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IMPACT OF DIFFERENT HERBICIDES APPLICATION ON GROWTH AND YIELD OF CHICKPEA

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ABSTRACT

An agronomic investigation on Impact of herbicides on growth and yield of chickpea under late sowing conditions was conducted during Rabi 2019-20 at Doon PG College of Agriculture Science and Technology, Selaqui, Dehradun. To study the Impact of different herbicides on growth and yield of chickpea. 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.

***Key words*:** Chickpea, Weed Management, Herbicides, Efficacy

Introduction

Cicer arietinum L., the scientific name for chickpea, is an important grain legume that is grown in 44 countries on five continents. With around 75% of the world's production coming from there, India is the leading producer of chickpeas worldwide. The main Indian states that grow chickpeas on a large scale include Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Bihar, Karnataka, and Madhya Pradesh. In advanced countries, the grains are sold in markets dry or canned for common use in soups, vegetable combinations or as component of fresh salads. The grains are also used as vegetable (Chhole). Gram flour is mixed with wheat flour to increase the protein content of wheat flour and is used in making missi roti. The flour of dehusked gram called 'besan' is widely used in making pakoras, kadhi, namkeens and several snack foods. Chickpea also forms a good source of livestock feed. The experiment's goal was to evaluate the impact of herbicides on chickpea growth and yield. Gram (*Cicer arietinum L.*) is one of the most important pulse *(Rabi)* crop grown in the rainfed farming system throughout India. It is used for human consumption as well as animal feeding. It is eaten both whole fried or boiled and salted or more generally in the form of split pulse which is cooked and eaten. Both husks and bits of the dal are valuable cattle feed. Fresh green leaves are used for vegetable. Gram flour is used for preparing various types of sweets. It also has medicinal value. It contains 21.1 per cent protein, 61.5 per cent carbohydrates, 4.55 per cent fat besides rich in Ca, Fe, niacin. Its leaves secrete malic acid (90-95 per cent) and oxalic acid (5 to 10 per cent), which have medicinal importance against stomach ache, intestinal disorder and blood purification. The use

of appropriate herbicides can eliminate this early weed competition and prevent yield losses Herbicides are selective, cost effective, and easy to apply, and offer flexibility in application time. (Hoseiny *et al.*, 2011). When properly used, pre-emergence herbicides accomplish effective and economic weed control, and consequently chickpea seed yields as similar to or only slightly smaller than those of weed free treatments are resulted (Gul Hassan *et al.*, 2007). In the pulse crops especially in case of chickpea Pendimethalin at 1000 g ha^{-1} applied as pre-emergence is a very common herbicide which is used to control all type of weeds, but there is no herbicide available to be applied as post-emergence to control the emerging broad leaf weeds effectively (Dubey, Santosh Kumar *et al.*, 2018). Chickpea, being slow in its early growth and short stature plant, is highly susceptible to weed competition and often considerable losses may occur if weeds are not controlled at proper time and integrated weed management practices can be achieved by application of herbicides and hoeing twice at 20 and 40 days after the crop germination (Sunil, C.M. *et al.*, 2011).

Material and Methods

Site Specifications

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. Farm Situated at Latitude and longitude 30.3591° N, 77.8442° E.

Treatment Details

The experiment consisting of 8 treatments was laid out in a Randomized block design with 3 replications and treatments are T_1: Pendimethalin @ 1.0 kg ha^{-1} (Preemergence), T_2: Metribuzin @ 1.0 kg ha^{-1} (Pre Plant injection), T_3: Quizalofop – ethyl @ 0.04 kg ha^{-1} (35-40 DAS), T_4: Clodinafop @ 0.060 kg ha^{-1}(40 DAS), T_5: Pinoxadan @0.0050 $mlha^{-1}$(40DAS), T_6: Hand weeding @ (20, 40) DAS, T_7: Weed check and T_8: Weed free.

Soil Sample analysis

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).

Weather conditions

The weather condition during experiment was weekly maximum and minimum temperature ranged from 19.01°C to 35.86°C. A total of 24.86 mm rainfall was received during the crop season. The mean weekly sunshine ranged from 1.00 hrs to 9.00 hrs during the crop season. The climate was favourable for the growth and development of the crop.

Land Preparation and Fertilizer application

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 seed bed for sowing keeping a seed rate of 80 kg ha^{-1}. Nitrogen and phosphorus were applied through DAP (di-ammonium 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 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.

Results and Discussion

Plant height (cm)

The data pertaining to Plant height (cm) reveals application of Pendimethal in @1.0 kg ha^{-1} recorded

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: Weight of Pods Plant^{-1} (g) and Number of Seeds pod^{-1} of chickpea by various treatments.

