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Studies on the Effect of Land Configuration & Weed Management Practices on Different Growth & Yield Parameters of Rabi Planted Chickpea (*Cicerarietinum*)

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Abstract: ***Chickpea is most popular cereal crop in the world due to its nutritive value. Further it takes very less time to cultivate as compare to all other cereal crops. There are lots of factors which affect the production yield of chickpea. However, most of the factors could be managed by growers but managing of all factors at same time is a tedious job for any of the grower. Here, we studied the effect of land configuration & weed management practices on different growth & yield parameters of rabi planted Chickpea (Cicerarietinum)***

Keywords: Chickpea (Cicerarietinum); yield; growth; weed management & Land configuration

1. Introduction

Chickpea, botanically known as *Cicerarietinum*, is one of the most important Rabi legume crop.There is strong evidence that chickpeas were first cultivated in the Middle East a staggering 7500 years BC. The popularity of the chickpea quickly spread all over the world, and they were soon grown and consumed in many ancient civilisations such as Egypt, Greece and Rome. In India, lentil is mostly grown in northern plains, central and eastern parts of the country. The major lentil producing states are Madhya Pradesh, Uttar Pradesh, Bihar, Uttarakhand and Bengal. It is mainly grown for its edible seed which matures between 125 to 135 days. India is the world's number one leader in chickpea production, with a staggering 8,832,500 metric tons reportedly produced in 2013.

Chickpea is the important world legume crop providing more plant protein than cereals. Chickpea is a source of protein to communities preferring vegetable protein in their diet Inclusion of legume in the cropping system plays an important role of sustainable agriculture .Chickpea has unique ability of biological nitrogen fixation, deep root system, mobilization of insoluble nutrients. Chickpea improves physical, chemical and biological environment of soil, It can arrest the declining trend in productivity of cereal-cereal cropping system. This crop has emerged as a viable option to improve soil health, conserve the natural resources and sustain the agriculture productivity.

Chickpea is the most important winter legume cultivated in India. It contributes 47% of total pulse production and about 40% of pulse growing area in the country. India accounts for over 60% of global chickpea (Cicerarietinum L.) production.

In India, it is grown on an area of about 8.16 million ha. with an annual production of 7.47 million tones and an average productivity of 895 kg/ha. In the country Madhya Pradesh is the largest producer of chickpea, which covers 3085.5 thousand hectares area and the total annual production of 3304.1 thousand tones with an average productivity of 972 kg/ha. (Chickpeas are a great source of both soluble and dietary fibre, important for maintaining a healthy digestive system. Soluble fibre may assist with reducing the absorption of cholesterol into the bloodstream and helps maintain blood sugar levels, which may help to reduce the risk of developing heart disease and also aid in managing diabetes. The dietary fibre in chickpeas and their low glycemic index (GI) may also assist with weight loss by making you feel fuller for longer. Chickpea is rich in many valuable components with its high nutritive value. It is composed of approx 63% of carbohydrates, 29% of protein, 8% of iron, 2% of sugars and 0.87 of thiamine (vitamin B1), 5 % fiber, 3% ash and 4186 kcal/kg of gross energy . Chickpea helps in improving soil texture and soil fertility and conserve natural resources providing long term sustainability in agricultural productivity. It utilizes limited soil moisture and nutrients more efficiently than cereal crop thus it can grow under highly adverse conditions.

2. Materials and Methods

The field experiment was conducted at Shri Guru Ram Rai (PG) College, Dehradun, Uttarakhand, during ***rabi*** season of 2018. The soil of the experimental field was 'sandy loam' with characteristics as deep, well- drained, coarse loamy cover over fragmental soils and of medium fertility. Starter dose of 20 kg N2 and 55 kg P2O5 per ha has been applied in all experimental plots uniformly. Sowing of Chickpea "L-144" was done on November 5, 2018. The experiment designed as two land configuration treatments i.e., Flat Bed Method and Raised Bed Method in main plot and four weed management treatments i.e., weedy (control), Pendimethalin @ 1.0 kg/ha as PE, imazethapyr 52 g/ha as PoE at 20 DAS and pendimethalin 1.0 kg/ha as PE + imazethapyr 52 g/ha as PoE at 20 DAS laid out in split plot design with three replications. Weed samples were collected by placing a quadrate (50 cm x 50 cm) randomly at two places in each plot. The observations taken at 30, 45, 60 & 75 DAS and crop harvest were compared and analysed. Weed control efficiency (WCE) was calculated according to the standard

formula (Mani *et al.* 1981). Growth and yield parameters were calculated by using standard formula (Donald C.M., 1962).

3. Results and Discussion

The major weed species identified in the experimental field were *Chenopodium album* and *Melilotusalba*. The weed species were correlated with the observations found by Tamang *et al.*, (2015).

