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EFFECTS OF HERBICIDES ON GROWTH AND YIELD OF *CICER ARIETINUM* L. UNDER RAINFED CONDITION

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Key words: Chickpea, Herbicide, Planting dates, Weed, Yield

Abstract

A field experiment was conducted in sandy clay loam soil during winter season of 2012-13. The experimental field was infested with *Melilotus alba, Chenopodium album, Cynodon dactylon, Phalaris minor* and *Medicago hispida* during both the years. Among herbicidal treatments, sequential application of pendimethalin (1 kg/ha) as pre-emergence followed by quizalofop (50 g/ha) as post-emergence recorded lowest density and dry weight of weeds and showed highest yield of chickpea.

Introduction

Chickpea (*Cicer arietinum* L., Fabaceae)) is an important food legume and has exceptional, immediate potential for alleviating human malnutrition in tropical and sub-tropical countries by virtue of its nutritional and agronomic values. It contains on an average, 23% protein, 64% carbohydrates, 5% fat, 65 crude fiber, 3% ash and a high mineral content (Oberoi *et al*. 2010 and Shamsi 2010). In India, chickpea crop ranks first among pulses, occupying about 30% of the total cultivated area of pulses and contributing 40% total pulse production (Ready *et al*. 2007). In Uttar Pradesh, it is grown in 0.97 m ha with a production of 0.66 mt (Pooniya *et al*. 2009). In general, the chickpea is cultivated on marginal and sub-marginal land under rainfed conditions as early sown. This early sown crop results in excess vegetative growth and greater weed infestation leads to poor pod setting. Whereas, North-eastern part of India grow long duration high yielding rice varieties, the planting of chickpea is usually delayed. Under such situation, the crop has to be sown by end of December. This late sown crop experiences very low temperature at initial stage resulting in poor vegetative growth and yield. Mohammadnejad *et al.* (2005) and Shamsi (2010) reported that yield and yield attributes per unit area were affected by planting dates.

Weeds are the major problem in irrigated chickpea. Many research workers reported the predominance of *Avena ludoviciana, Chenopodium album, Cynodon dactylon, Phalaris minor* and *Medicago hispida, Anagalis arvensis, Melilotus indica, Melilotus alba, Cyperus rotundus, Argemone maxicana, Solanum nigrum, Vicia hirsute* and *Vicia sativa* weeds in chickpea field (Gupta *et al.* 2012). However, the composition and density of weeds in the soil vary greatly and are closely linked to the cropping history of the filed. Season long weed competition in winter pulses has been reported to offer serious competition and causes yield reduction to the extent of 75% in chickpea (Chaudhary *et al*. 2005). The high cost and unavailability of labour at right time, some times compell the farmer for opting alternative, cheaper and easier method of chemical weed control.

At present several herbicides *viz.*, metribuzin, pendimethalin, metolachlor, clodinafop, quizalofop and imazethapyr are presently being used for controlling both grassy and broad-leaved weeds, but their effect under different agro-climatic conditions are not well defined. Considering

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the above facts in view, it was realized to evaluate the performance of chickpea under different sowing dates along with good weed control system. Therefore, the present investigation was conducted to find out the optimum sowing time and weed control systems to get better yield of chickpea.

