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# Evaluation of Pre and Post Emergence Herbicides for Weed Control on Growth and Yield in Chickpea

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author MY designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors RKS, Sirazuddin, VN and RKM managed the analyses of the study. Author TRR managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

Chickpea, scientifically known as *Cicer arietinum* L., is a significant grain legume that is cultivated in 44 countries across five continents. India holds the position of the world's largest producer of chickpeas, contributing to approximately 75% of global production. The primary states in India where chickpeas are extensively grown include Maharashtra, Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh, and Gujarat. The aim of the experiment was to assess how various herbicides impact weed control in chickpea cultivation.

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An agronomic investigation on "Evaluation of pre and post emergence herbicides in chickpea (*Cicer arietinum* L.)" under late sowing conditions was conducted during Rabi 2019-20 at Doon PG College of Agriculture Science and Technology, Selaqui, Dehradun. To study the effect and performance of different weed control treatments. The experiment was laid out in a Randomized Block Design with eight treatments. The treatments were Pendimethalin@1.0 kg $ha^{-1}$, Metribuzin @1.0 kg $ha^{-1}$, Quizalofop-p-ethyl @ 40 a.i. g $ha^{-1}$, Clodinafop @ 0.060 kg $ha^{-1}$, Pinoxadan @0.005 kg $ha^{-1}$, Hand weeding at 20 and 40 DAS, Weedy check and Weed Free. They were replicated three times. Observations on growth and weed parameters were recorded periodically at an interval of 30 days. Among the treatments, weed-free recorded the highest grain and straw. It was on par with Pendimethalin @ 1.0 kg $ha^{-1}$ significantly superior over the rest of the treatments. Among the chemical weed control treatment application of Pendimethalin @1.0 kg $ha^{-1}$ was found beneficial to higher grain yield, and straw yield and effective in controlling weeds and increasing the yield of chickpea.

*Keywords: Chickpea; chemical control; herbicide; efficacy; weed management.*

## 1. INTRODUCTION

Gram (*Cicer arietinum* L.) is one of the most important pulses (Rabi) crops grown in the rainfed farming system throughout India. It is used for human consumption as well as animal feeding. Chickpea is an important pulse crop of the semi-arid tropics, particularly in the rainfed ecology of the Indian subcontinent. In the last decade, this crop has experienced an export-driven expansion in new riches such as Australia and Canada. Globally, chickpea is cultivated on about 10.4 million ha area adding 8.57 million tonnes of seeds to the global food market, with an average productivity of 826 kg $ha^{-1}$. The average yield of this crop is very high which may be due to many factors but this infestation of weeds is very important. Weed infestation in winter pulses has been reported to offer serious competition and causes yield reduction to the extent of 75% in chickpea [1]. When properly used, pre-emergence herbicides accomplish effective and economic weed control, and consequently, chickpea seed yields as similar to or only lightly smaller than those of weed free treatments are resulted [2]. New pre and post emergence weedicides are available in the market for effective control of weeds. It is therefore felt necessary to study the efficacy of these new weedicides for control of weeds in gram.

The total productivity of pulses especially chickpea is much below its requirement and there is a great need to increase its area as well as productivity per unit area. The average yield of this crop is very much which may be due to many factors but among these infestation of weeds is very important. (Suijit Singh, U. S. Walla and Buta Singh., 2008).