3.1 Effect of different treatments on weed dynamics

1) Total weed density and total weed dry matter accumulation:

Experimental results revealed that crop establishment methods *i.e.*, flat bed method and raised bed method have non-significant effect on the total weed density and total weed dry matter accumulation of weeds at 60 days after sowing. Highest total weed density and total weed dry matter accumulation weeds was recorded in the uncontrolled weedy check which was significantly higher than imazethapyr 10 SL @ 52 g/ha P0E, 20 DAS followed by pendimethalin 30 EC @ 1.0 kg /ha PE followed by pendimethalin 30 EC @ 1.0 kg /ha PE + imazethapyr 10 SL @ 52 g/ha POE, 20 DAS respectively. Pre emergence application of pendimethalin 30 EC @1.0kg/ha + post emergence application of imazethapyr 10SL @52g/ha 20 DAS) caused significant reduction in total weed density than other treatments at all the stages of crop growth. Pendimethalin 30 EC @ 1 kg/ha, PE remained at par with imazethapyr @52g/ha, PoE applied at 20 DAS with respect to total weed reduction at all the growth stages.

The highest total weed density 10.2 and 14.2 No/m2 and dry matter accumulation 7.9 and 14.7 g/m2 were recorded in weedy check, whereas lowest total weed density 5.4 and 7.3 No./m2 and dry matter accumulation 4.3 and 8.1 g/m2 at 30 and 60 DAS were recorded in pendimethalin 30 EC @ 1.0 kg /ha PE + Imazethapyr 10SL @ 52g/ha P0E, 20 DAS). The long lasting effects and weed control efficiency of imazethapyr in reducing weed dry matter might be due to broad spectrum activity of herbicides particularly on established plants of both narrow and broadleaved weeds

The large dry biomass production in weaker treatments were due to ineffective suppression of weeds at their initial and active growth stages leading to maturity and fair dry matter accumulation (Table-1).

2) Weed control efficiency

Weed control efficiency (WCE) differed significantly due to under different weed management practices. The highest weed control efficiency (69.5%) was obtained with pre emergence application of 30 EC @1.0kg/ha + post emergence application of imazethapyr 10SL @52g/ha at 20 DAS. Weed control efficiency calculated under pre emergence application of 30 EC @1.0 kg/ha and imazethapyr were 43.5% and 31.89% respectively (Table-1). No interaction was observed between the crop established methods and weed management practices.

3.2 Effect of different treatments on crop growth dynamics

A perusal on pooled data showed that there was non-significant difference between different crop establishment methods with respect to growth parameters and yield attributing characters of Chickpea.

1) Number of branches

The number of branches of Chickpea plant was not affected by different establishment methods significantly at all the growth stages of crop. However, more number of branches was observed in raised bed method as compared to flat bed methods.

A significant difference in number of branches per plant was recorded due to different weed management practices at all the growth stages of crop. Pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha + post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS being at par with pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha recorded significantly higher number of branches per plant than other treatments at all the growth stages of crop. This may be attributed to better crop growth environment along with less crop weed competition in these treatments than weedy check (Table-2).

2) Number of nodules

Both establishment methods (Flat bed and Raised bed methods) were unable to bring significant number of nodules per plant at 30 DAS. However, at 45 and 60 DAS stage raised bed planting out produced nodules over flat bed. Highest nodules were recorded under raised bed method than flat bed method among the land configuration treatments.

Among the weed management methods, number of nodules per plant was not significantly affected at 30 and 60 DAS stage. At 45 DAS stage, pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha + post emergence application of imazethapyr 10 SL @52g/ha PoE at 20 DAS being at par with pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha and post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS resulted significantly higher number of nodules per plant than weedy check which had the least number of nodules per plant than all other treatments.

Pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha + post emergence application of imazethapyr 10 SL @52g/ha PoE at 20 DAS had increased number of nodules per plant over weedy check by a margin of 11.6% at 45 DAS respectively (Table-2).

3) Number of pods per plant

In pulse crops number of pods/m2 is the most important determinant of grain or seed yield. The number of pods/m2, which normally gives a more reliable or accurate picture and contributing most in determining the yield, is presented here as main yield component. The number of pods per plant in Chickpea was affected significantly by different establishment methods. Raised bed method of planting in lentil resulted in significantly higher number pods than flat

bed. Raised bed planting increased the number of pods/plant by a margin of 26 per cent over flat bed.

The number of pods per plant was affected significantly by different weed management practices. Among the different weed management practices, the maximum number of pods per plant counted was in pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha + post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS which was significantly higher than other treatments. The lowest number of pods per plant was found in weedy check which was significantly lower than other treatments (Table-2).

3.3 Effect of different treatments on grain yield and economics *1- Grain yield per hectare:*

The grain yield per hectare was not affected significantly by different methods of planting (Kumar *et al.*, 2004). Though, grain yield per hectare was higher in raised bed method of planting than that of flat bed. Raised bed method increased grain yield by 7.8 per cent over flat bed.