Materials and Methods

A field experiment was conducted during the winter season 2009-10 and 2010-11, at the Agronomy research farm of Institute of Agricultural Sciences, BHU, Varanasi, which is geographically situated at 23.2º N latitude, 83.03ºE longitude and at an altitude of 113 msl in the north-eastern Gangetic Plains. This location has a typical sub tropical climate characterized by hot, dry summer and cool winter. The soil of experimental site was sandy clay loam in texture with slightly saline in reaction (pH 7.2). It was low in organic C (0.33%) and available nitrogen (168.9 kg/ha), medium in available phosphorus (26.6 kg/ha) and potassium (242.5 kg/ha) in soil surface. The field was kept under rice - wheat rotation for the last eight years. Eight weed control systems *viz*. W_1 - weedy,W_2 weed free, W_3 - pendimethalin 1 kg/ha pre-emergence, W_4 - quizalofop 50 g/ha post-emergence, W_5 - imazethapyr 37 g/ha post-emergence, W_6 - pendimethalin fallowed by quizalofop,W_{7-} pendimethalin followed by imazethapyr and W_8 - pendimethalin + mechanical in split plot design with three replications. The chickpea variety 'T-59' was sown manually at 30 × 10 cm row spacing using 80 kg seed/ha in 4.6 × 3.6 m^2 gross plot size. Crop was raised with recommended package of practices for the region. Herbicides were applied as per treatments with hand sprayer fitted with flat fan nozzle and the spray volume was 500 litters/ha. Density and dry weight of weeds were observed at 90 days after sowing of crop. Data on weed density was recorded from an area enclosed in the quadrate of 0.25m^2 randomly selected at four places in each plot. Weed species were separately counted from each sample and their density was recorded as average number/m^2. Oven dry weight of weeds was recorded at 70ºC for 48 hrs and expressed as dry matter production/m^2. Crop was harvested when pod began to turn yellow and leaf start shedding on 30th March 2010 and 3rd April 2011. Crop was sun dried and biological yield were recorded separately for each treatment. Data collected on various parameters were analyzed statistically for valid conclusion.

Results and Discussion

The major weeds in experimental crop were *Melilotus alba, Chenopodium album, Cynodon dactylon, Phalaris minor* and *Medicago hispida* during both the years of study. Similar weed species in chickpea during winter season also reported by Gupta *et al*. (2012) and Butter *et al*. (2008).

Among the weed control treatments, sequential application of pendimethalin (1 kg/ha) as pre-emergence followed by quizalofop (50 g/ha) as post-emergence recorded lowest density and dry weight of weeds followed by the alone application of quizalofop (50 g/ha post-em), pendimethalin (1 kg/ha pre-em) followed by mechanical weeding at 60 DAS and imazethapyr (37.5 g/ha post-em), respectively (Figs 1 - 4). Reduction in density and dry weight of weeds suggested that pendimethalin controlled the germinated weeds and next flush of weeds were checked by post-emergence application of quizalofop. These results are supported by the research findings of Pooniya *et al.* (2009) and Marodi *et al.* (2010). None of the weed control treatments effective as weed free situation. Higher killing and long lasting effects of quizalofop and imazethapyr in reducing density and weed dry matter might be primarily appeared due to broad-spectrum activity of these herbicides particularly on established plants of both narrow and broad leaf weeds. Likewise, Gupta *et al*. (2012) also recommended use of imazethapyr chemical in legumes which inhibit acetohydroxy acid synthase and the synthesis of branched chain amino acids. Pre-emergence application of pendimethalin (1 g/ha) least effective against weeds and had higher density and dry weight weed species when compared with other weed control treatments.

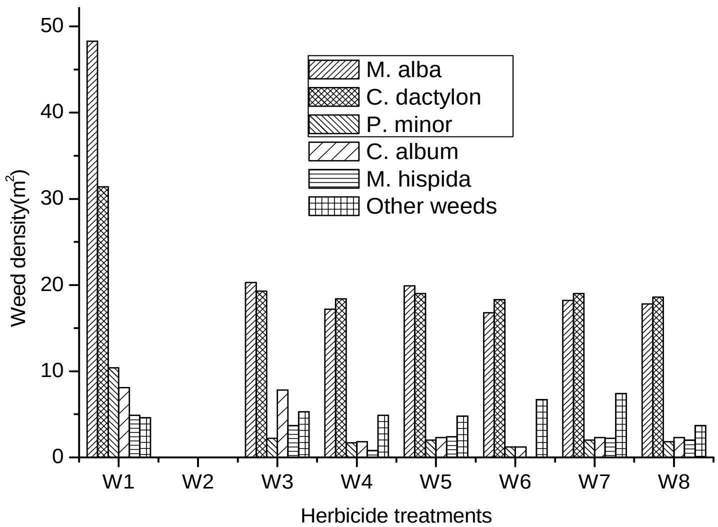

Fig. 1. Effects of herbicide treatments on density of different weed flora at 90 DAS (Pooled data of two years; W_1 - weedy, W_2 - weed free (HW 30 and 60 DAS), W_3 - pendimethalin (Pre-em) @1 kg/ha, W_4 - quizalofop (Post-em) @ 0.05 kg/ha, W_5 - imazethapyr (Post-em) @ 37.5 kg/ha, W_6 - pendimethalin fb quizalofop, W_7 - pendimethalin fb Imazethapyr, W_8 - pendimethalin fb mechanical weeding (60 DAS).

