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EFFECT OF PHOSPHORUS AND WEED MANAGEMENT ON PRODUCTIVITY OF CLUSTER BEAN (*Cyamopsis tetragonoloba* L.)

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ABSTRACT

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) is an important legume crop grown extensively in the arid and semi-arid regions of India. Its productivity is often constrained by early-season weed competition and inadequate phosphorus availability. A field experiment was conducted during the *kharif* season of 2025 at the Agronomy Farm, S.K.N. College of Agriculture, Jobner, Rajasthan, to evaluate the effect of weed management practices and phosphorus fertilization on yield attributes and productivity of cluster bean. The experiment was conducted in a Factorial Randomized Block Design with three replications, comprising three weed management practices, viz., unweeded check (W_0), pendimethalin PE @ 0.75 kg a.i. ha⁻¹ followed by one hand weeding at 25 DAS (W_1) and pendimethalin PE @ 0.75 kg a.i. ha⁻¹ followed by imazethapyr PoE @ 40 g a.i. ha⁻¹ (W_2) and four phosphorus levels, viz., control (P_0), 20 kg P₂O₅ ha⁻¹ (P_1), 40 kg P₂O₅ ha⁻¹ (P_2) and 60 kg P₂O₅ ha⁻¹ (P_3). Weed management and phosphorus application significantly affected the yield attributes and yields of cluster bean. Among weed management practices, W_1 produced the highest pods plant⁻¹ (71.25), seeds pod⁻¹ (8.16), test weight (27.30 g), seed yield (1292 kg ha⁻¹), haulm yield (3160 kg ha⁻¹) and biological yield (4452 kg ha⁻¹), and remained statistically comparable with W_2 . Among phosphorus treatments, application of 40 kg P₂O₅ ha⁻¹ recorded the maximum pods plant⁻¹ (70.70), seeds pod⁻¹ (7.96), test weight (26.96 g), seed yield (1253 kg ha⁻¹), haulm yield (3045 kg ha⁻¹) and biological yield (4298 kg ha⁻¹), which were statistically at par with 60 kg P₂O₅ ha⁻¹. Harvest index was not significantly affected by either weed management practices or phosphorus levels. The results indicated that pendimethalin PE @ 0.75 kg a.i. ha⁻¹ followed by one hand weeding at 25 DAS in combination with 40 kg P₂O₅ ha⁻¹ was an effective treatment for enhancing cluster bean productivity under the semi-arid conditions of Rajasthan.

Key words : Cluster bean, Phosphorus, Weed management, Pendimethalin, Imazethapyr, Productivity, Yield attributes.

Introduction

Cluster bean (*Cyamopsis tetragonoloba* L.), commonly known as guar, is an important drought-hardy legume crop cultivated extensively in the arid and semi-arid regions of India. Besides being used as vegetable, fodder and green manure, it is recognized as an industrial crop because of the presence of galactomannan gum in its endosperm, which is extensively used in food, textile, paper, pharmaceutical, petroleum and cosmetic industries. Owing to its deep root system and nitrogen-fixing ability, cluster bean improves soil fertility and plays an important role in sustainable crop production under rainfed ecosystems. India is the leading producer of cluster bean

in the world and Rajasthan accounts for the largest share of its area and production. Despite its economic importance, the average productivity of cluster bean remains comparatively low due to cultivation under rainfed conditions, poor soil fertility, nutrient deficiencies and severe weed infestation during the initial stages of crop growth.

Weed infestation is one of the most important biological constraints limiting the productivity of cluster bean. Weeds compete vigorously with crop plants for nutrients, moisture, light and space during the critical period of crop-weed competition, thereby reducing crop growth, yield attributes and final yield. Effective weed

management is therefore essential for minimizing yield losses and improving resource-use efficiency. Among the essential plant nutrients, phosphorus plays a vital role in root development, nodulation, biological nitrogen fixation, energy transfer, flowering and seed development. The majority of soils in Rajasthan are deficient to medium in available phosphorus; therefore, application of an optimum phosphorus dose is indispensable for realizing higher productivity of cluster bean. Considering the importance of integrated nutrient and weed management, the present investigation entitled “Effect of Phosphorus and Weed Management on Productivity of Cluster Bean (*Cyamopsis tetragonoloba* L.)” was undertaken to identify suitable weed management practices and optimum phosphorus levels for improving productivity under the semi-arid conditions of Rajasthan.

