Published by :
https://www.ijert.org/
An International Peer-Reviewed Journal

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 05 , May - 2026

Comparative Study of Weed Management Practices and Their Effect on Weed Dynamics in Cowpea (*Vigna unguiculata* L.)

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Abstract **- A field experiment was conducted at the Research farm, Vivekananda Global University, Jaipur during *kharif*, 2025. The experiment comprised of 12 treatment combinations *i.e.* weedy check (W1), Two hand weeding at 15 & 30 DAS (W2), Pendimethalin @ 0.5 kg ha^{-1} (PE) (W3), Metribuzin @ 0.35 kg ha^{-1} (PE) (W4), Imazethapyr @ 0.075 kg ha- 1 20 DAS (PoE) (W5), Quizalofop Ethyl @ 0.04 kg ha^{-1} 20 DAS (PoE) (W6), Pendimethalin @ 0.5 kg ha^{-1} (PE) + One hand weeding at 20 DAS (W7), Metribuzin @ 0.35 kg ha^{-1} (PE) + Quizalofop Ethyl @ 0.04 kg ha^{-1} 20 DAS (PoE) (W8), Pendimethalin @ 0.5 kg ha^{-1} (PE) + Quizalofop Ethyl @ 0.04 kg ha^{-1} 20 DAS (PoE) (W9), Metribuzin @ 0.35 kg ha^{-1} (PE) + Imazethapyr @ 0.075 kg ha^{-1} 20 DAS (PoE) (W10), (Pendimethalin @ 0.5 kg ha^{-1} (PE) + Imazethapyr @ 0.075 kg ha^{-1} 20 DAS (PoE) (W11) and weed free (W12). These treatments were replicated thrice in randomized block design. All the weed management treatments reduced weed population and dry matter accumulation at all the stages of observations *i.e.*, 30, 60 DAS and at harvest by weeds compared to weedy check. The treatment weed free (W12) was found significantly superior over rest of treatments in reducing the weed density at 3at all stage of crop growth. Minimum weed dry matter accumulation and highest weed control efficiency (83.25%) was recorded under Two hand weeding at 15 and 30 DAS (W2) at all stages. Minimum weed index (12.68%) was obtained under W2 which was statistically at par with W7. Maximum nutrient content in weeds was recorded highest under W2 both for monocots and dicots. In case of nutrient uptake, maximum uptake was observed under W1 (weedy check) (*Abstract*)**

Keywords - Dry matter accumulation, Weed dynamics, Weed control efficiency, Weed index,

I. INTRODUCTION

Cowpea (Vigna unguiculata L.) is an important pulse crop cultivated extensively under tropical and sub-tropical areas of world (Asia, Africa, Central and South America) [1], widely for food, fodder, and soil fertility improvement due to its nitrogen-fixing ability [2]. Despite its economic and nutritional importance, cowpea productivity remains low because of several constraints, among which weed infestation is one of the major yield-limiting factors.

Weeds compete with the crop for nutrients, moisture, light, and space, particularly during the early stages of crop growth. Weeds are a significant barrier to the production of arable crops and depending on the cultivar and location, weed alone losses in cowpea production can range from 25 to 70 per cent. [3]. Cowpea shows slow initial growth and wider row spacing, which provide favourable conditions for rapid weed emergence. The problem becomes more severe during the rainy season due to congenial environmental conditions for weed growth. Severe weed infestation not only reduces crop yield but also affects produce quality and increases the incidence of insect pests and diseases by serving as alternate hosts. Timely weed control is therefore essential during the critical period of crop-weed competition in cowpea. Depending on the variety and additional conditions, the critical period of crop weed competition in cowpea has been determined to be 11-36 days after emergence [4]. Although manual weeding is effective, it is labour-intensive, costly, and often difficult during peak agricultural operations and rain