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## 2. MATERIALS AND METHODS

The present field experiment was conducted during the rabi season of 2019-2020 at Doon PG College of Agriculture Science and Technology, Selaqui, Dehradun, U.K. The experiment consisting of 8 treatments was laid out in a Randomized block design with 3 replications and treatments are T1: Pendimethalin @ 1.0 kg $ha^{-1}$ (Preemergence), T2:Metribuzin @ 1.0 kg $ha^{-1}$ (Pre Plant injection), T3: Quizalofop – ethyl @ 0.04 kg $ha^{-1}$ ( 35-40 DAS), T4: Clodinafop @ 0.060 kg $ha^{-1}$ ( 40 DAS), T5: Pinoxadan @0.0050 mL $ha^{-1}$ ( 40DAS), T6: Hand weeding @ ( 20, 40) DAS, T7:Weed check and T8: Weed free. The soil of the experimental plot was clayey in texture, low in available nitrogen (214.3 kg $ha^{-1}$), medium in available phosphorus (17.9 kg $ha^{-1}$), moderately high in available potassium (237.1 kg $ha^{-1}$ and the soil was slightly alkaline in reaction (7.2 pH). The field was ploughed once in summer with a bullock-drawn plough, followed by two cross-harrowing. By planking to level the field and to obtain the desirable seedbed for sowing keeping a seed rate of 80 kg $ha^{-1}$. Nitrogen and phosphorus were applied through DAP (diammonium phosphate) having 18 % N and

46% P2O. The remaining amount of nitrogen was applied through urea (46% N) according to the doses in the treatments. Diammonium phosphate (DAP) and The recommended dose of fertilizers is (N:P:K) 25:50:20 % respectively. Five plants were selected at random from each net plot and labelled with wooden pegs and tags. Periodical biometric observations were recorded on these labelled plants. These plants were separately harvested at maturity to assess their yield and yield attributes. Harvesting was done when the crop was fully matured Border rows were removed and each net plot was harvested separately.

## 3. RESULTS AND DISCUSSION

The growth and development of chickpea, which is to determine the growth habit of the crop, were studied periodically. Plant height at 30, and 60 DAS and harvest are presented in [Table 1]. The mean plant height was increased continuously up to harvest. At 30, 60 DAS and at harvest plant height was influenced significantly due to various treatments. The highest plant height was observed in the treatment weed free check which was significantly superior over the rest of the treatments The mean dry matter was increased continuously up to harvest. The increase in dry matter was rapid during 30 to 60 DAS and 50 thereafter it increased gradually up to the harvest. Whereas at harvest the application of Pendimethalin @1.0 kg ha-1 was found to be at par with Quizalofop-p-ethyl @ 40 a.i. g ha-1 and significantly lowest weight of pods plant-1 was recorded in unweeded control i.e., weedy check. This might be due to the lowest weed competition, particularly during early crop growth and it may be attributed to the maximum utilization of soil moisture and nutrients and their diversion for increasing growth of plant particularly in plant height. These results conform with the findings of Kumar et al. [3], and Goud et al. [4].

Data furnished in [Table 2] indicate that the seed yield of chickpea was significantly influenced by various weed control treatments As we see the effect of chemical weed control methods, the application of Pendimethalin @1.0 kg $ha^{-1}$

**Table 1. Plant Height and Dry Matter Production (kg $ha^{-1}$) as influenced Periodically by Various Treatments**

| Treatments | Plant Height | | | Dry Matter Production | | |
|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | At Harvest | 30 DAS | 60 DAS | At Harvest |
| $T_1$: Pendimethalin@1.0 kg $ha^{-1}$ | 14.08 | 26.76 | 40.66 | 10.00 | 14.98 | 28.41 |
| $T_2$: Metribuzin @1.0 kg $ha^{-1}$ | 13.03 | 24.57 | 37.70 | 9.46 | 13.60 | 24.56 |
| $T_3$: Quizalofop-p-ethyl @ 40 a.i. g $ha^{-1}$ | 13.51 | 25.73 | 39.03 | 9.69 | 14.73 | 26.35 |
| $T_4$: Clodinafop @ 0.060 kg $ha^{-1}$ | 11.50 | 21.17 | 32.76 | 7.18 | 11.27 | 22.63 |
| $T_5$: Pinoxadan @0.005 kg $ha^{-1}$ | 12.07 | 22.57 | 34.46 | 7.52 | 11.81 | 23.53 |
| $T_6$: Hand weeding at 20 and 40 DAS | 12.90 | 23.16 | 36.67 | 8.41 | 12.30 | 24.36 |
| $T_7$: Weedy Check | 10.27 | 20.88 | 31.11 | 7.15 | 10.31 | 20.05 |
| $T_8$: Weed Free | 14.43 | 27.44 | 41.75 | 10.32 | 15.42 | 29.30 |
| S.E.± | 0.55 | 0.59 | 0.63 | 0.51 | 0.59 | 1.12 |
| C.D. at 5 % | 1.67 | 2.16 | 1.92 | 1.55 | 1.78 | 3.40 |

