

## EFFECTS OF DIFFERENT PRE AND POST EMERGENCES HERBICIDE ON GROWTH, YIELD ATTRIBUTES, YIELD AND QUALITY OF CHICKPEA (*Cicer arietinum* L.)

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**Abstract:** A field experiment was conducted at Instructional Farm, Junagadh Agricultural University, Junagadh during the *rabi* season of 2015-16 to study the “Efficacy of pre and post emergence herbicides for weed management in chickpea (*Cicer arietinum* L.)”. Twelve weed management treatments comprising of T<sub>1</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS), T<sub>2</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS), T<sub>3</sub> (Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 20 DAS *fb* 1 HW at 40 DAS), T<sub>4</sub> (Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 20 DAS *fb* 1 HW at 40 DAS), T<sub>5</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS), T<sub>6</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS), T<sub>7</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS), T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS), T<sub>9</sub> (HW at 20 DAS), T<sub>10</sub> (Two HW at 20 and 40 DAS), T<sub>11</sub> (Weed free) and T<sub>12</sub> (Unweeded check) The results revealed that effective and economically viable weed management on growth, yield attributes, yield and quality of chickpea can be achieved by application of Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS. Alternatively, maintaining the crop weed free throughout crop growth period OR adopting Two HW at 20 and 40 DAS days after sowing can be employed according to availability of labourers.

**Keywords:** Chickpea, Herbicide, Hand weeding, Pre and Post emergence herbicide.

### Introduction

India is the largest producer of chickpea in the world. In India, chickpea or gram ranks 5<sup>th</sup> among grain crops, and is one of the most important pulse crop. In India and Pakistan, a chickpea is consumed locally, and about 56% of the crop is retained by growers. It accounts for 61% of the total area and 66% of total production in the world. In India chickpea represents 32% (6.42 M ha) of total pulse area and 49% (5.47 Mt) of total pulse production. (Nadarajan, 2011). In India, cultivated area of chickpea was 102.2 lakh ha and annual production was 98.8 lakh tones, productivity was 967 kg ha<sup>-1</sup>. In Gujarat cultivated area 1.36 lakh ha and annual production is 1.33 lakh, productivity of chickpea is 978 kg ha<sup>-1</sup> (Anon., 2015).

Simultaneous emergence and rapid growth of weed lead to severe weed-crop competition for light, moisture, space and nutrients resulting in drastic reduction in yield. Yield losses varied between 40 to 94 % (Bhan and Kukula, 1987). Another study shows that weeds cause 40-90 % seed yield losses in chickpea (Solh and Pala, 1990). Whish *et al.* (2002) narrated that loss in chickpea yield and yield components increased with increasing density of weeds. Even low weed densities of <10 plants m<sup>2</sup> caused large (approx 50%) reduction in yield and more yield losses in wider row spacing.

The field of chemical weed control is practically unexplored, particularly in Gujarat. The cultivators are not aware of proper doses of herbicides, time of application and their economics. Several selective herbicides are available in the market which is considered to be effective for particular crop. The farmers have to make decision about the selection of right type of herbicide.

Judicious use of herbicides in crop land, generally result in :- (1) Increase in crop yield. (2) Improvement in crop quality. (3) Reduction of production costs. Weed emergence with the *rabi* sown chickpea crop creates a severe competition unless controlled timely and effectively. Inter-row cultivation is not sufficient and inter-row hand weeding is necessary under most conditions. There is, therefore an urgent need to move from the costly manual mechanical weed control to chemical weed control. The present study was undertaken to see the efficacy of pre and post emergence herbicides and to find out the environment friendly, safe and economical herbicides to control weeds in chickpea.

## **MATERIALS AND METHODS**

The field experiment entitled “Efficacy of pre and post emergence herbicides for weed management in chickpea (*Cicer arietinum* L.)” was conducted during *rabi* season of the year 2015-16. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 8.0 and EC 0.56 dS m<sup>-1</sup>. The soil was low in available nitrogen (248 kg ha<sup>-1</sup>), high in available phosphorus (37 kg ha<sup>-1</sup>) and medium in available potash (272 kg ha<sup>-1</sup>). Twelve weed management treatments comprising of T<sub>1</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS), T<sub>2</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS), T<sub>3</sub> (Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 20 DAS *fb* 1 HW at 40 DAS), T<sub>4</sub> (Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 20 DAS *fb* 1 HW at 40 DAS), T<sub>5</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS), T<sub>6</sub> (Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS), T<sub>7</sub>

(Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS), T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS), T<sub>9</sub> (HW at 20 DAS), T<sub>10</sub> (Two HW at 20 and 40 DAS), T<sub>11</sub> (Weed free) and T<sub>12</sub> (Unweeded check) were tried under randomized block design with three replications. The pre-emergence applications of herbicides were applied after sowing and post-emergence at 20 and 40 DAS using water 500 l ha<sup>-1</sup>. The improved variety 'Chickpea GG-5' was sown at 45 cm row spacing by bullock drawn seed drill at third week of november. The fertilizer dose of 20-40 kg N-P<sub>2</sub>O<sub>5</sub>/ha in form of Urea and Diammonium Phosphate was applied to the crop just before sowing. Gap filling were carried out at 25-30 DAS to maintain intra-row spacing of 10 cm.