S. No.	Common name	Trade name	Chemical name
1	Pendimethalin	Stomp® 30percent EC	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzene amine
2	etribuzin	Sencor70percent WP	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
3	mazethapyr	Pursuit®10percent SL	2-[4,5-dihydro-4-methyl-4-(1-methyl ethyl)-5-oxo-1Himidazol-2-yl]-5-ethyl-3 pyridinecarboxylic acid
4	Quizalofop Ethyl	TargaSuper® 5percent EC	Ethyl 2-[4-{(6-chloro-2-quinoxalinyl)oxy}phenoxy] propanoate

Table 1: Detail of herbicides used

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ISSN: 2278-0181
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The experimental field was infested by many weed species

S. No.	Botanical name	English name	Type of weed flora
1.	*Commelina benghalensis* L.	Day flower	Broad-leaved weed
2.	*Convolvulas arvensis* L.	Hiran khuri	Broad-leaved weed
3.	*Amaranthus dubius* L.	Spleen amaranth	Broad-leaved weed
4.	*Digera arvensis* L.	False amaranth	Broad-leaved weed
5.	*Trianthema portulacastrum* L.	Desert horse purslane	Broad-leaved weed
6.	*Cyperus rotundus* L.	Purplenut sedge	Sedges
7.	*Dactyloctenium aegyptium* L.	Egyptian crow foot grass	Grassy
8.	*Digitaria sanguinalis* L.	Crabgrass	Grassy
9.	*Cynodon dactylon* L.	Bermuda grass	Grassy
10.	*Eleusine indica* L.	Indian goose grass	Grassy

Table 2. Weed flora (Grasses, sedges and broad-leaved)

II. RESULTS AND DISCUSSION

Weed density

The findings showed that all weed management practices significantly lowered weed density throughout the crop growth period. Data recorded at 30 DAS, 60 DAS, and at harvest indicated that the weed-free treatment, followed by W2, was highly effective in reducing the population of grasses, sedges, and broad-leaved weeds. This suggests that timely hand weeding during the early growth stages plays an important role in minimizing crop-weed competition. Among the herbicidal treatments, W11 recorded the minimum weed density and remained statistically at par with other superior treatments. The effectiveness of this treatment may be due to the combined action of pre- and post-emergence herbicides in controlling a wide spectrum of weeds. Pendimethalin reduced the emergence of new weeds through its residual soil activity, whereas imazethapyr controlled actively growing weeds by inhibiting the acetolactate synthase (ALS) enzyme. Similar observations were also reported by [1], [5] and [6].

Weed control efficiency and weed index

The data presented in Table 4.3 indicated that weed management practices significantly influenced weed control efficiency at all stages of crop growth. At 30 DAS, the weed-free treatment and W2 recorded the highest weed control efficiency (100%) and remained significantly superior to the other treatments. This may be attributed to effective removal of weeds during the critical early growth period of the crop. A similar trend was observed at 60 DAS and at harvest. Among the herbicidal treatments, W11 recorded the highest weed control efficiency at all stages and performed significantly better than the sole application of Pendimethalin or Imazethapyr. The superior performance of this treatment may be due to the combined effect of pre- and post-emergence herbicides, where pendimethalin suppressed germinating weed seeds through residual soil activity, while imazethapyr effectively controlled actively growing weeds, resulting in broad-spectrum and prolonged weed control. The lowest weed index (12.28%) was observed under W2, which remained statistically at par with W7, indicating that timely manual and integrated weed management practices effectively minimized yield losses caused by weed competition. Among the herbicidal treatments, W11 recorded the lowest weed index (17.64%), demonstrating its efficiency in reducing weed competition and improving crop productivity. In contrast, the weedy check treatment recorded the highest weed index, confirming the detrimental effect of uncontrolled weeds on crop yield. Similar findings were also reported by [7], [8] and [9].

