# Influence of Weed Management and Phosphorus Fertilization on Yield Attributes and Economics of Cowpea [*Vignaunguiculata* (L.) Walp.]

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## Abstract

A field experimentation was conducted during *kharif* 2019 at Instructional Farm of Agronomy, Rajasthan College of Agriculture, Udaipur to study theeffect of weed management and phosphorus fertilization on weeds and productivity of cowpea. Results shown that all the yield attributes significantly influenced by all the weed control treatments compared to weedy check. The highest number of seeds pod$^{-1}$, length of pod, pod yield plant$^{-1}$ and weight of 100 seeds were documented with weed free treatment which was statistically at par with pendimethalin 750 g ha$^{-1}$as pre-emergence in combination with imazethapyr + imazamox 33.75 g ha$^{-1}$ as post-emergence. With regard to net returns and B-C ratio are concerned, the highest net returns and B-C ratio was obtained with pendimethalin750 g ha$^{-1}$ as pre-emergence in conjugation with imazethapyr + imazamox33.75 g ha$^{-1}$ as post-emergence which was statistically at par with pendimethalin1000 g ha$^{-1}$ along with HW at 15-20 DAS in terms of net returns and with imazethapyr + imazamox45 g ha$^{-1}$ in terms of B-C ratio.

Yield attributes like number of seeds pod$^{-1}$, length of pod, pod yield plant$^{-1}$ and 100 seed weight pointedly increased with application of phosphorus at 40 kg $P_2O_5$ ha$^{-1}$ compared to 30 kg $P_2O_5$ ha$^{-1}$ at significant level and further addition of phosphorus from 40 to 50 kg $P_2O_5$ ha$^{-1}$ failed to bring any significant improvement in these parameters. Application of 40 kg $P_2O_5$ ha$^{-1}$ significantly enhanced net returns and B-C ratio of cowpea over 30 kg $P_2O_5$ ha$^{-1}$ and further addition of phosphorus from 40 to 50 kg $P_2O_5$ ha$^{-1}$ failed to enhance this parameter significantly.

**Keywords**: Cowpea, Yield attributes, Phosphorus fertilization, Economics of Cowpea

## Introduction

Cowpea is known for its versatile utilities *viz.*, grain, forage, cover/smother crop and green manure crop. Leguminous pulses are renowned for their exceptional nutritional value and delightful taste. Beyond their role as a dietary staple, these pulses contribute significantly

to agricultural sustainability through their unique ability to fix nitrogen (Abayomi and Abidoye, 2009). The productivity of the crop in Rajasthan is low and far below than its yield potential. This disparity is primarily attributed to inadequate weed management practices and insufficient nutritional support, particularly in terms of phosphorus fertilization.The unchecked growth of weeds in the rainy season poses a serious threat to crop thereby drastic reduction in crop yield.

The scarcity of labor and challenging soil conditions renders manual weeding less effective and efficient, especially during critical periods. Consequently, herbicidal weed control has emerged as a predominant solution in contemporary agricultural practices. However, the effectiveness of herbicides necessitates detailed studies focusing on their selectivity concerning specific crops. In addition, acknowledging the pivotal role of phosphorus in influencing root growth, nodule development, bacterial activity, and nitrogen fixation, its application becomes indispensable for achieving a profitable yield. In light of these considerations; a field study was designed with the primary objective of investigating the impact of weed management and phosphorus nutrition on the yield of cowpea.

**Materials and Methods**

The experiment was conducted during *kharif*2019 at Instructional Agronomy Farm of Rajasthan College of Agriculture, MPUAT, Udaipur. The soil of the experimental site was clay loam in texture with 288.00, 20.54 and 286.92 kg $ha^{-1}$ available nitrogen, phosphorus and potassium, respectively, in 0-30 cm soil depth with pH 8.19. The experiment was laidin factorial randomized block design with three replications and constituting 18 treatment combinations consisting of 6 weed control treatments (Pendimethalin 1000 g $ha^{-1}$ PE *fb* hoeing and weeding 15-20 DAS, imazamox + imazethapyr 45 g $ha^{-1}$ at 15-20 DAS, pendimethalin 750g $ha^{-1}$ PE *fb*imazamox + imazethapyr 33.75 g $ha^{-1}$ at15-20 DAS, one hoeing and weeding 15-20 DAS, weed free up to 50 days and weedy check ) and 3 phosphorus levels (30, 40 and 50 kg $P_2O_5$ $ha^{-1}$). As per treatments, the needed quantities of fertilizers were applied below the seed at the time of sowing. Cowpea variety RC-101 was used as test crop with seed rate 15 kg $ha^{-1}$ with recommended package of practices.

