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Effect of Herbicidal and Mechanical Weed Management on Weed Dynamics, Nutrient Depletion by Weeds, Growth and Yield of Urdbean [*Vigna mungo* (L.) Hepper]

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ABSTRACT

Background: Urdbean (*Vigna mungo* L.) yields are heavily impacted by weed infestations, which compete aggressively for space, light, water and soil nutrients. To address this issue, a field study was executed to determine the impact of integrating herbicidal and mechanical weed management on weed parameters, crop growth, nutrient uptake through weeds and final grain output.

Methods: During the *Kharif* season (2023), a field trial was executed in Kota, Rajasthan, to investigate how distinct mechanical and chemical weed control strategies alter weed proliferation, crop-weed nutrient competition and final urdbean yields. Utilizing a randomized block design with three replications, the study compared ten separate treatments consisting of individual and combination weed management techniques.

Result: The experimental field was characterized by a diverse infestation of both narrow-leaved (grassy) and broad-leaved weed flora. Compared to the unweeded control plots, all evaluated weed management strategies significantly curtailed weed density and dry biomass accumulation. Concurrently, these interventions lowered weed-induced nutrient exhaustion across all growth stages of the crop. Among the tested regimes, manual weeding executed twice (at 20 and 40 DAS) demonstrated the highest efficacy in suppressing weed counts and dry matter, consequently minimizing the depletion of primary soil nutrients by weeds. Furthermore, this dual hand-weeding practice optimized weed control efficiency, culminating in significantly superior grain and stover yields. However, the performance of Fomesafen 11.1% + fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g *a.i.*/ha remained statistically at par with this treatment.

Key words: Growth, Herbicide, Nutrient depletion, Urdbean, Weed, Yield.

INTRODUCTION

Urdbean [*Vigna mungo* (L.) Hepper.] being a leguminous crop belongs to the family “Leguminosae”. This hardy, drought-resistant crop demands a warm and humid climate for optimal development. Pulses are high in protein, fiber, vitamins and minerals such as iron, zinc or magnesium, which play an important role in human nutrition. It not only improves human health, but also enhances soil health by enriching its nitrogen content, cropping systems sustainability and long-term fertility.

Grain legumes are essential components of a human diet and widely consumed as a cheapest sources of protein. On a global scale, India dominates the pulse sector as both the primary producer and consumer, accounting for roughly 25% to 28% of the world’s total output. It can tolerate high temperatures (up to 42°C) but 25°-35°C is considered optimum (Guna *et al*., 2023). Owing to its resilient and drought-resistant nature, urdbean is well-suited for arid regions experiencing an annual precipitation of fewer than 600 to 700 mm, though it remains highly susceptible to frost and overcast conditions. In India, the maximum area coverage is under *kharif* season. The crop improves soil fertility by fixing atmospheric nitrogen in the soil (Giri and Naik, 2024). India is foremost producer and consumer of urdbean worldwide. In India, urdbean production yields approximately 2.55 million tonnes from a cultivated area encompassing 4.58 million hectares, with key growing regions located in Madhya Pradesh, Uttar Pradesh, Rajasthan, Tamil Nadu, Maharashtra and Andhra Pradesh. Looking at the regional statistics for Rajasthan, the state contributes a production of 2.92 lakh tonnes from an

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agricultural acreage of 4.82 lakh hectares (Annual report, 2023-2024).