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Treatment	30 DAS		60 DAS			At Harvest			Total Weed density			
	Grasses	Sedges	Broad-leaved	Grasses	Sedges	Broad-leaved	Grasses	Sedges	Broad-leaved	30 DAS	60 DAS	At harvest
W1	4.11	2.54	5.48	5.06	2.87	7.38	5.06	3.19	6.97	7.29	9.36	9.19
W2	0.70	0.70	0.70	2.56	1.54	3.62	2.62	1.39	3.72	0.74	4.59	4.72
W3	2.98	1.57	4.55	3.73	2.28	5.59	3.72	2.36	5.50	5.62	7.04	7.04
W4	3.75	2.03	4.71	4.38	2.56	6.25	4.26	2.62	5.98	6.33	8.01	7.80
W5	2.66	1.57	3.20	3.31	1.96	4.37	3.32	2.02	+4.47	4.39	5.76	5.90
W6	2.73	1.46	4.05	3.22	2.04	5.80	3.34	2.17	5.71	5.05	6.88	6.96
W7	1.62	0.97	2.03	2.65	1.59	3.70	3.14	1.56	4.06	2.64	4.73	5.34
W8	2.93	1.52	4.15	3.06	1.62	5.67	3.17	1.70	]5.58	5.26	6.59	6.62
W9	2.40	1.34	3.96	2.98	1.79	5.21	3.06	1.85	5.22	4.77	6.19	6.31
W10	2.96	1.57	3.09	3.26	1.64	4.27	3.34	1.71	4.32	4.50	5.55	5.70
W11	2.21	1.28	2.73	2.83	1.58	4.07	3.10	1.65	4.02	3.66	5.13	5.32
W12	0.70	0.70	0.70	0.72	0.72	0.72	0.69	0.69	0.69	0.74	0.74	0.74
SEm±	0.08	0.07	0.08	0.15	0.12	0.11	0.10	0.08	0.06	0.12	0.15	0.11
CD(P=0.05)	0.25	0.22	0.26	0.41	0.32	0.29	0.33	0.28	0.22	0.30	0.38	0.27

Table: 3 Effect of different weed management practices on weed density

Nutrient content and uptake

Different weed management practices significantly influenced nutrient content and nutrient uptake by weeds in cowpea. In monocot weeds, the highest nitrogen content was recorded under W11, whereas maximum phosphorus and potassium contents were observed under W2. In dicot weeds, the highest nitrogen content was also recorded under W11, while phosphorus and potassium contents varied among different treatments. The data presented in Table 4.5 revealed that W1 (weedy check) recorded the maximum uptake of nitrogen, phosphorus, and potassium by both monocot and dicot weeds, which was significantly higher than all other treatments. This may be attributed to unchecked weed growth resulting in greater weed biomass and higher nutrient removal by weeds. In contrast, significantly lower nutrient uptake was observed under manual and herbicidal weed management treatments, particularly W11 and W2, indicating effective suppression of weed growth and reduced nutrient depletion from the soil. Similar findings were also reported by [10], [11] and [12].