Materials and Methods

The field experiment was conducted during the kharif season of 2025 at the Agronomy Farm, S.K.N. College of Agriculture, Jobner, Rajasthan. The experimental site is situated at 26°05' N latitude and 75°28' E longitude with an altitude of 427 m above mean sea level and falls under Agro-climatic Zone IIIA (Semi-arid Eastern Plain Zone) of Rajasthan. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications. Treatments consisted of three weed management practices and four phosphorus levels.

Cluster bean variety RGC-1038 was sown following the recommended agronomic practices of the region. Pendimethalin was applied as pre-emergence immediately after sowing, whereas Imazethapyr was applied as post-emergence according to the treatment schedule.

Table 1 : Treatment details.

(A)	Weed management treatments
(i)	W_0 : Unweeded check
(ii)	W_1 : Pendimethalin PE @ 0.75 kg a.i. ha ⁻¹ + one HW at 25 DAS
(iii)	W_2 : Pendimethalin PE @ 0.75 kg a.i. ha ⁻¹ + Imazethapyr PoE @ 40 g a.i. ha ⁻¹
(B)	Phosphorus levels
(i)	P_0 : Control
(ii)	P_1 : 20 kg P ₂ O ₅ ha ⁻¹
(iii)	P_2 : 40 kg P ₂ O ₅ ha ⁻¹
(iv)	P_3 : 60 kg P ₂ O ₅ ha ⁻¹

Phosphorus was applied as basal through DAP at sowing. Observations on yield attributes, seed yield, haulm yield, biological yield and harvest index were recorded and statistically analysed using analysis of variance (ANOVA) appropriate for the Factorial Randomized Block Design. Treatment means were compared using the critical difference (CD) test at the 5% level of significance.

Results and Discussion

Effect of phosphorus and weed management on yield attributes of cluster bean

Effect on number of pods plant⁻¹

The data presented in Table 1 revealed that weed management practices and phosphorus levels significantly influenced the number of pods per plant of cluster bean. Among the weed management treatments, application of pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS (W_1) recorded the highest number of pods plant⁻¹

(71.25), which remained statistically at par with pendimethalin PE @ 0.75 kg a.i. ha⁻¹ followed by Imazethapyr PoE @ 40 g a.i. ha⁻¹ (W_2) recording 68.49 pods plant⁻¹. Both these treatments were significantly superior to the unweeded check (W_0), which recorded the lowest value (60.92). Application of W_1 and W_2 increased the number of pods plant⁻¹ by 16.96 and 12.43 per cent, respectively, over the unweeded check. Effective weed control during the critical period of crop growth minimized crop-weed competition for nutrients, moisture, light and space, resulting in better crop growth, higher photosynthetic activity and improved translocation of assimilates towards reproductive

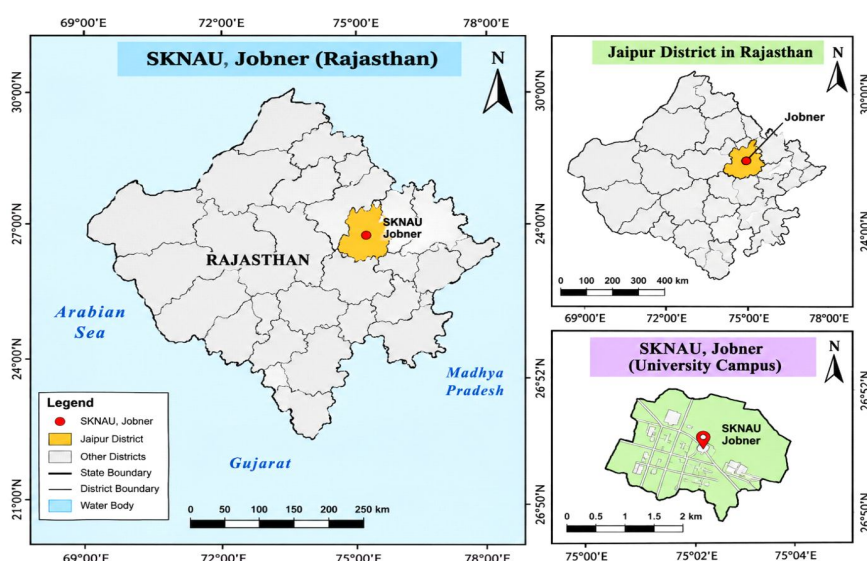


Fig. 1 : The experimental location belongs to Agro-climatic Zone III-A of Rajasthan, commonly referred to as the Semi-Arid Eastern Plain Zone of Rajasthan.

organs, thereby enhancing pod formation. Similar findings were also reported by Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Bamboriya *et al.* (2024).