Urdbean is susceptible to weed competition (Balyan *et al*., 2016). The kind and degree of weed flora determine how much of a decline there will be (Chauhan *et al*., 2002) with yield reduction of 42-51% (Malliswari *et al*., 2008; Begum and Rao, 2006). Three to six weeks after seeding is when weed competition is most intense, necessitating control actions to meet yield requirements (Asaduzzaman *et al*., 2010). Among the methods for weed control cultural and mechanical approaches tend to be less effective during the initial 45 days during rainy season. Frequent rains and wet soil condition further aggravates the situation (Shashidhar *et al*., 2020). Depending on their type, density and occurrences duration, weeds can lead to grain yield ranging from 27 to 90 per cent. Both manual and mechanical weed control methods require a lot of labour and it is very tedious work. Labour is frequently unavailable during the critical period when crop are competing with weeds. The situation is further complicated by increasing labour costs, even when workers are available. Only a limited number of farmers use chemical weed control for pulses crop such as urdbean. To control the initial flush of weed flora in most pulse crops, such as urdbean, the pre-emergence herbicide pendimethalin is typically administered at dosage rates spanning 0.75 to 1.0 kg ha^{-1}. The varied weed flora of the urdbean cannot be controlled by this alone (Singh *et al*., 2014). Discussed about the importance of post-emergence herbicide to reduce human labour and manage the second flush of weeds in pulses. (Kumar, 2010) highlighted how crucial it is to identify the broad-spectrum effective group of pre- and post-emergence herbicides in order to maintain the urdbean productivity.

MATERIALS AND METHODS

The field trial was conducted during the 2023 *kharif* season at the Agricultural University, Kota, Rajasthan, India, a region situated within Agro-climatic Zone V (the Humid South Eastern Plain Zone). The soil texture at the research site was classified as clay loam. Prior to initiating the experiment, initial soil analysis revealed neutral pH and EC levels, a medium status of organic carbon, intermediate levels of available nitrogen and phosphorus and a rich potassium content. Characterized by a subtropical climate, this geographic zone records a mean annual precipitation of 954.7 mm. Maximum temperature range in the *Kharif* is 31.5-41.5°C and minimum 21.6-29.0°C, respectively.

The study compared ten separate treatments, which were arranged in a randomized complete block design *viz.* pre-emergence application of pendimethalin 30 EC at a rate of 1.0 kg a.i./ha (T_1), T_2-pendimethalin 30 EC + imazethapyr 2 EC @ 0.75 kg a.i./ha and post-emergence application imazethapyr 10 SL @ 55 g a.i./ha (T_3), T_4-clodinafop propargyl 8 EC + sodium-aciflurofen 16.5 EC (Ready mix) @187.5 g a.i./ha, T_5-fomesafen 11.1% + fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha, T_6-fluazifop-p-butyl 13.4% EC @ 250 g a.i./ha, T_7- mechanical weeding at 20 and 40 DAS, T_8 - two hand weeding at 20 and 40 DAS, T_9-one hand weeding at 20 DAS and weedy check (T_{10}). The urdbean variety "KU-4" (Kota Urd-4) is used as test crop, having duration of 70-80 days.

Pre emergence application of T_1 and T_2 was done one day post sowing and post emergence herbicides; T_3-Imazethapyr, T_4-Clodinafop Propargyl + Sodium-Aciflurofen, T_5-Fomesafen + Fluzaifop-p butyl, T_6-Fluazifop-P-Butyl was applied at 15 days after sowing. A knap-sack hydraulic sprayer was employed for herbicide application,

Table 1: Effect of different weed management practices on weed density, weed control efficiency and weed competition index of urdbean.

Treatment	Weed count (No./m^2)	Weed dry weight (g/m^2)	Weed control efficiency (%)	Weed competition index (%)
Pendimethalin 30 EC @ 1.0 kg a.i./ha PE	8.59 (73.68)	78.97	37.91	42.79
Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM)	8.22 (67.31)	77.37	39.11	41.93
Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS	6.90 (47.50)	49.17	61.29	29.20
Clodinafop Propargyl 8 EC + Sodium-Aciflurofen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS	5.61 (31.22)	28.68	77.39	13.62
Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS	3.85 (14.53)	16.24	87.25	3.19
Fluazifop-P-Butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE)	6.62 (43.65)	44.31	65.12	25.28
Mechanical weeding at 20 and 40 DAS	8.72 (75.78)	81.93	35.29	44.85
Two hand weeding at 20 and 40 DAS	3.02 (8.86)	10.31	91.82	0.00
One hand weeding at 20 DAS	7.90 (62.03)	75.43	40.48	41.28
Weedy check	9.65 (92.73)	127.87	0.00	64.13
SEm ±	0.31	2.94	1.88	2.41
CD (P=0.05)	0.92	8.75	5.59	7.17

*Data in parenthesis are original values.