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Treatment	30 DAS			60 DAS			At Harvest			Total Weed Dry Matter Accumulation		
	Grasses	Sedges	Broad-leaved	Grasses	Sedges	Broad-leaved	Grasses	Sedges	Broad-leaved	30 DAS	60 DAS	At harvest
W1	71.73	30.20	330.20	772.83	321.50	4275.83	2224.83	786.17	6377.83	432.03	5372.17	9390.83
W2	0.00	0.00	0.00	185.83	76.50	660.17	421.50	59.50	1127.83	0.00	924.50	1610.83
W3	36.30	10.20	218.77	412.50	195.50	2129.83	1012.50	309.50	3087.17	265.17	2739.83	4411.17
W4	59.47	18.53	236.33	572.17	251.50	2691.17	1322.83	389.50	3668.83	314.23	3516.83	5383.17
W5	27.93	10.20	109.03	319.83	139.50	1094.17	782.17	219.50	1774.67	147.07	1555.50	2778.33
W6	29.37	8.53	183.37	306.17	153.50	2242.50	753.17	259.50	3291.83	221.17	2704.17	4306.50
W7	8.53	2.70	38.73	209.50	83.50	705.17	574.83	79.50	1339.50	49.87	1000.17	1995.83
W8	35.20	9.37	183.37	279.50	90.50	2064.50	713.17	149.50	3172.50	227.83	2436.50	4037.17
W9	21.43	6.87	168.30	251.83	111.50	1724.83	674.83	179.50	2772.17	196.50	2090.17	3628.50
W10	37.33	10.20	97.53	312.83	90.50	1088.50	793.83	149.50	1881.17	144.97	1493.83	2826.50
W11	19.20	6.03	76.57	226.50	83.50	1002.83	673.83	139.50	1396.83	101.70	1314.83	2212.17
W12	0.20	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SEm±	2.08	1.44	9.16	27.09	16.21	80.29	71.78	25.29	101.97	9.45	95.76	110.18
CD(P=0.05)	5.73	3.84	26.48	80.41	47.81	236.44	211.48	75.14	300.04	26.76	279.88	322.17

Table 4: Effect of different weed management practices on weed dry matter accumulation

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Treatment	Weed control efficiency (%)			Weed index (%)
	30 DAS	60 DAS	At harvest	
W1 : Weedy check	0.00	0.00	0.00	49.69
W2 : Two hand weeding at 15 and 30 DAS	100	83.19	83.25	12.68
W3 : Pendimethalin @ 0.5 kg ha^{-1}(PE)	38.91	49.46	53.46	28.71
W4 : Metribuzin @ 0.35 $kgha^{-1}$ (PE)	27.54	34.83	43.07	33.50
W5 : Imazethapyr @0.075 $kgha^{-1}$ 20 DAS (Po E)	66.43	71.46	70.84	25.94
W6 : Quizalofop Ethyl @ 0.04 $kgha^{-1}$20 DAS (Po E)	49.23	49.99	54.52	30.95
W7 : Pendimethalin @ 0.5 $kgha^{-1}$(PE) + One hand weeding at 20 DAS	88.95	81.77	79.15	17.46
W8 : Metribuzin @ 0.35 $kgha^{-1}$(PE)+Quizalofop Ethyl@ 0.04 $kgha^{-1}$ 20 DAS (Po E)	47.71	55.05	57.44	24.38
W9 : Pendimethalin @ 0.5 kg ha^{-1}(PE) + Quizalofop Ethyl @ 0.04 $kgha^{-1}$ 20 DAS (Po E)	54.93	61.44	61.77	22.48
W10 : Metribuzin @ 0.35 $kgha^{-1}$ (PE)+Imazethapyr @ 0.075 $kgha^{-1}$20DAS (Po E)	66.91	72.52	70.29	20.14
W11 : Pendimethalin @ 0.5 kg ha^{-1} (PE) + Imazethapyr @ 0.075 kg ha^{-1} 20 DAS (Po E)	76.94	75.97	76.85	18.04
W12 : Weed free	100.00	100.00	100.00	0.40
SEm±	2.57	2.15	1.53	2.52
CD(P=0.05)	6.76	5.54	3.72	6.60

Table 5: Effect of different weed management practices on weed control efficiency and weed index