Phosphorus application also exerted a significant influence on the number of pods plant⁻¹. Application of 40 kg P₂O₅ ha⁻¹ (P₂) produced 70.70 pods plant⁻¹, which remained statistically at par with 60 kg P₂O₅ ha⁻¹ (P₃) recording 72.28 pods plant⁻¹. Both treatments were significantly superior to 20 kg P₂O₅ ha⁻¹ and the control. The lowest value (58.81 pods plant⁻¹) was observed under the control treatment. Application of 40 and 20 kg P₂O₅ ha⁻¹ increased pods plant⁻¹ by 20.22 and 11.80 per cent, respectively, over the control. The favourable response to phosphorus may be attributed to improved root growth, enhanced nodulation, better biological nitrogen fixation and efficient energy transfer, resulting in increased flowering and pod development. These findings are in close conformity with those reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025).

Effect on number of seeds/pod

The number of seeds per pod was significantly influenced by weed management practices as well as phosphorus fertilization (Table 1). Among the weed management treatments, application of pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS (W₁) recorded the maximum number of seeds per pod (8.16), which remained statistically at par with W₂ (7.82). Both treatments were significantly superior to the unweeded check (6.56). Application of W₁ and W₂ increased the number of seeds pod⁻¹ by 24.39 and 19.21 per cent, respectively, over the unweeded check. This improvement may be attributed to effective weed suppression, which reduced competition and ensured better availability of growth resources during flowering and seed setting, ultimately resulting in improved seed formation within the pods. Similar results have also been reported by Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Bamboriya *et al.* (2024).

Among phosphorus levels, application of 40 kg P₂O₅ ha⁻¹ recorded the highest number of seeds pod⁻¹ (7.96), which remained statistically at par with 60 kg P₂O₅ ha⁻¹ (8.28). Both treatments were significantly superior to the lower phosphorus levels. The minimum number of seeds pod⁻¹ (6.51) was observed under the control treatment. Application of 40 and 20 kg P₂O₅ ha⁻¹ increased seeds pod⁻¹ by 22.27 and 12.14 per cent, respectively, over the control. The increase in seeds pod⁻¹ under phosphorus fertilization could be attributed to enhanced metabolic

Table 2 : Effect of weed management and phosphorus fertilization on yield attributes of cluster bean.

Treatment	Pods plant ⁻¹	Seeds pod ⁻¹	Test weight (g)
Weed management practices			
W ₀	60.92	6.56	22.60
W ₁	71.25	8.16	27.30
W ₂	68.49	7.82	25.99
SEm±	1.41	0.17	0.59
CD (P=0.05)	4.14	0.50	1.72
Phosphorus levels			
P ₀	58.81	6.51	21.92
P ₁	65.75	7.30	24.79
P ₂	70.70	7.96	26.96
P ₃	72.28	8.28	27.51
SEm±	1.63	0.20	0.68
CD (P=0.05)	4.78	0.57	1.98
CV (%)	7.31	7.80	8.02

activities, improved nutrient uptake and greater assimilate supply to developing reproductive structures, leading to better seed setting. The present findings corroborate those of Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025).

Effect on test weight

Test weight was significantly influenced by different weed management practices and phosphorus levels (Table 2). Among the weed management treatments, application of pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS (W₁) recorded the highest test weight (27.30 g), which remained statistically at par with W₂ (25.99 g). Both treatments were significantly superior to the unweeded check (22.60 g). Application of W₁ and W₂ increased test weight by 20.80 and 15.00 per cent, respectively, over the unweeded check. The higher test weight obtained under effective weed management may be attributed to better grain filling resulting from reduced crop-weed competition and greater availability of nutrients and moisture throughout the reproductive phase of the crop. These results are in agreement with the findings of Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Singh and Dhillon (2023).