**Results and Discussion**

**Yield attributes**

An examination of data (Table 1) implies that all the weed management treatments significantly improved number of seeds $pod^{-1}$, length of pod and pod yield $plant^{-1}$, weight of 100 seeds were consistently higher by all the weed management treatments except weedy

check. The highest number of seeds pod$^{-1}$ was observed with pendimethalin 750 g ha$^{-1}$ as pre-emergence in combination with imazethapyr + imazamox 33.75 g ha$^{-1}$ as post-emergence (7.30). Weed free treatment (13.91 cm) was found superior in terms of length of pod which was statistically at par with pendimethalin 750 g ha$^{-1}$ as pre-emergence in combination with imazethapyr + imazamox 33.75 g ha$^{-1}$ as post-emergence (13.31 cm) and pendimethalin 1000 g ha$^{-1}$*fb* hoeing and weeding at 15-20 DAS (13.23 cm). The lowest length of the pod was observed with weedy check (10.73 cm). The highest pod yield plant$^{-1}$ was obtained with weed free treatment (7.18 g) which was statistically at equivalence with pendimethalin 750 g ha$^{-1}$ as pre-emergence in conjugation with imazethapyr + imazamox 33.75 g ha$^{-1}$ as post-emergence (6.86 g) and pendimethalin 1000 g ha$^{-1}$ along with hoeing and weeding at 15-20 DAS (6.82 g). Weed free treatment (8.16 g) caused the highest weight of 100 seeds which was statistically comparable with pendimethalin 750 g ha$^{-1}$ as pre-emergence along with imazethapyr + imazamox 33.75 g ha$^{-1}$ as post-emergence (8.08 g) and pendimethalin 1000 g ha$^{-1}$ accompanied by hoeing and weeding at 15-20 DAS (7.93 g). It can be described in the light of realities that these treatments controlled the weeds effectively, might have made more nutrients, space and soil moisture available to crop and thus enhanced seed and haulm yield of cowpea. This can be further explained on the basis of facts that these treatments remarkably controlled weeds in this way showing the highest weed control efficiency and documented the lowest weed index thus improving seed yield of cowpea. These results coincide with the results recorded by Rao *et al*. (2010), Choudhary*et al*. (2014).

Application of phosphorus did not increase number of seeds pod$^{-1}$and weight of 100 seeds of cowpea significantly as it is clear from data presented in Table 1. Addition of phosphorus at 40 kg $P_2O_5$ ha$^{-1}$ significantly influenced length of pod of cowpea over 30 kg $P_2O_5$ ha$^{-1}$. Analysis of data further indicates that additional increase in the phosphorus by 10 kg failed to enhance this parameter considerably. Application of phosphorus at 40 kg $P_2O_5$ ha$^{-1}$influentially increased pod yield plant$^{-1}$ over 30 kg $P_2O_5$ ha$^{-1}$ by 0.71 g plant$^{-1}$. It is also evident from the data that further increase in the phosphorus by 10 kg failed to improve pod yield plant$^{-1}$ considerably. This might be ascribed to enhancement both in growth and yield attributes. Adequate phosphorus levels boost vigorous root and shoot growth thus increased seed yield. The overall improvement in all these parameters owing to phosphorus nutrition appears to be due to its indispensable role in photosynthesis, pod development and grain filling in leguminous crops. It is accountable for nodulation in cowpea, thus higher nodulation resulted in higher nitrogen fixation and eventually the number of pods plant$^{-1}$ and seed yield. These results substantiate findings of Singh *et al*. (2011).

**Economics**

Data pertaining to net returns and B-C ratio of cowpea under the influence of weed management treatments presented in Table 2 reveal that all the weed management treatments considerably increased these parameters over weedy check plot. The highest net returns of ₹ 39,737 $ha^{-1}$ was obtained with pendimethalin750 g $ha^{-1}$ as pre-emergence in conjugation with imazethapyr + imazamox 33.75 g $ha^{-1}$ as post-emergence which was statistically at par with pendimethalin 1000 g $ha^{-1}$ along with hoeing and weeding at 15-20 DAS (₹ 36,994 $ha^{-1}$). Maximum B-C ratio was obtained under pre-emergence application of pendimethalin 750 g $ha^{-1}$ accompanied by post-emergence application of imazethapyr + imazamox 33.75 g $ha^{-1}$ at 15-20 DAS (2.04) which was statistically at par with imazethapyr + imazamox 45 g $ha^{-1}$ (1.90). On account of higher yield and relatively lower cost of pendimethalin 750 g $ha^{-1}$ as pre-emergence in conjugation with imazethapyr + imazamox 33.75 g $ha^{-1}$ documented maximum B-C ratio (2.04) compared to other treatments.

