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NM Sonwane
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

PS Solunke
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

VV Goud
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

NW Raut
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

AB Age
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

SD Jadhao
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Manasi R Bulle
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
NM Sonwane
PG Scholar, Department of Agronomy, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Efficacy of different herbicides on weed index, yield attributes, yield and economics of greengram [Vigna radiata (L.) Wilczek]

NM Sonwane, PS Solunke, VV Goud, NW Raut, AB Age, SD Jadhao and Manasi R Bulle

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Abstract
A field investigation entitled "Efficacy of different herbicides on yield and economics of greengram" was carried out at Research field of AICRP on Weed Management, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season of 2024. The field experiment was laid out in randomized block design with three replications and eight herbicidal treatments. Among the herbicidal treatments, propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} (17 DAS) exhibited the greatest yield attributes followed by quizalofop-ethyl 7.5% + imazethapyr 15% EC (RM) @ 98.43 g a.i. ha^{-1}(17 DAS). Propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} (17 DAS) also demonstrated superior weed control efficiency and the lowest weed index. From an economic standpoint, propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} (17 DAS) proved to be the most effective among the herbicidal treatments, recording the highest values for NMR (51188 $Rs.ha^{-1}$) and B:C ratio (2.64), respectively.

Keywords: Weed index, yield, economics, greengram

Introduction
Greengram [*Vigna radiata* (L.) Wilczek], commonly known as mungbean, is widely cultivated during the *kharif* season across several regions of India. Weed infestation is one of the major challenges in its cultivation. Yield losses attributed to weed competition in greengram have been reported to range between 30–85% (Raman and Krishnamoorthy, 2005) [6]. An integrated strategy for weed management in greengram involves the combined use of pre-emergence and post-emergence herbicides, applied either sequentially or in mixtures, along with supplementary manual weeding. In recent years, reliance on herbicides has increased, mainly because of the limited availability of labour for timely manual weeding. Hand weeding alone is often expensive, less efficient, and impractical under adverse soil or climatic conditions, making herbicides a feasible and effective option for greengram cultivation. The present investigation was undertaken to examine the effectiveness of different pre- and post-emergence herbicide combinations for weed management in greengram.

Materials and Methods
A field experiment entitled Efficacy of different herbicides on weed index, yield attributes, yield and economics of greengram [Vigna radiata (L.) Wilczek] was conducted at the AICRP on weed management, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *Kharif* season of 2024.
The soil was black in colour, well-drained, and deep. Seeds of greengram Pusa Baisakhi were sown on 2nd July 2024 @ 15 kg ha^{-1} with a spacing of 45 cm× 10 cm. The full RDF (20 kg N, 40 kg P_2O_5, and 20 kg K_20) was applied in all the treatments as a basal dose. In this study different herbicides were examined during experiment such as pendimethalin 38.7% CS @ 678 g a.i ha^{-1} as PE (T_1), pendimethalin 30% + imazethapyr 2% EC (RM) @ 800 g a.i. ha^{-1} as PE (T_2), imazethapyr 10% SL @ 75 g a.i. ha^{-1}(17 DAS) (T_3),imazethapyr 70% WG @ 70 g a.i. ha^{-1} (17

DAS) (T_4), propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} (17 DAS) (T_5), quizalofop-ethyl 7.5% + imazethapyr 15% EC (RM) @ 98.43 g a.i. ha^{-1}(17 DAS) (T_6), farmers practice (hoeing at 15 DAS *fb* hand weeding at 25 DAS) (T_7) and weedy check (T_8), respectively.

Results and Discussion

The experimental field was infested with both monocot and dicot weed species. Among the monocots, *Commelina* spp., *Cyperus rotundus* and various grasses were dominant, while *Parthenium hysterophorus*, *Digera muricata*, and *Phyllanthus* spp. represented the major dicot weeds. Compared with the weedy check, all the weed management treatments substantially reduced the density of both monocot and dicot species, indicating their effectiveness in suppressing the overall weed population.