** $\sqrt{(x+0.5)}$ Subjected to square root transformation values.

utilizing a spray volume of 500 liters per hectare. Mechanical weeding and hand weeding were done twice at 20 and 40 days after sowing. Mechanical weeding was practiced with wheel hoe.

To evaluate structural yield attributes, five randomly chosen and tagged plants per plot were monitored to determine branch numbers and cumulative pod counts at maturity, from which the mean pod number per plant was derived. Seed counts per pod were established at harvest by averaging the seeds extracted from ten randomly selected pods across the tagged plants. For final yield determination, a net plot area of 3.0 m × 4.0 m was manually harvested, excluding two defensive border rows along the length and a 0.5 m clearance buffer on both widths. The harvested biomass from individual plots was securely bundled, tagged and sun-dried on the threshing floor. Dried bundle weights were recorded to calculate total biological yield. Post-drying, manual threshing and winnowing were carried out and the cleaned seed yield was documented and standardized to kg ha^{-1}. Finally, stover yield was computed by deducting the clean seed weight from the total biological biomass.

The weed samples were collected from two randomly chosen locations within each plot using 1.0 m^2 quadrate and the average weight was calculated. Initially, these samples were sun-dried followed by oven drying at 70°C until they reached a constant weight, after which the average was determined. The final dry weight of weeds was reported in kg ha^{-1}. In order to draw a valid conclusion, the weed count data underwent square root transformation $\sqrt{(x+0.5)}$ to normalize their distribution prior to statistical analysis (Blackman and Roberts, 1950). To assess the effectiveness of weed control treatments, the weed control efficiency for each treatment was computed using the following formula:

$$\text{WCE (\%)} = \frac{\text{Weed dry weight in weedy check (kg ha}^{-1}) - \text{Weed dry weight in treated plot (kg ha}^{-1})}{\text{Weed dry weight in weedy check}} \times 100$$

Nitrogen content was determined *via* the micro Kjeldahl distillation method (Bremner, 1965). For this procedure, separate samples of 0.5 g of seeds and straw were digested with H_2SO_4 and H_2O_2 to obtain a clear extract before adjusting the volume to 100 ml with distilled water. The phosphorus concentration in plant samples was measures using Vanado-Molybdo phosphoric acid, yellow colour method (Jackson, 1973).

Digestion of seed and straw sample utilized a tri-acid mixture composed of AR grade Concentrated HNO_3, $HClO_4$ and H_2SO_4 in 9:4:1 ratio. Potassium levels in plant samples were also assessed through flame photometry (Jackson, 1973). The potassium concentration in the acid-digested plant sample could then be quantified using flame photometer; for this analysis, after dilution, a volume of 50 ml was used.

The depletion of nitrogen, phosphorus and potassium by weeds at harvest was estimated by using following formula:

$$\text{Depletion of N/P/K (kg ha}^{-1}) = \frac{\text{N/P/K concentration in weeds (\%)} \times \text{Total dry weight of weeds at harvest stage (kg ha}^{-1})}{100}$$

Statistical analysis

All the data analysed statistically. The experimental data recorded for growth, yield and quality characters were subjected to statistical analysis in accordance with the 'Analysis of variance' technique suggested by Fisher (1950). Significance of differences among treatment effects was tested by 'F' test as described by Panse and Sukhatme (1985) for randomized block design experiments. The critical difference was tested at five per cent level for field experiment.