Treatments	Weight of Pods Plant^{-1}(g)	Number of Seeds pod^{-1}
T1: Pendimethalin@1.0 kgha^{-1}	20.07	1.62
T_2: Metribuzin @1.0 kgha^{-1}	18.72	1.45
T_3: Quizalofop-p-ethyl @40a.i.gha^{-1}	19.42	1.51
T_4: Clodinafop @0.060 kgha^{-1}	14.49	0.97
T_5: Pinoxadan @0.005 kgha^{-1}	15.49	1.14
T_6: Hand weeding at 20 and 40 DAS	16.87	1.32
T_7: Weedy Check	13.3	0.84
T_8: Weed Free	21.49	1.74
S.E.±	0.47	0.07
C.D. at 5 %	1.43	0.2

Table 3: Grain Yield (kg ha^{-1}), Straw Yield (kg ha^{-1}) of Chickpea by Various Treatments.

Treatments	Grain yield (kgha^{-1})	Straw yield (kgha^{-1})
T1:Pendimethalin@1.0kgha^{-1}	2821	3101
T_2: Metribuzin @1.0kgha^{-1}	2676	2907
T_3:Quizalofop-p-ethyl@40a.i.gha^{-1}	2730	3023
T_4:Clodinafop @0.060 kgha^{-1}	2207	2517
T_5: Pinoxadan @0.005 kgha^{-1}	2323	2649
T_6:Hand weedingat 20 and 40 DAS	2515	2829
T_7: Weedy Check	1659	1947
T_8:Weed Free	2907	3296
S.E.±	81.15	70.62
C.D.at 5 %	246.15	214.21

significantly higher plant height over rest of the chemical treatments except at 30 DAS it was found at par with Quizalofop-p-ethyl @ 40 a.i. g ha^{-1}, Metribuzin @1.0 kg ha^{-1} and Hand weeding at 20 and 40 DAS and 60 DAS and at harvest whereas it was at par with Pendimethalin @1.0 kg ha^{-1} and significantly superior over rest of treatmentsare presented in Table 1. The increase in plant height was attributed to the weed free environment at initial stage of crop growth and availability of nutrients to crop with the pre-emergence application of various herbicides (Singh *et al.*, 2014 and Bankoti, Priyanka *et al.*, 2021).

Dry matter accumulation plant^{-1}

The data pertaining to dry matter accumulation plant^{-1} reveals application of Pendimethalin @1.0 kg ha^{-1} produced significantly highest dry matter per plant at all the stages of observations over rest of the chemical treatments and even weedy check but it was at par with Quizalofop-p-ethyl @ 40 a.i. G ha^{-1}, Metribuzin @1.0 kg ha^{-1}, at 30 DAS and 60 das are presented in Table 1. This might be because Pendimethalin, which kills weeds by deterring cell division and elongation, has a broad spectrum of activity (Das *et al.*, 2015).

Weight of pods plant^{-1}

The data pertaining to weight of pods plant^{-1} reveals that the weed free situation *i.e.* weed free (21.49 g) recorded significantly higher weight of pods plant^{-1} than rest of the treatments, data are presented in Table 2. However, it was found at par with pre emergence application of Pendimethalin @1.0 kg ha^{-1}. The significantly lowest weight of pods plant^{-1} was recorded in unweeded control *i.e.* weedy check (13.30 g). The better initial growth promoted flowering and higher pod production because of timely supply of resources might have reduced shedding of flowers and pods (Yadav *et al.*, 2019).

Number of seeds pod^{-1}

The data pertaining to seeds pod^{-1} reveals the number of seeds pod^{-1} as influenced by different weed control treatments are presented in Table 2. The significantly higher number of seeds pod^{-1} was observed in weed free (1.74 g) situation. Whereas it was found at par with Pendimethalin @ 1.0 kg ha^{-1} and it was found superior over rest of weed control treatments and weedy check as regards chemical weed control treatments the significantly higher number of seeds pod^{-1} was observed in Pendimethalin @ 1.0 kg ha^{-1} than rest of the herbicidal treatments and weedy check. However, it was found at par with Quizalofop-p-ethyl @ 40 a.i. G ha^{-1} and Metribuzin @1.0 kg ha^{-1}. The results found in the present study were also supported the findings of Singh *et al.*, (2014), Chandrakar *et al.*, (2015) and Singh and Jain (2017).

Grain yield/ Straw yield (kg ha^{-1})

The data pertaining to grain yield and straw yield reveals application of Pendimethalin @1.0 kg ha^{-1} 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} the application of Pendimethalin@1.0 kg ha^{-1} recorded significantly higher straw yield (3023 kg ha^{-1}) among chemical weed control treatments where it was found at par with Quizalofop-p-ethyl (POE) @ 40 a.i. g ha^{-1}, Metribuzin @1.0 kg ha^{-1}and significantly superior over rest of weedy check are presented in Table 3. Similar results had also been reported by Ratnam and Reddy (2011), Pedde *et al.*, (2013) and Rathod *et al.*, (2017).

Conclusion

The findings of the present study highlights among various pre-emergence chemical weed control treatments Pendimethalin @1.0kg 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 $ha^{-1}$was found effective in controlling grassy weeds and improving growth and yield of chickpea crop as compared to Weedy check.

Thus, it can be concluded that in the event of shortage of labour, pre emergence application of Pendimethalin @1.0 kg ha^{-1} will be helpful in reducing the weed competition, increasing the yield and the net monetary returns of the chickpea crop.

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