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# Effect of Sowing Methods and Weed Management Practiced on Growth, Yield, Weed Flora and Nutrient Uptake on Late Sown Chickpea

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## ABSTRACT

Chickpea is highly sensitive crop to weed competition as early stage of growth. In the light of fragmental information available on the response of application of sequential application of herbicides under different sowing methods, a field experiment was conducted during winter season of 2013-14 to 2015-16. Results revealed that chickpea sowing in reduced tillage performed better and produced higher number of pods per plant, seed yield, protein yield and nutrient uptake over conventional tillage. In weed management treatment, sequential application of pendimethalin@0.75 kg a.i./ha pre-emergence followed by imezethapyr @40g a.i./ha post-emergence improve the crop growth and produced higher seed yield (1515 kg/ha), protein yield and nutrient uptake. Weed density and weed dry weight of different species were recorded minimum under reduced tillage at both 30 and 60 days after sowing. Application of pendimethalin @0.75kg a.i./ha pre-emergence followed by imezethapyr @40g a.i./ha post-emergence reduced theweed density and weed dry weight over other treatments and recorded minimum. Weed control efficiency recorded higher with conventional tillage (70.04%) and closely followed by reduced tillage (70.81%). Pendimethalin@0.75kg a.i./ha pre-emergence fbimazethapyr @ 40g a.i./ha post-emergence recorded highest weed control efficiency (92.93%).

**Key Words:** Chickpea, Economics, Growth, Weed management, Yield.

## INTRODUCTION

Chickpea or gram (*Cicer arietinum*)is an important pulse crop of the semi-arid tropics, particularly in the rainfed ecology of the Indian sub-continent. The daily per caput availability of 14g chickpea is a source of approximately 2.3% (56kcal) energy and 4.7% (2.7g) protein to Indian population besides, being an important source of calcium and Iron (10-12%).Chickpea being slow in its early growth and short stature plant is poor competitor to weeds, especially during initial growth period suffers 17-85 percent yield loss depending upon the nature and intensity of weed flora and management practices (Singh *et al*, 2014).Weed management in chickpea at initial stage of crop growth is important since crop-weed competition is higher at this stage (Chouhan*et al,* 2018). Among all the agronomic practices sowing method assumes the great significance as it brings considerable change in plant environment with respect of spacing, light and availability of soil moisture and consequently influences the crop-weed competition and crop productivity (Bhargav *et al,* 2018). In southern part of Bihar, manual weeding is the most common method of weed management (Singh, 2018). However, this conventional method of weed control in chickpea is time consuming, expensive and laborious. Therefore, it is more favourable to use herbicides due to non-availability of human labour resource during peak crop season.

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Pendimethalin at 1.0kg/ha as pre-emergence is the most common herbicide used in chickpea. There is a need of post-emergence herbicide to control the second flush of weeds in chickpea and to reduce human labour. Recently some of the post-emergence herbicides such as imazethapyrand quizalofop ethyl have been found effective in controlling weeds in pulses. Keeping in view these facts, the present investigation was undertaken to test the performance of sowing method and post-emergence herbicide in combination with pre-emergence herbicides for providing effective weed control in chickpea.

## MATERIALS AND METHODS

A field experiment was conducted during winter season2013-14 to 2015-16, at the Research farm(25˚34'6.33"N, 83˚59'0.18" E and 63 m above sea level) of KrishiVigyan Kendra (ICAR Research Complex for Eastern Region), Buxar.The soil of experimental site was sandy clay loam in texture with neutral in reaction (pH-7.2). It was low in organic C (0.33%) and available nitrogen (168.9kg/ha), medium in available phosphorus (26.6kg/ha) and potassium (242.5kg/ha) in soil surface. The field was kept under rice - wheat cropping system for the last five years. The experiment was laid out in split plot design with two sowing methods *viz.,* $S_1$- reduced tillage(sowing was done by zero-till seed cum fertilizer drill after two tillage operation by cultivator), $S_2$- conventional tillage and five weed management practices *viz.,* $W_1$- weedy, $W_2$- weed free, $W_3$- pendimethalin 1.0kg/ha pre-emergence, $W_4$- pendimethalin0.75kg ai/ha pre emergence fbimazethapyr (40g ai/ha) at 25 DAS post-emergence and $W_5$-pendimethalin0.75kg ai/ha pre-emergencefbquizalofop-ethyl 50g ai/ha at 25 DAS post-emergence.The chickpea variety KWR 108used for test crop. Seed was sown on first week of December in each year. Herbicides were applied as per treatments with hand sprayer fitted with flat-fan nozzle and the spray volume was 500 l/ha. Density (no/$m^2$) and dry weight (g/$m^2$) of weeds were recorded at different stages of weed growth. Weed and crop samples were analyzed for nutrient concentration as per the standard procedure. Nutrient uptake (kg/ha) were calculated by multiplying their nutrient concentration with weed biomass and crop yield.