RESULTS AND DISCUSSION

Effect on weed

The weed community characterising the experimental area comprised a diverse mix of species, predominantly

Table 2: Effect of weed management practices on nitrogen, phosphorus and potassium content in weeds and nutrient depletion by weeds at harvest.

Treatment	Nutrient depletion (kg/ha)		
	N	P	K
Pendimethalin 30 EC @ 1.0 kg a.i./ha PE	21.93	10.70	13.71
Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM)	20.36	9.82	12.82
Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS	14.05	6.71	8.64
Clodinafop Propargyl 8 EC + Sodium-Aciflurofen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS	8.08	3.79	4.92
Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS	4.45	2.09	2.71
Fluazifop-P-butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE)	12.04	5.70	7.32
Mechanical weeding at 20 and 40 DAS	22.23	10.92	14.14
Two hand weeding at 20 and 40 DAS	3.13	1.46	1.88
One hand weeding at 20 DAS	19.74	9.44	12.21
Weedy check	47.10	23.26	30.06
SEm ±	1.02	0.54	0.68
CD (P=0.05)	3.02	1.61	2.03

represented by *Cynodon dactylon* (L.) Pers, *Echinochloa crusgalli* L., *Parthenium hysterophorus* L., *Digera arvensis* Forsk, *Eleusine indica* (L.) Gaertn, *Chenopodium album* L., *Commelina benghalensis* L., *Trianthema spp*, *Celosia argentea* L., *Cyperus rotundus* L., *Phyllanthus niruri* L., *Amaranthus viridus* L., *Portulaca oleracea* L., *etc*. observed during the experimentation. The data presented in Table 1 shows that, regarding weed suppression, the execution of manual weeding twice (at 20 and 40 DAS- T_8) proved exceptionally efficient, markedly reducing both weed populations and dry weight accumulation relative to the weedy control plots, which consistently maintained the maximum values for these criteria. Among herbicidal treatments, post-emergence application of T_5-fomesafen 11.1% + fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha was significantly reducing both weed count and their dry matter. The enhanced efficiency of this herbicide combination is likely attributed to their synergistic interaction, as they operate through similar and diverse modes or sites of action specifically. Fomesafen (Diphenylether) inhibits protoporphyrinose oxidase and fluzifop-P-butyl (Arloxyphenoxy-propionate) inhibits acetyl CoA carboxylase that minimise the development and growth of weeds. As a result, bronzing, desiccation, chlorosis and necrosis develop in susceptible weeds. The results obtained are mostly consistent with findings of Singh *et al*. (2014); Elankavi *et al*. (2019); Gupta *et al*. (2019); Karunakaran *et al*. (2025) and Rajarathinam *et al*. (2025).

Highest weed control efficiency found in T_8-two hand weeding at 20 and 40 DAS, which was statistically similar with T_5-fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha as post-emergence. The data of Table 2 indicated that T_8-two hand weeding at 20 and 40 DAS observed the lower depletion of major nutrients (kg ha^{-1}) at harvest and at par with treatment fomesafen 11.1% + fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha (T_5), because removing the first two flushes of weeds under T_8- hand weeding twice significantly and efficiently decreased the growth of weed. The results are in closely conformity with the findings of Kantar *et al*. (1999); Singh *et al*. (2015); Karunakaran *et al*. (2025) and Rajarathinam *et al*. (2025).

Effect on crop

Data of Table 3 revealed that the highest number of branches per plant was found under the dual hand-weeding regime (T_8). Notably, this treatment demonstrated statistical equivalence with fomesafen 11.1% + fluzaifop-p butyl 11.1% SL @ 220 g a.i./ha (T_5). Enhanced weed control also attributed to greater availability of nutrients specially nitrogen, which has a significant role to play in chlorophyll synthesis. Weed free environment conserve nutrients, moisture, sunlight and space that would otherwise be consumed by uncontrolled weeds in infested conditions. Singh *et al*. (2003); Bhandari *et al*. (2004) and Chand *et al*. (2004) also reported similar findings.