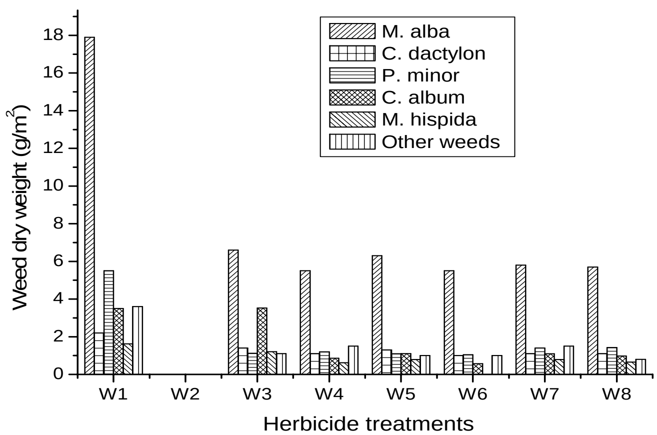

Fig. 2. Effects of herbicide treatments on dry weight of different weed flora at 90 DAS (Pooled data of two year, W_1 - weedy, W_2 - weed free (HW 30 and 60 DAS), W_3 - pendimethalin (Pre-em) @1 kg/ha, W_4 - quizalofop (Post-em) @ 0.05 kg/ha, W_5 - imazethapyr (Post-em) @ 37.5 kg/ha, W_6 - pendimethalin fb quizalofop, W_7 - pendimethalin fb imazethapyr, W_8 - pendimethalin fb mechanical weeding (60 DAS).

An sequential application of pendimethalin (1 kg/ha) followed by quizalofop (50 g/ha) recorded maximum plant height, dry matter and root nodules/plant followed by alone application of quizalofop (50 g/ha post-em), pendimethalin (1 kg/ha pre-em) followed by mechanical weeding at 60 DAS and imazethapyr (37.5 g/ha post-em, Fig. 5). The results are in close conformity with the finding of Mishra *et al*. (2005).

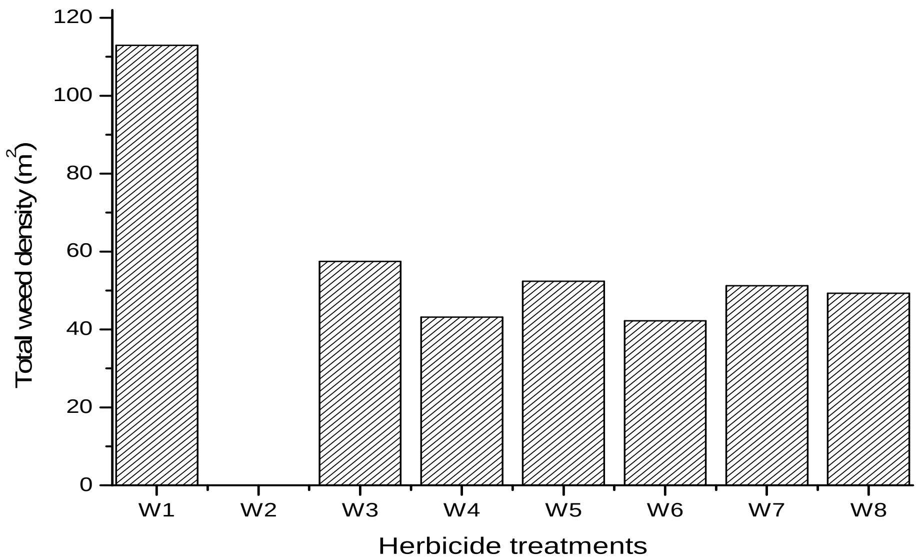

Fig. 3. Effects of herbicide treatments on total weed density at 90 DAS (Pooled data of two years).