## RESULTS AND DISCUSSION

### Effect on crop

The number of branches, number of nodules/plant, nodule dry weight/plant, 100 seed weight and protein content were not significantly influenced by sowing method (Table 1). Number of pods per plant was recorded highest (72.64) with reduced tillage and significantly superior over conventional tillage sowing of chickpea (67.42). Seed yield (1382 kg/ha), stover yield (3021 kg/ha), protein yield (290 kg/ha) and nutrient uptake was associated highest with reduced tillage and super imposed over conventional tillage. It could be ascribed due to reduced tillage enhanced the seed germination and more absorption of light; proper spacing between row to row and plant to plant suppress the weed population and better crop growth resulting more number of pods/plant led higher seed, stover, protein yield and nutrient uptake (Mishra *et al*, 2012).Amongst weed management practices no of branches/plant and number of nodules/plant, nodule dry weight were recorded highest with $W_5$. Number of pods/plant (80.30) and 100 seed weight (23.6 g)recorded highest under $W_4$ over other weed management practice, except $W_5$. Protein content in chickpea grain was not influenced by any weed management practices. Minimum pod/plant was recorded with weedy check. Weed management treatment showed marked improved in seed yield and maximum seed yield (1515 kg/ha) was recorded under $W_4$.This result can be attributed due to marked improvement in yield attributes and better weed control efficiency. The minimum grain yield was recorded in weedy check which was attributed due to more weed growth and poor yield attributes formations. Results were in agreement with the findings of Singh *et al*(2014) and Singh (2016).

**Table 1. Effect of sowing method and weed management on growth, nodulation, yield attributes, yield, nutrient uptake and weed control efficiency of chickpea (Pooled data over 3 years).**

| Treatment | No of branches/ plant | No of nodules/ plant | Nodule dry weight/ plant | No of pods/ plant | 100 seed weight (g) | Seed yield (kg/ha) | Protein content (%) | Protein yield (kg/ ha) | Total nutrient uptake by crop (kg/ha) | | | Nutrient uptake by weeds (kg/ha) | | | Weed control efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | N | P | K | N | P | K | |
| Sowing method | | | | | | | | | | | | | | | |
| $S_1$ | 21 | 25 | 22 | 73 | 24 | 1382 | 21 | 290 | 81 | 17 | 28 | 2.6 | 0.5 | 1.9 | 70 |
| $S_2$ | 20 | 26 | 21 | 67 | 23 | 1174 | 21 | 245 | 70 | 14 | 23 | 2.7 | 0.6 | 2.1 | 70 |
| CD (P=0.05) | NS | NS | NS | 4 | NS | 68 | NS | 14 | 4 | 1 | 1 | 0.1 | 0.03 | 0.1 | |
| Weed management | | | | | | | | | | | | | | | |
| $W_1$ | 12 | 13 | 11 | 38 | 22 | 619 | 20 | 129 | 35 | 7 | 11 | 9.0 | 1.9 | 6.7 | 0 |
| $W_2$ | 25 | 33 | 30 | 84 | 24 | 1572 | 22 | 336 | 94 | 20 | 32 | 0.0 | 0.0 | 0.0 | 100 |
| $W_3$ | 19 | 25 | 22 | 71 | 23 | 1213 | 21 | 246 | 71 | 15 | 23 | 2.3 | 0.5 | 1.8 | 74 |
| $W_4$ | 23 | 28 | 24 | 77 | 24 | 1515 | 21 | 316 | 89 | 19 | 29 | 0.6 | 0.1 | 0.5 | 93 |
| $W_5$ | 24 | 30 | 25 | 80 | 23 | 1469 | 21 | 309 | 88 | 19 | 30 | 1.3 | 0.3 | 1.0 | 85 |
| CD (P=0.05) | 1 | 1 | 1 | 3 | 1 | 65 | NS | 14 | 4 | 1 | 1 | 0.2 | 0.1 | 0.2 | |

**Table 2. Effect of sowing method and weed management on weed density of different weed flora (Pooled data over 3 years).**

| Treatment | Density of *Phalaris minor* | | Density of *Avena ludoviciana* | | Density of *Cynodon dactylon* | | Density of *Chenopodium album* | | Density of *Rumex retroflexus* | | Density of *Anagalis arvensis* | | Density of *Vicia sativa* | | Density of other weeds | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| Sowing method | | | | | | | | | | | | | | | | |
| $S_1$ | 3 | 4 | 2 | 3 | 3 | 3 | 10 | 11 | 6 | 8 | 1 | 3 | 10 | 11 | 5 | 6 |
| $S_2$ | 5 | 6 | 3 | 2 | 2 | 2 | 11 | 11 | 8 | 8 | 2 | 2 | 12 | 14 | 6 | 7 |
| CD (P=0.05) | 0.2 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.5 | NS | 0.4 | NS | 0.1 | 0.1 | 0.5 | 0.6 | 0.2 | 0.3 |
| Weed management | | | | | | | | | | | | | | | | |
| $W_1$ | 14 | 17 | 6 | 7 | 5 | 7 | 38 | 43 | 24 | 26 | 5 | 7 | 36 | 42 | 17 | 21 |
| $W_2$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $W_3$ | 3 | 4 | 3 | 2 | 2 | 3 | 11 | 9 | 7 | 8 | 3 | 4 | 11 | 13 | 5 | 6 |
| $W_4$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 2 | 2 |
| $W_5$ | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 5 | 5 | 4 | 2 | 2 | 6 | 6 | 3 | 4. |
| CD (P=0.05) | 0.4 | 0.4 | 0.2 | 0.2 | 0.1 | 0.2 | 0.9 | 1.0 | 0.6 | 0.6 | 0.1 | 0.2 | 0.9 | 1.0 | 0.4 | 0.5 |