Phosphorus application significantly improved test weight. Application of 40 kg P₂O₅ ha⁻¹ recorded the highest test weight (26.96 g), which remained statistically at par with 60 kg P₂O₅ ha⁻¹ (27.51 g). Both treatments

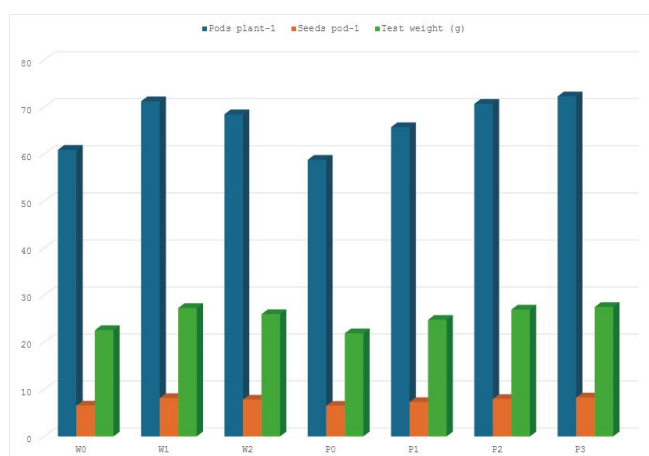


Fig. 2 : Effect of weed management and phosphorus fertilization on yield attributes of cluster bean.

were significantly superior to 20 kg P₂O₅ ha⁻¹ and the control. The lowest test weight (21.92 g) was recorded under the control treatment. Application of 40 and 20 kg P₂O₅ ha⁻¹ increased test weight by 22.99 and 13.09 per cent, respectively, over the control. Improved phosphorus nutrition enhanced carbohydrate synthesis, energy transfer and assimilate translocation towards developing seeds, thereby producing bolder and heavier seeds. Similar observations were also reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025).

Effect of seed yield

The data presented in Table 3 revealed that seed yield of cluster bean was significantly influenced by different weed management practices and phosphorus levels. Among the weed management treatments, application of pendimethalin as pre-emergence (PE) @ 0.75 kg a.i. ha⁻¹ followed by one HW at 25 DAS (W₁) recorded the highest seed yield (1292 kg ha⁻¹), which remained statistically at par with pendimethalin PE @ 0.75 kg a.i. ha⁻¹ followed by Imazethapyr as post-emergence (PoE) @ 40 g a.i. ha⁻¹ (W₂) producing 1239 kg ha⁻¹. Both treatments were significantly superior to the unweeded check (907 kg ha⁻¹). Application of W₁ and W₂ increased seed yield by 42.4 and 36.6 per cent, respectively, over the unweeded check. Effective weed control minimized crop-weed competition during the critical growth period, thereby improving crop growth, dry matter accumulation and yield attributes, which ultimately resulted in higher seed yield. These findings are in close agreement with those reported by Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022), Singh and Dhillon (2023) and Bamboriya *et al.* (2024).

Phosphorus application significantly improved seed

Table 3 : Effect of weed management and phosphorus fertilization on yield and harvest index of cluster bean.

Treatment	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Biological yield (kg ha ⁻¹)	Harvest index (%)
Weed management practices				
W ₀	907	2510	3417	26.46
W ₁	1292	3160	4452	28.93
W ₂	1239	3019	4258	29.01
SEm ±	29	63	103	0.78
CD (P=0.05)	84	185	303	NS
Phosphorus levels				
P ₀	916	2564	3480	26.20
P ₁	1149	2817	3965	28.84
P ₂	1253	3045	4298	29.02
P ₃	1267	3160	4427	28.49
SEm ±	33	73	119	0.91
CD (P=0.05)	97	213	350	NS
CV (%)	8.70	7.54	8.86	9.65

yield. The maximum seed yield (1253 kg ha⁻¹) was recorded with 40 kg P₂O₅ ha⁻¹ (P₂), which remained statistically at par with 60 kg P₂O₅ ha⁻¹ (1267 kg ha⁻¹). Both treatments were significantly superior to 20 kg P₂O₅ ha⁻¹ and the control. Application of 20 kg P₂O₅ ha⁻¹ also produced significantly higher seed yield (1149 kg ha⁻¹) than the control (916 kg ha⁻¹). Application of 40 and 20 kg P₂O₅ ha⁻¹ increased seed yield by 36.8 and 25.4 per cent, respectively, over the control. Adequate phosphorus nutrition promoted root growth, nodulation, biological nitrogen fixation, energy transfer and efficient translocation of photosynthates towards developing seeds, resulting in higher seed yield. Similar findings have also been reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025).

Effect of haulm yield

The haulm yield of clusterbean was significantly influenced by weed management practices and phosphorus fertilization (Table 3). Among the weed management treatments, W₁ (Pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS) recorded the highest haulm yield (3160 kg ha⁻¹), which remained statistically at par with W₂ (3019 kg ha⁻¹). Both treatments were significantly superior to the unweeded check, which produced the lowest haulm yield (2510 kg ha⁻¹).

