing yield. Higher crop dry matter accumulation was noted in weed free, two MW at 20 & 40 DAS, Pendimethalin 30 EC + Imazethapyr 2 EC @1.0 kg/ha (Ready mix) + manual weeding at 30 DAS and Pendimethalin 30 EC @1.0 kg/ha + Imazethapyr @55 g/ha POE, 20 DAS. Physical elimination of existing weeds by hand weeding on 20 and 40 DAS coupled with adverse environment for weed seed germination due to declining soil moisture, increasing temperature and shading due to smothering crop canopy, might have contributed for its superior performance. Besides, the highest nutrients (N, P and K) uptake by crop was recorded in the above treatments.

Weed free treatment gave 95.1, 92.2 and 9.5 per cent more grain yield over weedy check, pre-emergence application of weedy check, pendimethalin 30 EC @1.0 kg/ha and two manual weedings at 20 and 40 DAS, respectively. Two manual weedings at 20 and 40 DAS and Pendimethalin 30 EC + Imazethapyr 2 EC @1.0 kg/ha (Ready mix) PE + manual weeding at 30 DAS, were next to weed free treatment and yielded 78.3 and 68.3 per cent higher grain yield over weedy check respectively. Significantly lower grain yield is obtain in weedy check except Pendimethalin 30 EC @1.0 kg/ha PE, Pendimethalin 30 EC + Imazethapyr 2 EC @1.0 kg/ha (Ready mix) PE and Pendimethalin 30 EC @1.0 kg/ha PE + Quizalofop-ethyl @100 g/ha POE, which are at par with weedy check. Higher grain yield is recorded in weed free and two manual weedings at 20 and 40 DAS due to removal of

weeds from inter and intra row spaces which provide better environment for crop growth. Thus more space, light, water, nutrients were available for growth and development of crop plants. (Ali *et al.* 2011, Pal *et al.* 2013) [2]. Gupta *et al*. (2013) [5] from Jammu observed highest grain yield of urdbean with two hand weedings at 20 and 40 days after sowing and the values were found statistically at par with POE application of Imazethapyr 25 g/ha at 20 DAS.

In treatments weed free and two manual weedings at 20 and 40 DAS, there is higher accumulation of photosynthesis and nitrogen uptake during crop growth which also resulted in higher protein yield. The next best treatment after manual weeding was Pendimethalin 30 EC @1.0 kg/ha PE followed by post-emergence application Imazethapyr @55 g/ha POE (20 DAS).

Conclusion

On the basis of the experimental findings, it can be concluded that the pre-emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC (ready mix) 1.0 kg/ha followed by one manual weeding at 30 DAS) and Pendimethalin 1.0 kg/ha (PE) + Imazethapyr 55 g/ha (POE) may prove as an alternative to the two hand weddings for optimum weed control and more grain yield in urdbean sown during *kharif* season.

Acknowledgements

Authors are thankful to The Head, Agronomy for providing the necessary facility and laboratory support for conducting the study.

Table 1: Effect of weed control treatments on weed growth, weed control efficiency and nitrogen removal by weed at 45 DAS in Urdbean

Treatments	Weed density (no./m^2)				Total dry matter (g/m^2)	Weed control efficiency (%)	Nitrogen removal (kg/ha) by weeds
	Sedges	Grasses	BLW	Total			
PD 1.0 kg/ha (PE)	4.7 (21.3)	6.0 (35.0)	5.4 (27.7)	9.6 (91.7)	13.84 (190.66)	3.36	38.77
PD + IMZ 1.0 kg/ha (PE)	3.9 (14.3)	5.0 (24.3)	5.3 (27.0)	8.2 (65.7)	9.30 (85.6)	56.55	22.11
PD 1.0 kg/ha (PE) + QFE 100 g/ha (POE)	4.6 (20.3)	3.8 (13.7)	4.9 (23.3)	7.6 (57.3)	9.14 (82.66)	57.85	28.47
PD + IMZ 1.0 kg/ha (PE) + QFE 100 g/ha (POE)	3.8 (13.3)	4.4 (18.0)	4.8 (22.0)	7.4 (53.3)	8.29 (68.00)	65.46	23.92
PD 1.0 kg/ha (PE) + IMZ 55 g/ha (POE)	2.6 (5.7)	4.2 (16.3)	4.2 (17.0)	6.3 (39.0)	6.74 (44.46)	77.48	27.74
PD 1.0 kg/ha (PE) + MW at 30 DAS	3.2 (9.3)	3.7 (12.3)	3.7 (12.7)	5.9 (34.3)	4.98 (24.00)	87.76	3.19
PD + IMZ 1.0 kg/ha (PE) + MW at 30 DAS	3.0 (8.0)	3.9 (14.7)	3.4 (10.3)	5.8 (33.0)	4.32 (17.73)	91.00	3.05
Two MW at 20 and 40 DAS	2.6 (6.0)	2.7 (6.3)	2.7 (6.7)	4.5 (19.0)	2.51 (5.33)	97.32	1.32
Weedy check	5.3 (27.3)	6.1 (36.7)	6.2 (37.0)	9.7 (93.3)	14.09 (197.73)	0.00	54.53
Weed free check	0	0.0	0.0	0.0	0	100.00	0.00
SEm±	0.1	0.1	0.1	0.1	0.16	1.36	10.04
C.D. at 5%	0.3	0.3	0.3	0.3	0.49	4.05	30.1