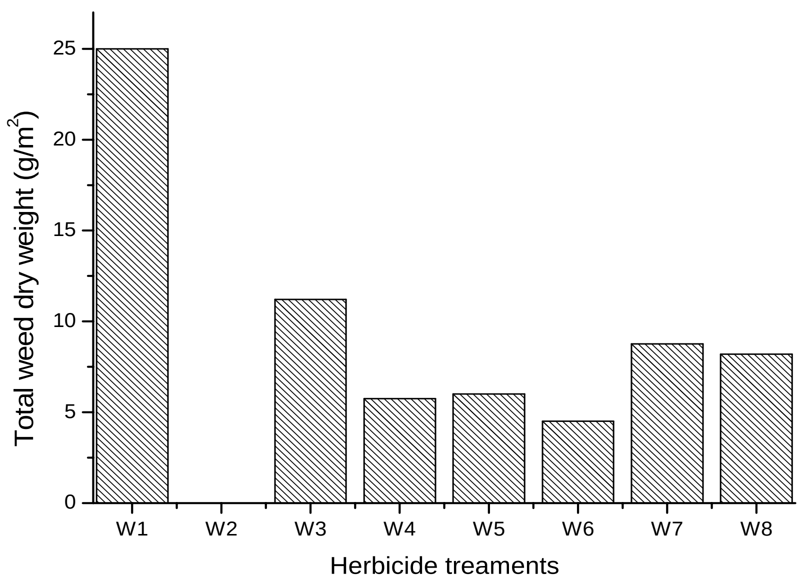

Fig. 4. Effects of herbicide treatments on total weed dry weight at 90 DAS (Pooled data of two years).

Maximum yield attributes, seed and straw yield was found under weed free treatment and same was lowest in control (Figs 5 and 6). This was due to better development crop plant contributed to the increase in seed and straw yield as compared to control, which was having

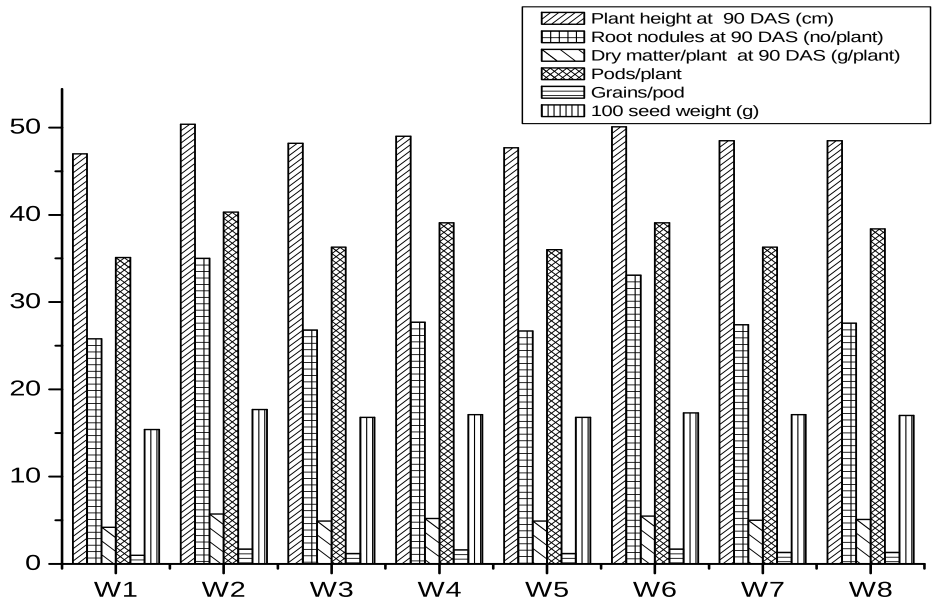

Fig. 5. Effects of herbicid treatments on growth and yield attributes (Pooled data of two years).