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Treatment	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
W1 : Weedy check	1.07	1.26	0.31	0.37	1.40	1.47
W2 : Two hand weeding at 15 and 30 DAS	1.09	1.29	0.32	0.38	1.47	1.55
W3 : Pendimethalin @ 0.5 kg ha^{-1}(PE)	1.08	1.28	0.31	0.37	1.40	1.47
W4 : Metribuzin @ 0.35 $kgha^{-1}$ (PE)	1.07	1.26	0.31	0.38	1.40	1.51
W5 : Imazethapyr @0.075 $kgha^{-1}$ 20 DAS (Po E)	1.08	1.30	0.31	0.37	1.39	1.47
W6 : Quizalofop Ethyl @ 0.04 $kgha^{-1}$20 DAS (Po E)	1.10	1.29	0.31	0.37	1.42	1.49
W7 : Pendimethalin @ 0.5 $kgha^{-1}$(PE) + One hand weeding at 20 DAS	1.10	1.32	0.31	0.38	1.36	1.48
W8 : Metribuzin @ 0.35 $kgha^{-1}$(PE)+Quizalofop Ethyl@ 0.04 $kgha^{-1}$ 20 DAS (Po E)	1.08	1.29	0.30	0.36	1.38	1.46
W9 : Pendimethalin @ 0.5 kg ha^{-1}(PE) + Quizalofop Ethyl @ 0.04 $kgha^{-1}$ 20 DAS (Po E)	1.08	1.29	0.31	0.38	1.40	1.49
W10 : Metribuzin @ 0.35 $kgha^{-1}$ (PE)+Imazethapyr @ 0.075 $kgha^{-1}$20DAS (Po E)	1.10	1.31	0.31	0.37	1.41	1.46
W11 : Pendimethalin @ 0.5 kg ha^{-1} (PE) + Imazethapyr @ 0.075 kg ha^{-1} 20 DAS (Po E)	1.12	1.32	0.31	0.37	1.41	1.46
W12 : Weed free	0.05	0.05	0.05	0.05	0.05	0.05
SEm±	0.06	0.06	0.06	0.06	0.07	0.08
CD(P=0.05)	0.07	0.08	0.07	0.07	0.11	0.15

Table 6: Effect of different weed management practices on nutrient content in weeds at harvest

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Treatment	Nitrogen (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium (kg ha^{-1})	
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot
W1 : Weedy check	31.03	77.58	8.07	20.48	41.01	91.03
W2 : Two hand weeding at 15 and 30 DAS	7.16	14.23	2.03	3.92	9.71	17.17
W3 : Pendimethalin @ 0.5 kg ha^{-1}(PE)	13.78	38.10	3.63	10.03	18.02	44.03
W4 : Metribuzin @ 0.35 kgha^{-1} (PE)	17.67	44.58	4.63	12.25	23.41	53.87
W5 : Imazethapyr @0.075 kgha^{-1} 20 DAS (Po E)	10.56	22.39	2.78	5.81	13.62	25.42
W6 : Quizalofop Ethyl @ 0.04 kgha^{-1}20 DAS (Po E)	10.84	40.90	2.85	10.86	14.02	47.50
W7 : Pendimethalin @ 0.5 kgha^{-1}(PE) + One hand weeding at 20 DAS	5.24	17.22	1.48	4.58	6.48	19.41
W8 : Metribuzin @ 0.35 kgha^{-1}(PE)+Quizalofop Ethyl@ 0.04 kgha^{-1} 20 DAS (Po E)	9.12	39.56	2.39	10.21	11.68	45.16
W9 : Pendimethalin @ 0.5 kg ha^{-1}(PE) + Quizalofop Ethyl @ 0.04 kgha^{-1} 20 DAS (Po E)	9.04	34.48	2.46	9.27	11.74	40.08
W10 : Metribuzin @ 0.35 kgha^{-1} (PE)+Imazethapyr @ 0.075 kgha^{-1}20DAS (Po E)	10.09	23.85	2.66	6.19	13.01	26.72
W11 : Pendimethalin @ 0.5 kg ha^{-1} (PE) + Imazethapyr @ 0.075 kg ha^{-1} 20 DAS (Po E)	8.87	18.31	2.31	4.67	11.32	19.83
W12 : Weed free	0.20	0.20	0.20	0.20	0.20	0.20
SEm±	0.94	1.43	0.41	0.68	1.28	2.09
CD(P=0.05)	2.37	3.80	0.82	1.59	3.37	5.75

Table 7: Effect of different weed management practices on nutrients uptake by weeds at harvest

4 ACKNOWLEDGMENT

The authors are grateful to Head and Dean Department of Agriculture, Vivekananda Global University, Jaipur, India for valuable guidance, support and facilities provided to conduct this research experiment successfully.