PE = Pre-emergence, POE = Post Emergence (20 DAS), PD = Pendimethalin, IMZ = Imazethapyr, QFE = Quizalofop-p-ethyl, MW = Manual Weeding

Table 2: Effect of weed control treatments on crop growth, nutrient uptake, grain yield and protein content of urdbean

Treatments	Crop dry weight at 60 DAS	Nutrient uptake (kg/ha) at 60 DAS			Grain Yield (kg/ha)	Protein (%)	Protein yield (kg/ha)
		N	P	K			
PD 1.0 kg/ha (PE)	11.60	42.46	7.65	26.22	663	21.69	144
PD + IMZ 1.0 kg/ha (PE)	11.87	47.98	8.58	29.70	748	21.75	162
PD 1.0 kg/ha (PE) + QFE 100 g/ha (POE)	13.60	47.62	8.66	29.57	733	21.81	160
PD + IMZ 1.0 kg/ha (PE) + QFE 100 g/ha (POE)	14.20	62.13	11.10	38.87	948	22.00	209
PD 1.0 kg/ha (PE) + IMZ 55 g/ha (POE)	14.87	68.01	12.14	42.23	1060	21.94	232
PD 1.0 kg/ha (PE) + MW at 30 DAS	14.47	70.75	12.65	44.42	1064	21.94	233
PD + IMZ 1.0 kg/ha (PE) + MW at 30 DAS	14.80	72.99	13.04	46.02	1099	22.06	242
Two MW at 20 and 40 DAS	16.07	77.37	13.90	48.35	1164	22.13	258
Weedy check	10.33	41.22	7.47	25.50	653	21.69	142
Weed free check	16.13	84.23	14.91	52.25	1274	22.19	283
SEm±	0.45	4.65	0.80	4.08	55	0.38	12
C.D. at 5%	1.35	13.93	2.40	12.22	163	NS	35

PE = Pre-emergence, POE = Post Emergence (20 DAS), PD = Pendimethalin, IMZ = Imazethapyr, QFE = Quizalofop-p-ethyl, MW = Manual Weeding

References

1. Aggarwal N, Singh G, Ram H, Khanna V. Effect of post-emergence application of imazethapyr on symbiotic activities, growth and yield of black gram (*Vigna mungo* L. Hepper) cultivars and its efficacy against weeds. Indian Journal of Agronomy. 2014; 59(3):421-426.
2. Ali S, Patel JC, Desai LJ, Singh J. Effect of herbicides on weeds and yield of rainy season green gram (*Vigna*

radiata L.). Legume Research. 2011; 34(4):300-303.
3. Chhodavadia SK, Sagarka BK, Gohil BS. Integrated management for improved weed suppression in summer green gram (*Vigna radiata* L.). The Bioscan. 2014; 9(2):1577-1580.
4. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, 2nd Edition. A Wiley Inter-Science Publication New York (USA), 1984.
5. Gupta V, Singh M, Kumar A, Sharma BC, Kher D. Influence of weed management practices on weed dynamics and yield of urdbean gram (*Vigna mungo* L. Hepper) under rainfed conditions of Jammu. Indian Journal of Weed Science. 2013; 58(2):220-225.
6. Islam M, Mohanty AK, Kumar S. Correlating growth, yield and adoption of urdbean technologies. Indian Research Journal of Extension Education. 2011; 11(2):20-24.
7. Kanade. Agricultural marketing report, 2006, 1-6.
8. Khot DB, Munde SD, Khanpara VD, Pagar RD. Evaluation of new herbicides for weed management in summer black gram (*Vigna mungo* L. Hepper) Crop Research. 2012; 44(3):326-330.
9. Pal D, Bera S, Ghosh RK. Influence of herbicides on soybean yield, soil microflora and urease enzyme activity. Indian Journal of Weed Science. 2013; 45(1):34-38.
10. Rao AS, Rao RSN. Bio-efficacy of clodinafop propargyl on *Echinochloa spp*. In black gram. Indian Journal of Weed Science. 2003; 35:251-252.
11. Singh J, Deal JS, Sardana V, Singh J. Crop weed competition studies in summer black gram. Indian Journal of Weed Science. 2002; 34(3&4):299-300.
12. Singh M, Kewat ML, Dixit A, Kumar K, Vijaypal. Effect of post-emergence herbicides on growth and yield of soybean. Indian Journal of Weed Science. 2013; 42(3):219-222.
13. Singh S, Sheoran P. Studies on integrated weed management practices in rained maize under sub-mountainous conditions. Indian Journal of Dryland Agricultural Research and Development. 2008; 23:6-9.
14. Yadava SS. Studies on weed management in urdbean (*Vigna mungo* L.) during *kharif* season. M Sc Thesis, GB Pant University of Agriculture and Technology, Pantnagar, US Nagar, Uttarakhand, India. 2002, 97.