Table 3: Effect of different weed management practices on growth parameters, yield attributes, grain and stover yield of urdbean.

Treatments	Branches/ plant	No. of pods/plant	No. of seed/pod	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Pendimethalin 30 EC @ 1.0 kg a.i./ha PE	5.63	9.28	3.82	728	1429
Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg a.i./ha PE (RM)	5.68	9.47	3.85	738	1479
Imazethapyr 10 SL @ 55 g a.i./ha at 15-20 DAS	6.73	11.09	4.54	901	1800
Clodinafop propargyl 8 EC + Sodium-Acifluorfen 16.5 EC (Ready mix) @ 187.5 g a.i./h at 15-20 DAS	7.90	12.75	5.21	1099	2142
Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15-20 DAS	9.20	14.23	5.91	1231	2512
Fluazifop-P-butyl 13.4% EC @ 250 g a.i./ha at 15-20 DAS (POE)	6.88	11.17	4.57	951	1805
Mechanical weeding at 20 and 40 DAS	5.59	9.12	3.73	703	1365
Two hand weeding at 20 and 40 DAS	9.70	14.97	5.97	1275	2564
One hand weeding at 20 DAS	5.71	9.53	3.90	748	1498
Weedy check	4.23	7.23	3.03	456	1032
SEm±	0.29	0.48	0.20	30.65	100.50
CD (P=0.05)	0.86	1.42	0.58	91.08	299

Among all the weed management practices, T_8-hand weeding twice (20 and 40 DAS) was found particularly effective at controlling weeds. T_8 provided long-term weed control, which in tune produced yields that were much highest than those of unweeded plots. After two hand-weeding, the herbicidal application of Fomesafen 11.1% + Fluzaifop-p butyl 11.1% SL (Ready mix) at 220 g a.i./ha (T_5) was found statistically on par and effective. The productivity of urdbean, measured through both grain and stover fractions, demonstrated substantial variation across the diverse weed control strategies. Yield optimization was most pronounced under the dual hand-weeding treatment (at 20 and 40 DAS), which recorded the absolute maximum grain and stover outputs. Intriguingly, this mechanical approach maintained statistical equivalence with the chemical regime utilizing a post-emergence application of the fomesafen 11.1% + fluzaifop-p butyl 11.1% SL. In former section, it was well point out that reduced crop-weed competition for space, water and nutrients under two hand weeding at 20 and 40 DAS and T_5-fomesafen 11.1% + fluzaifop-p butyl 11.1% SL as well as other herbicides, markedly influenced source by virtue of higher metabolic and photosynthetic activity, which consecutively improved growth of crop and thus yield component, improving aeration by providing good tilth and nutrient uptake by plant (Lalitha and Sinha, 1993). This could be explained by the fact that crop yield is dependent on a number of linked yield factors. The claim is further supported by the current study's finding of a strong positive correlation on grain yield between pods/plant and seeds/pod. The results of this study significantly corroborate the findings of Nandan *et al*. (2011); Khairnar *et al*. (2014); Gupta *et al*. (2019); Verma and Kushwaha (2020); Kumar *et al*. (2020); Karunakaran *et al*. (2025) and Rajarathinam *et al*. (2025).

CONCLUSION

The highest grain yield of *Kharif* urdbean was achieved through two rounds of hand weeding at 20 and 40 DAS (1275 kg/ha), demonstrating statistical equivalence with the post-emergence application of T_5-fomesafen 11.1% + fluzaifop-p butyl 11.1% SL (Ready mix) @ 220 g a.i./ha at 15 DAS (1231 kg/ha). Among the chemical interventions tested, this specific ready-mix formulation proved to be the most proficient at mitigating weed pressure, thereby securing superior grain productivity.

Conflict of interest

All authors declare that there is no conflicts of interest regarding the publication of this article.