Application of phosphorus at 40 kg $P_2O_5$ $ha^{-1}$ significantly enhanced net returns of cowpea over 30 kg $P_2O_5$ $ha^{-1}$ by ₹ 5566 $ha^{-1}$. It is also clear from the data that further addition of phosphorus from 40 to 50 kg $P_2O_5$ $ha^{-1}$ failed to enhance this parameter significantly. Application of phosphorus at 40 kg $P_2O_5$ $ha^{-1}$significantly increased B-C ratio of cowpea over 30 kg $P_2O_5$ $ha^{-1}$. It is also apparent from the data that further addition of phosphorus from 40 to 50 kg $P_2O_5$ $ha^{-1}$ failed to enhance this parameter significantly.

**Conclusion**

After weed free treatment, pre-emergence application of pendimethalin 750 g $ha^{-1}$ accompanied by post-emergence application of imazethapyr + imazamox 33.75 g $ha^{-1}$ at 15-20 DAS in cowpea recorded significantly higher yield attributes while application of 40 kg $P_2O_5$ $ha^{-1}$ documented significantly higher yield attributes of cowpea.The highest net returns and B-C ratio of cowpea was obtained with pendimethalin750 g $ha^{-1}$ as pre-emergence in conjugation with imazethapyr + imazamox 33.75 g $ha^{-1}$ as post-emergence over all weed management treatments.

## 6. References

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**Table 1: Effect of weed management and phosphorus levels on yield attributes of cowpea**

| Treatments | No. of seeds pod$^{-1}$ | Length of pod (cm) | Pod yield plant$^{-1}$ (g) | Weight of 100 seeds (g) |
|---|---|---|---|---|
| **Weed management** | | | | |
| Pendimethalin 1000 g PE *fb* HW | 7.05 | 13.23 | 6.82 | 7.93 |
| Imazethapyr + imazamox 45 g | 7.00 | 12.19 | 6.28 | 7.80 |
| Pendimethalin 750 g PE *fb*imazethapyr + imazamox 33.75 g | 7.30 | 13.31 | 6.86 | 8.08 |
| One hoeing and weeding 15-20 DAS | 6.91 | 12.05 | 6.22 | 7.75 |
| Weed free (up to 50 days) | 7.26 | 13.91 | 7.18 | 8.16 |
| Weedy check | 6.08 | 10.73 | 3.00 | 7.36 |
| SEm± | 0.09 | 0.27 | 0.14 | 0.09 |
| CD(P= 0.05) | 0.27 | 0.76 | 0.40 | 0.26 |
| **Phosphorus levels ($P_2O_5$ kg ha$^{-1}$)** | | | | |
| 30 | 6.92 | 11.40 | 5.45 | 7.78 |
| 40 | 6.93 | 12.78 | 6.16 | 7.81 |
| 50 | 6.95 | 13.53 | 6.57 | 7.95 |
| SEm± | 0.13 | 0.38 | 0.20 | 0.13 |
| CD(P= 0.05) | NS | 1.09 | 0.58 | NS |

**Table 2: Effect of weed management and phosphorus levels on economics of cowpea**

| Treatments | Net return (₹ $ha^{-1}$) | B:C ratio |
|---|---|---|
| **Weed management** | | |
| Pendimethalin 1000 g PE *fb* HW | 36,994 | 1.69 |
| Imazethapyr + imazamox 45 g | 35,571 | 1.90 |
| Pendimethalin 750 g PE *fb*imazethapyr + imazamox 33.75 g | 39,737 | 2.04 |
| One hoeing and weeding 15-20 DAS | 32,282 | 1.51 |
| Weed free (up to 50 days) | 35,572 | 1.35 |
| Weedy check | 8,302 | 0.47 |
| SEm± | 1225 | 0.03 |
| CD(P= 0.05) | 3494 | 0.17 |
| **Phosphorus levels ($P_2O_5$ kg $ha^{-1}$)** | | |
| 30 | 26,697 | 1.30 |
| 40 | 32,263 | 1.53 |
| 50 | 35,268 | 1.64 |
| SEm± | 1733 | 0.08 |
| CD(P= 0.05) | 4979 | 0.22 |