REFERENCES

[1] T. Nagender, A. Srinivas, P. L. Rani, and J. Narender, "Evaluation of efficacy of different pre- and post-emergence herbicides for efficient weed control in green gram (Vigna radiata L.)," *Environment and Ecology*, vol. 35, no. 1B, pp. 595-600, 2017.

[2] Y. A. Abayomi and T. O. Abidoye, "Evaluation of cowpea genotypes for soil moisture stress tolerance under screen house conditions," *African Journal of Plant Science*, vol. 3, no. 10, pp. 229-237, 2009.

[3] J. Adigun, A. O. Osipitan, S. T. Lagoke, R. O. Adeyemi, and S. O. Afolami, "Growth and yield performance of cowpea (Vigna unguiculata L. Walp) as influenced by row-spacing and period of weed interference in South-West Nigeria," *Journal of Agricultural Science*, vol. 6, no. 4, pp. 188-198, 2014.

[4] M. L. D. Campos, M. L. Lacerda, I. Aspiazú, A. J. D. Carvalho, and R. F. Silva, "Weed interference periods in cowpea crop," *Revista Caatinga*, vol. 36, no. 1, pp. 01-08, 2023.

[5] T. C. Poonia and M. S. Pithia, "Pre- and post-emergence herbicides for weed management in chickpea," *Indian Journal of Weed Science*, vol. 45, no. 3, pp. 223-225, 2013.

[6] P. Mohanty, K. Sar, B. Duary, and G. Mishra, "Effect of sole and ready-mix herbicides on weeds and productivity of summer greengram in Odisha," *Indian Journal of Weed Science*, vol. 55, no. 1, pp. 50-53, 2023.

[7] T. Muthuram, R. Krishnan, and G. Baradhan, "Productivity enhancement of irrigated greengram (Vigna radiata L.) through integrated weed management," *Plant Archives*, vol. 18, no. 1, pp. 101-105, 2018.

[8] D. Jinger, R. S. Yadav, and S. S. Meena, "Effect of weed management practices on weed growth and yield of cowpea [Vigna unguiculata L. (Walp)]," *Legume Research*, vol. 39, no. 3, pp. 445-449, 2016.

[9] A. Kumar, R. Nandan, K. K. Sinha, and D. Ghosh, "Integrated weed management in lentil (Lens culinaris) in calcareous alluvial soils of Bihar," *Indian Journal of Agronomy*, vol. 61, no. 1, pp. 75-78, 2016.

[10] K. G. Teli, S. L. Mundra, N. K. Sharma, and A. Kumar, "Effect of weed management and phosphorous nutrition on yield of cowpea (Vigna unguiculata (L.) Walp.)," *Journal of Pharmacognosy and Phytochemistry*, vol. 9, no. 2, pp. 1165-1167, 2020.

[11] J. K. Sinchana and S. K. Raj, "A review on integrated approach for the management of weeds in cowpea (Vigna unguiculata)," *Journal of Applied and Natural Science*, vol. 12, no. 4, pp. 504-510, 2020.

[12] A. Kujur, N. Bhadauria, and R. L. Rajput, "Effect of weed management practices on seed yield and nutrient (NPK) uptake in cowpea," *Legume Research-An International Journal*, vol. 38, no. 4, pp. 555-557, 2015.

[13] D. Singh and R. Maurya, "Effect of weed management practices on growth and yield of vegetable cowpea (Vigna unguiculata (L.) Walp.) cv. Kashi Kanchan," *International Journal of Environment and Climate Change*, vol. 13, no. 10, pp. 1781-1787, 2023.