**Table 2. Grain Yield (kg $ha^{-1}$) and Straw Yield (kg $ha^{-1}$) of Chickpea by Various Treatments**

| Treatments | Grain Yield (kg $ha^{-1}$) | Straw Yield (kg $ha^{-1}$) | 100 Seed wt (g) |
|---|---|---|---|
| $T_1$: Pendimethalin@1.0 kg $ha^{-1}$ | 2821 | 3101 | 19.03 |
| $T_2$: Metribuzin @1.0 kg $ha^{-1}$ | 2676 | 2907 | 18.20 |
| $T_3$: Quizalofop-p-ethyl @ 40 a.i. g $ha^{-1}$ | 2730 | 3023 | 18.58 |
| $T_4$: Clodinafop @ 0.060 kg $ha^{-1}$ | 2207 | 2517 | 16.49 |
| $T_5$: Pinoxadan @0.005 kg $ha^{-1}$ | 2323 | 2649 | 17.28 |
| $T_6$: Hand weeding at 20 and 40 DAS | 2515 | 2829 | 17.65 |
| $T_7$: Weedy Check | 1659 | 1947 | 16.15 |
| $T_8$: Weed Free | 2907 | 3296 | 19.60 |
| S.E.± | 81.15 | 70.62 | 0.50 |
| C.D. at 5 % | 246.15 | 214.21 | 1.52 |

recorded significantly higher grain yield (2821 Kg $ha^{-1}$) which was found at par with Quizalofop-p-ethyl (POE) @ 40 a.i. g $ha^{-1}$, Metribuzin @1.0 kg $ha^{-1}$ and it was found significantly superior over the rest of chemical weed control treatment and weedy check The mean hundred seed weight was influenced significantly due to various weed control treatments. Thus, the effective weed control achieved in the earlier mentioned treatments resulted in enhancing various growth and yield attributing characters of chickpea and finally gave significantly higher gram a straw yield over weedy check, similar trend was observed by Vijay laxmi et al. [5], Kumar et al. [6], Kaushik et al. [7]. This might be due to lowest weed competition particularly during early crop growth and moreover it may be attributed to maximum utilization of soil moisture and nutrients and their diversion for increasing growth of plant particularly in plant height. These results are in conformity with the findings of Suijit Singh et al. (2003) and Ratnam et al. (2011).As regards chemical weed control methods, treatment Pendimethalin @ 1.0 kg ha-1 was found better and plots treated with Pendimethalin @ 1.0 kg ha-1 significantly produced taller plants than rest of the herbicide applied plots whereas it was found at par with Quizalofop-p-ethyl @ 40 a.i. g ha-1 and found significantly superior over rest of chemical weed control methods [8-11].

## 4. CONCLUSION

Based on the experimental findings one season of data following broad conclusions could be drawn. The mechanical methods i.e., Weed free were proved equally effective in controlling weeds and improving the growth and yield of chickpea as compared to Weedy check. Among various pre-emergence chemical weed control treatments Pendimethalin @1.0 kg $ha^{-1}$ was proved equally effective in controlling the weeds and improving the growth and yield of chickpea as compared to other chemical weed control treatments and Weedy check. Among various post-emergence chemical weed control treatments Quizalofop-p-ethyl @ 40 a.i. g $ha^{-1}$ were found effective in controlling grassy weeds and improving the growth and yield of chickpea crop as compared to Weedy check.

## COMPETING INTERESTS

Authors have declared that no competing interests exist

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