Grain yield per hectare was affected significantly by Different weed management practices. Pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha + post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS resulted in highest grain yield (1416 kg/ha).The lowest grain yield/ha was recorded in weedy check (441 kg/ha). The difference in grain yield obtained under pre emergence application of pendimethalin 30 EC @ 1.0 kg/ha and post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS was non significant. Although, pre emergence application of pendimethalin 30 EC @1 kg/ha resulted in higher grain yield/ha than post emergence application of imazethapyr 10 SL @52g/ha when applied at 20 DAS (Table-2).

1) Economic analysis

Raised bed method of planting resulted in higher cost of cultivation over flat bed method of planting (Veeraputhiran 2009). Both the land configuration treatments i.e. flat bed and raised bed recorded almost the same monetary returns and B: C ratio (1.35 and 1.41).

Among different weed management practices, Pendimethalin 30 EC @ 1.0 kg/ha PE + imazethapyr 10 SL @52g/ha PoE at 20 DAS resulted in the highest cost of cultivation while cost of cultivation in weedy check is lowest. Pre emeregence application of Pendimethalin 30 EC @ 1.0 kg/ha costs higher as compared to post emergence application of imazethapyr 10 SL @52g/ha at 20 DAS. The highest B: C ratio in pre emergence application of pendimethalin @ 1.0kg/ha and post-emergence application of imazethapyr 10SL @52g/ha at 20 DAS (B:C ratio-2.20)was due to higher grain and straw yield which resulted in the highest gross return and net return than the other treatments and cost of cultivation was not higher in proportionate to that of gross return (Table-1).

4. Conclusion

On the basis of experiment findings, it may be concluded that raised bed planting though was statistically at par to flat bed but it better performed than that flat bed. Though it was not much beneficial in *rabi* season of Dehradun climate but have the potential to perform well and mitigating the stresses than that of flat bed. As raised bed also resulted in high B:C ratio, we can recommend it to the farming community.

Among weed management practices pre emergence application of pendimethalin @1.0kg/ha+ post emergence application of imazethapyr 10SL @52g/ha at 20 DAS gave best result. So, imazethapyr 10SL @52g/ha at 20 DAS may be better alternate option of manual weeding at later stages of Chickpea.

Since, these findings are based on the result of one season data, investigation need to be repeated in future for validation and recommendation to farming community.

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Table 1: Effect of land configuration and weed management on weed dynamics and economic of chickpea

Treatment	Weed density (No./m2)		Weed dry matter (g/m2)		WCE (%)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B : C ratio
	30 DAS	60 DAS	30 DAS	60 DAS				
A. Land configuration								
*FB	8.4	10.8	6	11.8	36.12	30587	39735	1.3
**RB	7.6	10.2	5.9	10.8	35.95	31387	42401	1.35
S.E m ±	0.4	0.3	0.05	0.5	-	-	-	-
C.D at (5%)	NS	NS	0.5	NS	-	-	-	-
B. Weed Management Practice								
Weedy	8.2	11.8	7.2	11	-	28690	11848	0.41
Pendimethalin 30EC @ 1.0 kg /ha PE	7.2	10.5	6.4	9.9	43.37	31355	55060	1.75
Imazethapyr 10 SL @ 52 POE, 20DAS	7.6	11	6.9	10.6	31.69	30620	39085	1.27
Pendi. + Imaz.	6.7	9.8	5.8	9.5	69.30	33285	67257	2.02
S.E m ±	0.3	0.4	0.30	0.33	-	-	-	-
C.D at (5%)	0.9	1.2	0.80	0.94	-	-	-	-

*FB: Flat Bed Method; **RB: Raised Bed Method

Table 2: Effect of land configuration and weed management on crop growth dynamics of Chickpea

Treatment	No. of Branches at 60 DAS	No. of nodules/plant at 60 DAS	Plant Height (cm)	No. of pods/plant	No. of grains/pod	Grain Yield (kg/ha)
A. Land configuration						
*FB	6.2	23.6	39.8	21.8	6.2	978
**RB	7.2	24.0	41.8	22.6	6.6	1088
S.E m ±	0.5	0.2	1.0	0.4	0.2	55
C.D at (5%)	NS	1.2	0.7	2.6	NS	NS
B. Weed Management Practice						
Weedy	3.6	21.0	42.8	22.4	5.1	796
Pendimethalin 30EC @ 1.0 kg /ha PE	6.8	25.2	41	25.4	6.9	1099
Imazethapyr 10 SL @ 52 POE, 20DAS	5.4	24.7	40.4	24.2	7.3	994
Pendi. + Imaz.	7.2	27.8	39.2	28	7.9	1155
S.E m ±	0.76	1.40	0.75	1.17	0.60	79
C.D at (5%)	2.2	NS	0.3	3.2	NS	248

*FB: Flat Bed Method; **RB: Raised Bed Method