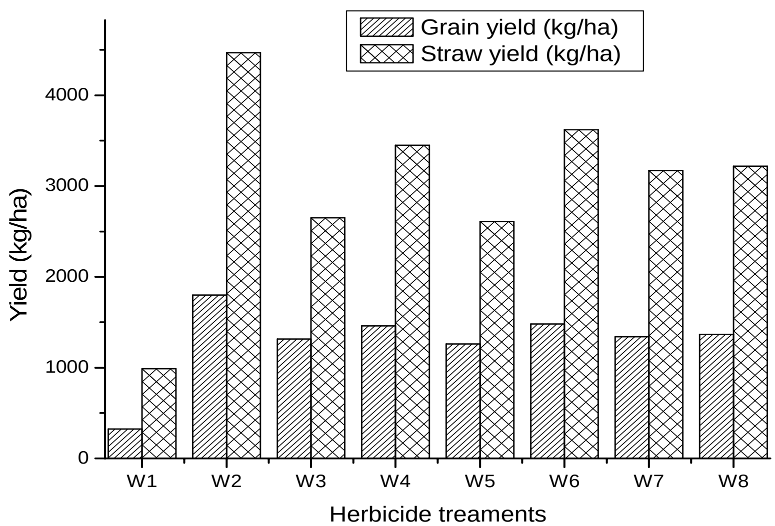

Fig. 6. Effects of herbicide treatments on grain and straw yield of chickpea (pooled data of two years).

highest density and dry weight of weeds. An sequential application of pendimethalin (1 kg/ha) followed by quizalofop (50 g/ha) recorded the highest yield attributes, seed and straw yield followed by alone application of quizalofop (50 g/ha post-em), pendimethalin (1 kg/ha pre-em) followed by mechanical weeding at 60 DAS and imazethapyr (37.5 g/ha post-em). This was due to effective control of weeds by this treatments resulting into better plant growth and finally highest seed and straw yield. The results are corroborated with the research finding of Gupta *et al*. (2012).

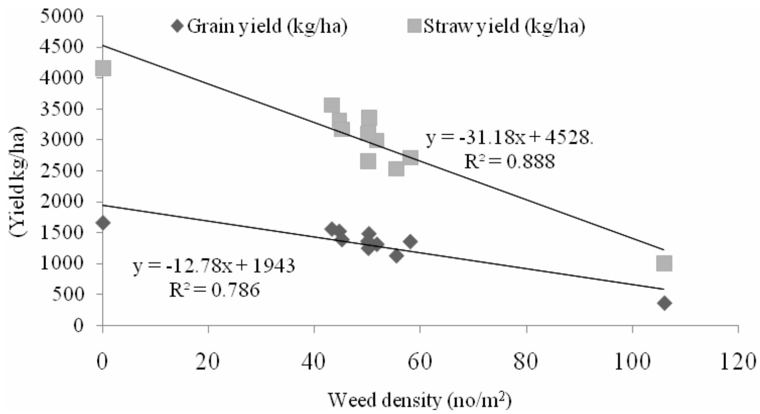

Fig. 7. Relationship between weed density, grain and straw yield of chickpea.

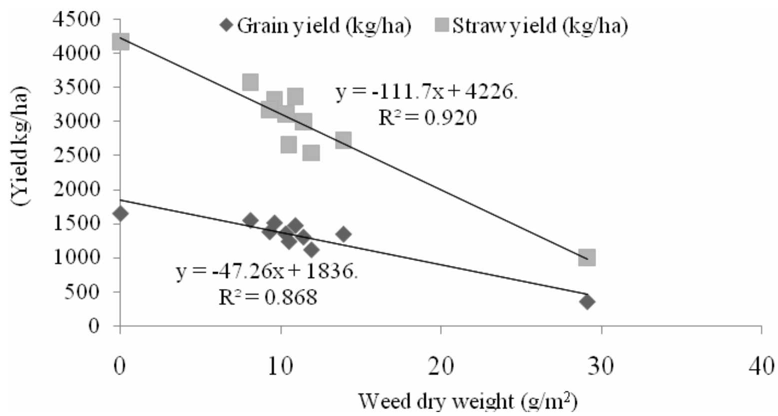

Fig. 8. Relationship between weed dry weight, grain and straw yield of chickpea.

The regression equation predicted linear reduction in the grain and straw yield with a unit increase in the weed density (Fig. 7). The extent of reduction could be 31.18 kg/ha in straw yield and 12.78 kg/ha in grain yield for weed density. The evaluation of weed dry weight, reduction could be 111.7 kg/ha in straw yield and 47.26 kg/ha in grain yield for weed dry weight (Fig. 8). The decrease in grain and straw yield by unit increase in the density and dry weight of weeds was also reported by Gupta *et al*. (2012).

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