## RESULTS AND DISCUSSION

### 1. Growth parameters

The data on plant height recorded at 30, 60 DAS and at harvest are given in Table 1. At 30, 60 DAS and at harvest, maximum plant height was recorded under weed free (T<sub>11</sub>), but it was found statistically at par with treatments T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS) and T<sub>10</sub> (Two HW at 20 and 40 DAS). Minimum plant height was recorded under treatment T<sub>12</sub> (Unweeded control). At 60 DAS and at harvest, maximum number of branches per plant was recorded under weed free (T<sub>11</sub>), but it was found statistically at par with treatments T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS) and T<sub>10</sub> (Two HW at 20 and 40 DAS). Minimum number of branches was recorded under treatment T<sub>12</sub> (Unweeded control). Maximum SPAD meter value at 15 and 30 days after spray was recorded under weed free (T<sub>11</sub>), but it was found statistically at par with treatments T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS) and T<sub>10</sub> (Two HW at 20 and 40 DAS), while, minimum SPAD meter reading was recorded under treatment T<sub>12</sub> (Unweeded control).

The higher values of growth parameters viz., plant height and number of branches per plant registered under treatments T<sub>11</sub> (weed free), T<sub>10</sub> (2 HW at 20 and 40 DAS) and T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS) and maximum SPAD meter reading mainly ascribed to better control of weeds through application of pre and post emergence herbicide and hand weeding thus, increase water and nutrient uptake, which might have accelerated photosynthetic rate, thereby increasing the supply of carbohydrates, resulted in increased cell division, multiplication and elongation leading to

increased plant height and number of branches. These findings are in agreement with those of Singh *et al.* (2003), Vyas and Jain (2003), Kachhadia *et al.* (2009), Mishra *et al.* (2013) and Poonia *et al.* (2013).

## 2. Yield and Yield Attributes

The number of pods per plant, yield and yield attributes as influenced by different weed control treatments recorded at harvest is obtainable in Table 1. The enhanced yield and yield attributes under treatments T<sub>11</sub> (weed free), but it was found significantly at par with T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS) and T<sub>10</sub> (2 HW at 20 and 40 DAS) might be due to early season control of weeds by application of pre emergence herbicides and at later stage by post emergence herbicide as evidenced by less number of weed (Table 4.8 to 4.13) and dry weight of weeds (Table 4.14), which might have maintained high soil fertility status and moisture content by means of less removal of plant nutrients and water through weeds. This might have increased nutrients and water uptake by the crop leading to increased rate of photosynthesis. Supply of photosynthates to various metabolic sinks might have favoured yield and yield attributes. The superiority of these treatments could be explained on the basis of better growth and higher uptake of nutrients under these practices might have produced more photosynthates and converted into numerous metabolites needed for such yield and yield attributes. The lowest value of yield and yield attributes viz., number of pods per plant, seed yield and stover yield under treatment T<sub>12</sub> (unweeded control). These findings are in close conformity with those reported by Vyas and Jain (2003), Kachhadia *et al.* (2009), Upadhyay *et al.* (2012), Mishra *et al.* (2013), Rajib *et al.* (2014) and Mamta *et al.* (2016).

## 3. Quality Parameter

The data regarding protein content of chickpea crop are presented in Table 1. Significantly higher protein content in seed was recorded under treatment T<sub>11</sub> (Weed free) but it was statistically at par with treatments T<sub>10</sub> (Two HW at 20 and 40 DAS) and T<sub>8</sub> (Oxyfluorfen 0.18 kg ha<sup>-1</sup> as PE *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> PoE at 40 DAS). Treatments T<sub>12</sub> (unweeded control) produced the lowest protein content in seed. This might have increased absorption of nitrogen and water by the crop and least by weeds which in turn enhanced assimilation of nitrogen leading to increased synthesis of amino acid. Similar, results are also reported by Yadav *et al.* (2007).

## CONCLUSION

On the basis of the results of the present one year field study, it can be concluded that effective and economically viable weed management on growth, yield attributes, yield and quality of chickpea under South Saurashtra Agro-climatic Zone can be achieved by application of Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS. Alternatively, maintaining the crop weed free throughout crop growth period OR adopting Two HW at 20 and 40 DAS days after sowing can be employed according to availability of labourers.