A-30 DAS, B-60 DAS

**Table 3.Effect of sowing method and weed management on weed dry weight of different weed flora (Pooled data over 3 years).**

| Treatment | **Dry weight of *Phalaris minor*** | | **Dry weight of *Avena ludoviciana*** | | **Dry weight of *Cynodon dactylon*** | | **Dry weight of *Chenopodium album*** | | **Dry weight of *Rumex retroflexus*** | | **Dry weight of *Anagalisa rvensis*** | | **Dry weight of *Vicia sativa*** | | **Dry weight of other weeds** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B | A | B | A | B | A | B |
| Sowing method | | | | | | | | | | | | | | | | |
| $S_1$ | 1 | 2 | 0.4 | 2 | 0.4 | 2 | 3. | 6 | 2 | 5 | 0.2 | 0.8 | 2 | 3 | 1 | 2 |
| $S_2$ | 2 | 3 | 0.6 | 1 | 0.2 | 1 | 4 | 6 | 3 | 6 | 0.4 | 1.0 | 3 | 4 | 1 | 3 |
| CD (P=0.05) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | NS | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | NS | 0.1 |
| Weed management | | | | | | | | | | | | | | | | |
| $W_1$ | 4 | 9 | 2 | 3 | 0.8 | 3 | 13 | 26 | 6 | 17 | 0.9 | 3 | 7 | 11 | 4 | 8 |
| $W_2$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| $W_3$ | 2 | 2 | 2 | 1 | 0.4 | 2 | 4 | 5 | 2 | 5 | 0.3 | 2 | 2 | 4 | 2 | 3 |
| $W_4$ | 1 | 1 | 1 | 0.5 | 0.1 | 0.4 | 0.4 | 1 | 0.4 | 1 | 0.1 | 0.4 | 0.4 | 0.5 | 0.3 | 0.5 |
| $W_5$ | 2 | 2 | 2 | 1 | 0.2 | 1 | 2 | 3 | 1 | 3 | 0.3 | 1 | 1 | 2 | 1 | 2 |
| CD (P=0.05) | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.6 | 0.1 | 0.4 | 0.1 | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 |

A-30 DAS, B-60 DAS

**Effect on weeds**

In the experimental plot eight weed species identified and grouped in grasses, sedges and broad leaved weeds. Composition of weed flora varies from sowing methods and weed management practices. In conventional tillage and weedy check plot percent weed population recorded was 10 *Phalaris minor*, 4 *Avena ludoviciana*, 4 *Cynodon dactylon*, 26 *Chenopodium album*, 15 *Rumex retroflexus*, 4 *Anagalis arvensis*, 25 *Vicia sativa* and 12 others.

Density of different weed species was influenced by different sowing methods. Maximum density of all types of weed flora recorded under conventional tillage except density of *Avena ludoviciana* at 60 DAS and *Cynodon dactylon* at both 30 and 60 DAS (Table 2). Among the weed management treatments, $W_4$was found very effective to controlling the density of different species of weed flora and super imposed over other weed management treatment. Dry weight of different weed species was recorded highest under crop sown by conventional method except dry weight of *Avena ludoviciana* at 60 DAS and *Cynodon dactylon* at both 30 and 60 DAS (Table 3). Among weed management practices, $W_4$was found effective to controlling the dry weight of weed flora. It could be ascribed due to fact that pendimethalin controlled the germination of initial flushes of weeds and imazethaypr controlled the grassy and broad leaved weeds emerged at later stages. Higher weed control and long lasting effects of imazethapyr in reducing density and weed dry matter might be primarily due to broad-spectrum activity of these herbicides particularly on both narrow and broad leaf weeds (Gupta *et al*, 2012).

Maximum weed control efficiency was recorded under conventional tillage (70.81%) closely followed by reduced tillage. Among weed management treatment $W_4$ (92.93%) recorded highest weed control efficiency followed by $W_5$ (85.41) and $W_3$ (73.78%). This is due to lesser number of weed germinate under this treatment (Singh *et al*, 2014).

## CONCLUSION

On the basis of above finding sowing of chickpea through reduced tillage enhanced the crop growth and suppresses the weed flora population and weight resulting crop produced higher seed, stove and protein yield and greater monetary return. Weed management treatment $W_4$-pendimethalin@ 0.75kg a.i./ha (pre-emergence) followed byimazethapyr@ 40g a.i./ha (post emergence)was found very effective for minimizing weed growth andmaximizing seed yield.

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