Application of W_1 and W_2 increased haulm yield by 25.9 and 20.3 per cent, respectively, over the unweeded check. The increase in haulm yield was mainly due to better weed suppression, resulting in improved vegetative growth, greater dry matter accumulation and enhanced utilization of available nutrients and moisture by the crop. These findings are in accordance with those reported by Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Bamboriya *et al.* (2024).

Among phosphorus levels, the highest haulm yield (3045 kg ha⁻¹) was obtained with 40 kg P₂O₅ ha⁻¹, which remained statistically at par with 60 kg P₂O₅ ha⁻¹ (3160 kg ha⁻¹). Both treatments were significantly superior to the control. Application of 20 kg P₂O₅ ha⁻¹ (2817 kg ha⁻¹) was significantly superior to the control and remained statistically at par with 40 kg P₂O₅ ha⁻¹. The lowest haulm yield (2564 kg ha⁻¹) was recorded under the control treatment. Application of 40 and 20 kg P₂O₅ ha⁻¹ increased haulm yield by 18.8 and 9.9 per cent, respectively, over the control. Improved phosphorus availability enhanced vegetative growth, root development and nutrient uptake, thereby increasing biomass production. Similar observations have also been reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025).

Effect of biological yield

Biological yield was significantly affected by weed management practices and phosphorus levels (Table 3). Among the weed management treatments, application of pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS (W_1) recorded the highest biological yield (4452 kg ha⁻¹), which remained statistically at par with W_2 (4258 kg ha⁻¹). Both treatments were significantly superior to the unweeded check (3417 kg ha⁻¹). Application of W_1 and W_2 increased biological yield by 30.3 and 24.6 per cent, respectively, over the unweeded check. The increase in biological yield was attributed to effective weed management, which reduced crop-weed competition for moisture, nutrients, light and space, thereby promoting vegetative growth, dry matter accumulation and reproductive development. These findings corroborate the reports of Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Singh and Dhillon (2023). Similar improvements in total biological productivity of cluster bean under effective weed-control treatments have also been reported by Kumawat *et al.* (2017) and Bijarnia *et al.* (2024), who observed that integrated and herbicidal weed-management practices enhanced crop growth and yield over the unweeded condition. The greater biological yield under weed-free

or effective weed-management treatments could be attributed to better resource availability and consequently greater accumulation of photosynthates and dry matter by the crop.

Application of phosphorus significantly improved biological yield. The highest biological yield was recorded under 60 kg P₂O₅ ha⁻¹ (4427 kg ha⁻¹), followed by 40 kg P₂O₅ ha⁻¹ (4298 kg ha⁻¹) and 20 kg P₂O₅ ha⁻¹ (3965 kg ha⁻¹), while the lowest value was recorded under the control (3480 kg ha⁻¹). The 60 and 40 kg P₂O₅ ha⁻¹ treatments were significantly superior to the control. Application of 40 and 20 kg P₂O₅ ha⁻¹ increased biological yield by 23.5 and 13.9 per cent, respectively, over the control. The improvement in biological yield with phosphorus application may be attributed to enhanced root development, better nutrient acquisition, improved energy transfers through ATP formation and greater photosynthetic activity, which collectively promoted vegetative growth and dry matter accumulation. The present findings are in agreement with those reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Pedada *et al.* (2025). Kumawat *et al.* (2017) also reported a significant improvement in seed, haulm and biological yield of cluster bean with increasing fertility levels, with higher productivity obtained at 20 kg N + 40 kg P₂O₅ ha⁻¹. Similarly, Meena *et al.* (2020) observed that phosphorus application significantly improved the productivity of cluster bean, indicating the important role of adequate P availability in biomass production. The present results therefore indicate that adequate phosphorus nutrition, particularly at 40-60 kg P₂O₅ ha⁻¹, enhanced total biomass production of cluster bean under the prevailing experimental conditions.

Effect of harvest index

Harvest index was not significantly influenced by either weed management practices or phosphorus levels (Table 3). Numerically, the highest harvest index (29.01%) was observed under W_2 (Pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + Imazethapyr PoE @ 40 g a.i. ha⁻¹), followed closely by W_1 (28.93%), whereas the lowest value (26.46%) was recorded under the unweeded check. However, the differences among weed management treatments were statistically non-significant. The non-significant variation in harvest index indicated that although weed management practices enhanced both seed and haulm yields, the proportional partitioning of total biomass into economic yield remained relatively unchanged. Similar non-significant effects of weed management on harvest index in cluster bean have also been reported by Sharma *et al.* (2017), Meena *et al.* (2020), Bijarnia *et al.* (2022), Meena *et al.* (2022) and Singh and Dhillon (2023).