REFERENCES

Annual Report, (2023-2024). Ministry of Agriculture and Farmers Welfare (Department of Agriculture and Farmers Welfare), Government of India, Directorate of Pulses Development Vindhyachal Bhavan, Bhopal (M.P.).

Asaduzzaman, M., Sultana, S., Roy, T.S. and Masu, M. (2010). Weeding and plant spacing effects on the growth and yield of blackgram. *Bangladesh Research Publications Journal*. **3(1):** 62-68.

Balyan, J.K., Choudhary, R.S., Kumpawat, B.S. and Choudhary, R. (2016). Weed management in blackgram under rainfed conditions, *Indian Journal of Weed Science*. **48(2):** 173-177.

Begum, G. and Rao, A.S. (2006). Efficacy of herbicides on weeds and relay crop of blackgram. *Indian Journal of Weed Science*. **38(1 and 2):** 145-147.

Bhandari, V., Singh, B., Randhawa, J.S. and Singh, J. (2004). Relative efficacy and economics of integrated weed management in blackgram under semi-humid climate of Punjab. *Indian Journal of Weed Science*. **36(3 and 4):** 276-277.

Blackman, G.E. and Roberts, H.A. (1950). Studies on selective weed control. *Journal of Agricultural Sciences*. **40:** 62-69.

Bremner, J.M. (1965). Nitrogen Availability Indexes. American Society of Agronomy. pp 1324-1345.

Chand, R., Singh, N.P. and Singh, V.K. (2004). Effect of weed control treatments on weeds and grain yield of late sown urdbean [*Vigna mungo* (L.) Hepper] during *kharif* season. *Indian Journal of Weed Science*. **36(1 and 2):** 127-128.

Chauhan, Y.S., Bhargava, M.K. and Jain, V.K. (2002). Effect of herbicides on weeds and soybean [*Glycine max* (L.) Merrill]. *Indian Journal of Weed Science*. **34(3 and 4):** 213- 216.

Elankavi, S., Ramesh, S., Baradhan, G. and Kumar, S.M.S. (2019). Effect of new generation herbicides on weed parameters of blackgram. *Plant Archives*. **19(1):** 421-424.

Fisher, R.A. (1950). Statistical Methods for Research Workers. Oliver and Boyd. Edinburg, London (U.K.).

Giri, M.D. and SJ, S.N. (2024). Enhancing urdbean [*Vigna mungo* (L.) Hepper] yield, nutrient uptake and protein content: Impact of fertilizer levels, farmyard manure and biofertilizers. *Journal of Food Legumes*. **37(4):** 396-403.

Guna, M., Ramanathan, S.P., Kokilavani, S., Djanaguiraman, M., Isaac, M.R., Chandrakumar, K. and Mohanapriya, R. (2023). Growth and yield response of *winter* blackgram [*Vigna mungo* (L.) Hepper] under high temperature and elevated CO_2 conditions. *Journal of Applied and Natural Science*. **15(4):** 1363-1368.

Gupta, V., Sharma, S., Sasode, D.P., Joshi, E., Kasana, B.S. and Joshi, N. (2019). Efficacy of herbicides on weeds and yield of greengram. *Indian Journal of Weed Science*. **51(3):** 262-265.

Jackson, M.L. (1973). Soil Chemical Analysis, Pentice Hall of India Pvt. Ltd., New Delhi, India. **498:** 151-154.

Kantar, F., Elkoca, E. and Zengin, H. (1999). Chemical and agronomical weed control in chickpea (*Cicer arietinum* L.). *Journal of Agriculture and Forestry*. **23(6):** 631-635.

Karunakaran, V., Sivagamy, K., Radhamani, S., Kalaisudarson, S., Chitra, M., Sivakumar, P. and Radha, M. (2025). Management of invasive golden dodder (*Cuscuta chinensis*) in rice-fallow pulse agro-ecosystem of Tamil Nadu through chemical weed control practices. *Legume Research*. **48(Special Issue):** 108-114. doi: 10.18805/LR-5580.