Weed Index (%)

Among the herbicidal treatments, T_5 (Propaquizafop 2.5% + imazethapyr 3.75% ME) had the lowest weed index (8.44%), making it the most promising chemical solution for maximizing greengram yield. This suggests that its strong weed control efficiency translated into minimal crop yield loss. The weedy check (T_8) had the highest weed index (36.82%), confirming a significant loss in crop yield where weeds were left uncontrolled. The pre-emergence treatments had a higher weed index compared to the best post-emergence treatments, further supporting the superior performance of the latter. The result is in conformity with the findings of Kuldeep *et al.* (2022) [3].

Yield Attributes

No. of pods plant^{-1}

Pods plant^{-1} is a key yield component. The farmers' practice (T_7) produced the highest number of pods per plant (19.13), a statistically significant increase compared to all other treatments. This is due to the superior weed control achieved by manual weeding, which minimizes competition and allows the plants to allocate more resources to reproductive growth. Among the chemical treatments, T_5 (Propaquizafop 2.5% + imazethapyr 3.75% ME) and T_6 (Quizalofop-ethyl 7.5% + imazethapyr 15% EC) showed the best performance, with 17.40 and 16.07 pods per plant, respectively. The significantly lower number of pods per plant was observed in the weedy check (T_8) at 9.77, highlighting the detrimental effect of uncontrolled weeds on plant development. Similar result was obtained by Laxmidevi *et al.* (2022) [4].

Seed yield plant^{-1} (g)

Seed yield plant^{-1} directly reflects the effectiveness of weed management. The farmers' practice (T_7) produced the significantly higher seed yield per plant (4.68 g). This was followed by T_5 (Propaquizafop 2.5% + imazethapyr 3.75% ME) and T_6 (Quizalofop-ethyl 7.5% + imazethapyr 15% EC), which yielded 4.27 g and 4.03 g per plant, respectively. The lowest seed yield was recorded in the weedy check (T_8) (2.96 g), a direct consequence of intense weed competition. Similar result was obtained by Maji *et al.* (2025) [5].

Seed index

Seed index showed non-significant differences between the treatments.

Seed yield (kg ha^{-1})

Seed yield ha^{-1} is the ultimate measure of crop performance. The highest seed yield was recorded under the farmers' practice (T_7) at 1040 kg ha^{-1}. This treatment was statistically superior to all other treatments. Among the herbicide treatments, T_5 (Propaquizafop 2.5% + imazethapyr 3.75% ME) yielded the most at 949 kg ha^{-1}, followed by T_6 (Quizalofop-ethyl 7.5% + imazethapyr 15% EC) at 895 kg ha^{-1} and T_4 (Imazethapyr 70%) at 872 kg ha^{-1}. The lowest yield was from the weedy check (T_8) at 657 kg ha^{-1}, emphasizing the significant yield loss from uncontrolled weeds. The similar result was recorded by Maji *et al.* (2025) [5].

Biological yield (kg ha^{-1})

Biological yield ha^{-1} (total plant biomass, including both vegetative and reproductive parts) followed a similar trend. The farmers' practice (T_7) resulted in the significantly higher biological yield (2981 kg ha^{-1}), followed by T_5 (2861 kg ha^{-1}) and T6 (2728 kg ha^{-1}). These results confirm that effective weed control enhances the overall plant growth and biomass production. Similar result was observed by Suryavanshi *et al.* (2018) [7].

Harvest index (%)

Harvest index (%) was also highest for the treatment of T_7 i.e farmers' practice (34.86%), followed by T_5 (33.42%) and T_6 (32.84%), respectively. This indicates that effective weed management not only increases the total biomass but also improves the efficiency with which the plant converts that biomass into economically valuable grain. The weedy check (T_8) had the lowest harvest index (29.40%) over all the treatments, reflecting the negative impact of weeds on resource allocation for grain production. The similar result was observed by Ghosh and Pramanik (2020) [1].

Effect on Economics

The cost of cultivation was generally lower for the herbicide treatments compared to the farmers' practice (T_7), which involved manual labour (hoeing and hand weeding). The lowest cultivation costs were observed in the weedy check (T_8) and T_3 (Imazethapyr 10% SL), with costs of Rs 27,834 ha^{-1} and Rs 29,569 ha^{-1}, respectively, (Table 2).