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**Table 1. Effect of different treatments on growth, yield attributes, yield and quality of chickpea**

| Treatments      | Plant height (cm) |           |            | No. of branches per plant |            | Leaf SPAD meter value at |                     |                     | Pods per plant | Seed yield (kg ha <sup>-1</sup> ) | Stover yield (kg ha <sup>-1</sup> ) | Protein content (%) |
|-----------------|-------------------|-----------|------------|---------------------------|------------|--------------------------|---------------------|---------------------|----------------|-----------------------------------|-------------------------------------|---------------------|
|                 | At 30 DAS         | At 60 DAS | At harvest | At 60 DAS                 | At harvest | Before spray             | 15 days after spray | 30 days after spray |                |                                   |                                     |                     |
| T <sub>1</sub>  | 21.33             | 28.67     | 32.33      | 5.33                      | 6.33       | 54.00                    | 62.67               | 67.00               | 55.33          | 2268                              | 2638                                | 21.04               |
| T <sub>2</sub>  | 23.00             | 30.00     | 34.33      | 6.00                      | 7.00       | 54.67                    | 63.00               | 68.33               | 61.67          | 2361                              | 2646                                | 20.21               |
| T <sub>3</sub>  | 22.22             | 30.33     | 34.85      | 6.33                      | 8.00       | 52.67                    | 59.67               | 63.33               | 61.00          | 2175                              | 2500                                | 21.04               |
| T <sub>4</sub>  | 16.22             | 28.19     | 30.33      | 4.33                      | 6.00       | 53.67                    | 61.67               | 62.67               | 58.67          | 2037                              | 2361                                | 20.00               |
| T <sub>5</sub>  | 19.67             | 29.53     | 33.33      | 5.00                      | 7.67       | 56.00                    | 63.00               | 64.33               | 52.67          | 2083                              | 2453                                | 21.04               |
| T <sub>6</sub>  | 23.67             | 28.54     | 34.37      | 6.67                      | 8.00       | 56.00                    | 61.67               | 65.33               | 61.33          | 2453                              | 2690                                | 20.83               |
| T <sub>7</sub>  | 21.78             | 30.33     | 35.00      | 5.67                      | 7.67       | 54.67                    | 63.00               | 66.00               | 55.33          | 2175                              | 2592                                | 20.83               |
| T <sub>8</sub>  | 27.05             | 33.33     | 38.33      | 7.00                      | 9.33       | 56.67                    | 67.00               | 73.00               | 66.00          | 2731                              | 3194                                | 22.71               |
| T <sub>9</sub>  | 14.33             | 30.04     | 34.00      | 5.33                      | 7.67       | 54.00                    | 62.33               | 65.33               | 58.00          | 1990                              | 2407                                | 20.63               |
| T <sub>10</sub> | 26.63             | 33.27     | 37.71      | 7.33                      | 9.67       | 55.33                    | 65.33               | 72.33               | 66.33          | 2546                              | 2916                                | 23.56               |
| T <sub>11</sub> | 28.31             | 34.33     | 40.00      | 7.67                      | 10.33      | 57.67                    | 69.00               | 75.33               | 69.67          | 2916                              | 3240                                | 24.58               |
| T <sub>12</sub> | 11.11             | 27.67     | 29.67      | 4.00                      | 5.33       | 53.33                    | 54.00               | 55.00               | 46.00          | 1851                              | 2175                                | 18.13               |
| S.Em. ±         | 1.20              | 1.22      | 1.43       | 0.29                      | 0.42       | 1.12                     | 1.79                | 2.06                | 2.21           | 137                               | 181                                 | 1.06                |
| CD at 5 %       | 3.52              | 3.59      | 4.20       | 0.86                      | 1.25       | NS                       | 5.26                | 6.05                | 6.51           | 404                               | 532                                 | 3.13                |
| CV %            | 9.78              | 7.00      | 7.2        | 8.7                       | 9.6        | 3.56                     | 4.95                | 5.38                | 6.48           | 10.39                             | 11.85                               | 8.72                |

**Treatment details:-**

T<sub>1</sub> = Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS, T<sub>2</sub> = Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb*1 HW at 40 DAS, T<sub>3</sub> = Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 20 DAS *fb* 1 HW at 40 DAS, T<sub>4</sub> = Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 20 DAS *fb* 1 HW at 40 DAS, T<sub>5</sub> = Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS, T<sub>6</sub> = Pendimethalin 0.90 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS, T<sub>7</sub> = Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Quizalofop-ethyl 0.040 kg ha<sup>-1</sup> as post-emergence at 40 DAS, T<sub>8</sub> = Oxyfluorfen 0.18 kg ha<sup>-1</sup> as pre-emergence *fb* Pre-mix (Imazamox + Imazethapyr) 0.03 kg ha<sup>-1</sup> post-emergence at 40 DAS, T<sub>9</sub> = HW at 20 DAS, T<sub>10</sub> = Two HW at 20 and 40 DAS, T<sub>11</sub> = Weed free and T<sub>12</sub> = Unweeded check.