Khairnar, C.B., Goud, V.V. and Sheti, H.N. (2014). Pre- and post-emergence application of imazethapyr in *summer* mungbean [*Vigna radiata* (L.) R. Wilczek]. *Indian Journal of Weed Science*. **46(4):** 392-395.

Kumar, N. (2010). Imazethapyr: A potential post-emergence herbicide for *Kharif* pulses. *Pulses Newsletter.* **21(3):** 5.

Kumar, R., Upadhaya, B., Kummar, P., Kishor, K. and Raushan, R.K. (2020). Effect of plant geometry and weed management on weed dynamics and yield of green gram. *The Pharma Innovation Journal*. **9(6):** 302-305.

Lalitha, B.E.K. and Sinha, M.N. (1993). Effect of phosphorus and weed management on greengram (*Phaseolus radiatus*) and its residual effect on mustard (*Brassica juncea*). *Indian Journal of Agronomy.* **38(1):** 37-41.

Malliswari, E.T., Reddy, M.T., Sagar, K.G. and Chandrika, V. (2008). Effect of irrigation and weed management practices on weed control and yield of blackgram. *Indian Journal of Weed Science*. **40(1 and 2):** 85-86.

Nandan, B., Shrma, B.C., Kumar, A. and Sharma, V. (2011). Efficacy of pre and post emergence herbicides on weed flora of urd bean under rainfed subtropical Shiwalik foothills of Jammu and Kashmir. *Indian Journal Weed Science*. **43(3 and 4):** 172-174.

Panse, V.G. and Sukhatme, P.V. (1985). Statistical Methods for Agricultural Workers. ICAR Publication, New Delhi.

Rajarathinam, P., Subrahmaniyan, K., Mathiyazhagan, S., Manimaran, R., Elamathi, S., Dhandapani, M. and Arulananth, R. (2025). Effect of seed inoculation, weed management and foliar nutrition in rice fallow blackgram for higher productivity in cauvery delta zone of Tamil Nadu. *Legume Research*. **48(3):** 474-479. doi: 10.18805/LR-5433.

Shashidhar, K.S., Jeberson, M.S., Premaradhya, N., Priyanka, I. and Vinoda, K.S. (2020). Effect of different pre and post-emergent application of herbicides on the productivity of black gram [*Vigna mungo* (L.) Hepper] under acidic soils of Manipur. *Journal of Current Opinion in Crop Science*. **1(1):** 21-26.

Singh, A., Vashist, K.K. and Kang, J.S. (2003). Chemical weed control in irrigated desi gram (*Cicer arietinum* L.). *Indian Journal of Weed Science*. **35(1 and 2):** 136-138.

Singh, G., Aggerwal, N. and Ram, H. (2014). Efficacy of post-emergence herbicide imazethapyr for weed management in different mungbean [*Vigna radiata* (L.) R. Wilczek] cultivars. *The Indian Journal of Agricultural Science*. **84(4):** 540-543.

Singh, G., Kaur, H., Aggarwal, N. and Sharma, P. (2015). Effect of herbicides on weeds growth and yield of greengram. *Indian Journal of Weed Science*. **47(1):** 38-42.

Singh, R.P., Verma, S.K., Singh, R.K. and Idnani, L.K. (2014). Influence of sowing dates and weeds management on weed growth and nutrients depletion by weeds and uptake by chickpea (*Cicer arietinum* L.) under rainfed condition. *Indian Journal of Agricultural Sciences*. **84(4):** 468-472.

Verma, L. and Kushwaha, H.S. (2020). Evaluation of different herbicides against weeds in mungbean [*Vigna radiata* (L.) R. Wilczek]. *Legume Research*. **43(6):** 866-871. doi: 10.18805/LR-4048.