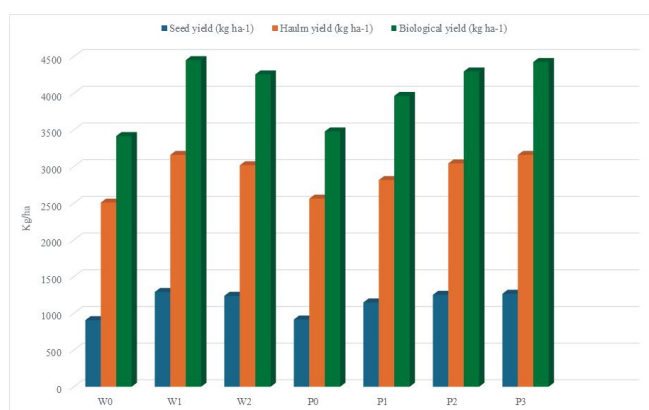


Fig. 3 : Effect of weed management and phosphorus fertilization on yield and harvest index of cluster bean.

Comparable results were also reported by Kumawat *et al.* (2017), who observed substantial improvement in seed, haulm and biological yields under effective weed-control treatments, while the response of biomass partitioning was comparatively less pronounced. Bijarnia *et al.* (2024) also reported that effective herbicidal weed management involving pendimethalin + imazethapyr improved yield attributes and productivity of cluster bean, with corresponding changes in harvest index.

Similarly, phosphorus fertilization did not significantly affect harvest index. Numerically, the highest harvest index (29.02%) was recorded with 40 kg P₂O₅ ha⁻¹, followed by 20 kg P₂O₅ ha⁻¹ (28.84%), 60 kg P₂O₅ ha⁻¹ (28.49%) and the control (26.20%). The non-significant response of harvest index indicated that the increase in seed yield was accompanied by a proportional increase in haulm yield, thereby maintaining a nearly constant partitioning of total biomass into economic yield. Comparable findings have been reported by Rathore *et al.* (2007), Sammauria *et al.* (2009), Naik *et al.* (2021), Agarwal *et al.* (2026) and Meena *et al.* (2020). In contrast, Meena *et al.* (2020) reported that increasing phosphorus levels significantly enhanced seed, haulm and biological yields as well as harvest index, with improvement up to 40 kg P₂O₅ ha⁻¹, demonstrating that the magnitude of response may depend on the experimental environment, genotype and nutrient status of the soil. Kumawat *et al.* (2017) similarly reported increased seed, haulm, biological yield and harvest index with increasing fertility levels, with 20 kg N + 40 kg P₂O₅ ha⁻¹ producing a harvest index of 31.98%. Thus, the present non-significant response of harvest index to phosphorus application suggests that under the prevailing experimental conditions, phosphorus primarily influenced overall biomass production and yield rather than substantially altering the relative partitioning of assimilates towards seed production.

Conclusion

The present investigation clearly demonstrated that both weed management practices and phosphorus fertilization significantly influenced the productivity of cluster bean under the semi-arid conditions of Rajasthan. Among the weed management practices, application of pendimethalin as pre-emergence @ 0.75 kg a.i. ha⁻¹ followed by one HW at 25 DAS proved to be the most effective treatment by producing significantly higher yield attributes, seed yield, haulm yield and biological yield compared with the unweeded check. However, it remained statistically at par with pendimethalin as pre-emergence followed by imazethapyr as post-emergence @ 40 g a.i. ha⁻¹ for most of the productivity parameters.

Application of phosphorus significantly improved the productivity of cluster bean. Application of 40 kg P₂O₅ ha⁻¹ recorded the highest values of pods per plant, seeds per pod, test weight, seed yield, haulm yield and biological yield and remained statistically at par with 60 kg P₂O₅ ha⁻¹, indicating that further increase in phosphorus beyond 40 kg P₂O₅ ha⁻¹ did not produce a significant improvement in crop productivity. Harvest index remained statistically unaffected by both weed management practices and phosphorus levels.

Therefore, under the loamy sand soils of the Semi-arid Eastern Plain Zone of Rajasthan, application of pendimethalin PE @ 0.75 kg a.i. ha⁻¹ + one HW at 25 DAS along with 40 kg P₂O₅ ha⁻¹ may be recommended for obtaining higher productivity and better economic returns in cluster bean cultivation.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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