The significantly higher GMR (Rs 90,325 ha^{-1}) and NMR (Rs 53,162 ha^{-1}) were obtained from the farmers' practice (T_7). However, among the herbicide treatments, propaquizafop 2.5% + imazethapyr 3.75% ME (RM) (T_5) yielded the highest GMR (Rs 82,407 ha^{-1}), NMR (Rs. 51,188 ha^{-1}) and B:C ratio of 2.64 which were statistically comparable to the farmers' practice (T_7). The weedy check recorded significantly lower GMR (Rs. 57067 ha^{-1}), NMR (Rs. 29233 ha^{-1}) and B:C ratio (2.05), (Table 2). The similar results were recorded by Yadav *et al.* (2022) [8] and Jain and Jain (2025) [2].

Table 1: Weed index (%), yield attributes, yield and harvest index as influenced by different treatments in greengram.

Treatment	Weed index (%)	Yield attributes			Yield		Harvest index (%)
		No. of pods plant^{-1}	Seed yield plant $^{-1}$ (g)	Seed index (g)	Seed yield (kg ha^{-1})	Biological yield (kg ha^{-1})	
T1: Pendimethalin 38.7% CS @ 678 g a.i ha^{-1} as PE	29.87	13.07	3.26	3.97	725	2392	30.27
T2: Pendimethalin 30% + imazethapyr 2% EC RM @ 800 g a.i. ha^{-1} as PE	19.76	14.67	3.73	3.94	829	2592	32.34
T3: Imazethapyr 10% SL @ 75 g a.i. ha-1 at 17 DAS	22.67	13.39	3.60	4.01	799	2582	30.99
T4: Imazethapyr 70% @ 70 g a.i. ha^{-1} at 17 DAS	16.15	15.60	3.92	4.01	872	2717	32.23
T5: Propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} at 17 DAS	8.44	17.40	4.27	4.04	949	2861	33.42
T6: Quizalofop-ethyl 7.5% + imazethapyr 15% EC (RM) @ 98.43 g a.i. ha^{-1} at 17 DAS	13.3	16.07	4.03	4.00	895	2728	32.84
T7: Farmers Practice (hoeing at 15 DAS fb hand weeding at 25 DAS)	0	19.13	4.68	4.06	1040	2981	34.86
T8: Weedy check	36.82	9.77	2.96	3.95	657	2243	29.40
S.E (m±)	-	0.85	0.19		39	142	1.65
C.D. at 5%	-	2.61	0.59	NS	121	436	5.07
GM	18.7	14.62	3.77	4.00	839	2627	32.00

Table 2: Economics of greengram influenced by different weed control treatments

Treatments	Cost of Cultivation (Rs ha^{-1})	Gross Monetary Returns (Rs ha^{-1})	Net Monetary returns (Rs ha^{-1})	B: C Ratio
T1: Pendimethalin 38.7% CS @ 678 g a.i ha^{-1} as PE	30596	62956	32349	2.06
T2: Pendimethalin 30% + imazethapyr 2% EC RM @ 800 g a.i. ha^{-1} as PE	32283	71980	39691	2.23
T3: Imazethapyr 10% SL @ 75 g a.i. ha-1 at 17 DAS	29569	69389	39821	2.35
T4: Imazethapyr 70% @ 70 g a.i. ha^{-1} at 17 DAS	29637	75693	46056	2.55
T5: Propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} at 17 DAS	31219	82407	51188	2.64
T6: Quizalofop-ethyl 7.5% + imazethapyr 15% EC (RM) @ 98.43 g a.i. ha^{-1} at 17 DAS	30977	77666	46690	2.51
T7: Farmers Practice (hoeing at 15 DAS fb hand weeding at 25 DAS)	37163	90325	53162	2.43
T8: Weedy check	27834	57067	29233	2.05
S.E (m.±)	-	3425	3306	-
C.D. at 5%	-	10510	10146	-
GM	31058	72754	41469	2.34

Conclusion

Among herbicidal treatments, application of propaquizafop 2.5% + imazethapyr 3.75% ME (RM) @ 125 g a.i. ha^{-1} at 17 DAS found to be suitable for lower weed index, higher yield attributes, seed yield, biological yield, monetory returns and benefit cost ratio.

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