

Original Research Article

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## Integrated Weed Management in Cowpea (*Vigna unguiculata* (L.) Wasp.) under Rainfed Conditions

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### ABSTRACT

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A field experiments was conducted during *Kharif* seasons 2007 at Junagadh Agricultural University, Junagadh, Gujarat to study the effect of weed management practices on cowpea under rainfed conditions. It was found that single application of herbicide or cultural practices (1 HW + 1 IC) at 20-25 DAS not sufficient to control weed in cowpea and significantly yield loss 20-25% recorded, which is just half of around 45% yield loss in case no weed control measure followed. Application of (pendimethalin at 0.5 kg ha<sup>-1</sup> as PRE + 1 HW + 1 IC at 25-30 DAS), (quizalofop- ethyl at 0.04 kg ha<sup>-1</sup> as POST 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) and (imazethapyr at 0.075 kg ha<sup>-1</sup> as POST 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) gave yield statistically at par with weed free plot. So integrated weed management is better option and cowpea farmer can replace 20-25 DAS (1 HW + 1 IC) cultural practices with suitable herbicide to get same yield.

### Introduction

Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global food security. The United Nations, declared 2016 as “International Year of Pulses” (IYP). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 20 per cent of the area under food grains and contribute around 7-10 per cent of the total food grains production in the country (Mohanty and Satyasa, 2015).

Cowpea (*Vigna unguiculata* (L.)) cultivated around the world primarily for seed, but also as a vegetable (for leafy greens, green pods, fresh shelled green peas, and shelled dried peas), as cover crop and for fodder Andargie *et al.*, (2011). It is one of the important *kharif* pulse crop grown in the India for grain, forage, and green manure purpose and commonly known as *lobia*. Cowpea is also called vegetable meat because of it rich in protein 19-26 % (average 22.5 %), carbohydrate 60.3 %, minerals and vitamins.

Cowpea is a most versatile kharif as well as summer pulse, because of its smothering nature, drought tolerant character, soil restoring properties and multipurpose uses.

During rainy season the crop suffers severely due to weed infestation resulting into wide range reduction in crop yield. The critical period of crop weed competition in cowpea has been identified as 20-30 days after sowing and presence of weeds beyond this period causes severe reduction in yields Gupta *et al.*, (2016). Hence, weed control needs to be undertaken during initial period of crop growth. Though the hand weeding is a well proven effective method of weed control, but non-availability of labour and the cost incurred in it is very high. Keeping in view the fact, the present experiment was conducted to find out suitable and cost effective weed management practice to manage weeds during the critical period of crop weed competition.

## **Materials and Methods**

### **Experimental site**

A field experiment was carried out in C8 block of the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat in kharif season 2007. Geographically this place is located at 21.50 N latitudes and 70.50 E longitudes with an altitude of 60 meters above the mean sea level on the western side at the foothills of Mount Girnar.

### **Weather conditions**

This place experience the typical sub-tropical climate characterized by fairly cold and dry winter, hot and dry summer and moderately humid monsoon season. The rainy season commences in the second fortnight of June and extends up to September. The average

annual rainfall is 868.6 mm, out of which maximum rainfall occurs during the months of July and August. Partial failure of monsoon once in 3 to 4 years is very common phenomenon in this region. Winter sets in the month of November and continues till the month of February. January is the coldest month of winter. Summer season commences from the second fortnight of February and ends in the middle of June. April and May are the hottest months of summer.

### **Experimental soil**

Soil was clayey in texture, slightly alkaline in reaction, medium in organic carbon (0.61%) low in available nitrogen (220.0 kg/ha) and available phosphorus (18.9 kg/ha), whereas high in available potassium (378.0 kg/ha) in 0–15 cm soil depth at the start of the experiment.

### **Experimental detail**

The experiment was laid out in Random block design (RBD) with twelve treatments and four replications. Gross and net plot sizes were 5.0 x 3.6 m and 4.0 x 2.7 m, respectively.

### **Agronomic practices**

The graded and healthy seeds of cowpea, Gujarat Cowpea-4 were sown manually in previously opened furrow at the depth of 3 to 5 cm and at 45 cm inter-row and 10 cm intra-row spacing on 7th July, 2007 with recommended seed rate of 25 kg ha<sup>-1</sup>. The recommended dose of fertilizer i.e. 20 kg N ha<sup>-1</sup> and 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> in the form of urea and single super phosphate applied in furrows just before sowing.

### **Results and Discussion**

In different weed management treatments it was found that treatments T<sub>10</sub> (2 HW + 2 IC

at 20 and 40 DAS), T<sub>2</sub> (pendimethalin at 0.5 kg ha<sup>-1</sup> pre- emergence + 1 HW + 1 IC at 25-30 DAS), T<sub>5</sub> (quizalofop-ethyl at 0.04 kg ha<sup>-1</sup> post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) and T<sub>8</sub> (imazethapyr at 0.075 kg ha<sup>-1</sup> as post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) were found very effective to control all three groups sedges, monocots and dicots as it shown in table 1 and at par with weed free treatment. Lowest weed index (WI) were recorded in treatments T<sub>10</sub> (2 HW + 2 IC at 20 and 40 DAS) followed

by T<sub>2</sub> (pendimethalin at 0.5 kg ha<sup>-1</sup> pre-emergence + 1 HW + 1 IC at 25-30 DAS), T<sub>5</sub> (quizalofop-ethyl at 0.04 kg ha<sup>-1</sup> post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) and T<sub>8</sub> (imazethapyr at 0.075 kg ha<sup>-1</sup> as post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) 0.89, 8.14, 9.63 and 10.95 per cent respectively. The treatment T<sub>12</sub> (weedy check) recorded the highest weed index (44.57) as compared to all other treatments (Figure 1).

**Table.1** Effect of different treatments on number of weeds (group wise) per m<sup>2</sup> recorded at 60 DAS and at harvest

Treatments		Sedge per m <sup>2</sup>		Monocot per m <sup>2</sup>		Dicot per m <sup>2</sup>	
		60DAS	At harvest	60DAS	At harvest	60DAS	At harvest
T <sub>1</sub>	Fluchloralin @ 0.6 kg ha <sup>-1</sup> PRE +1 HW + 1 IC at 25-30 DAS	4.16 (17.31)	4.28 (18.28)	4.94 (24.43)	5.08 (25.81)	4.87 (23.72)	5.02 (25.18)
T <sub>2</sub>	Pendimethalin @ 0.5 kg ha <sup>-1</sup> PRE +1 HW + 1 IC at 25-30 DAS	1.54 (2.36)	1.91 (3.66)	3.28 (10.77)	3.29 (10.82)	3.28 (10.77)	3.73 (13.91)
T <sub>3</sub>	Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS	4.90 (23.96)	5.20 (26.99)	5.09 (25.93)	5.24 (27.41)	5.10 (25.96)	5.45 (29.70)
T <sub>4</sub>	1 IC at 8-10DAS + Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS	4.82 (23.18)	5.11 (26.11)	5.02 (25.20)	5.14 (26.45)	5.04 (25.38)	5.30 (28.12)
T <sub>5</sub>	Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS +1HW + 1 IC at 40-45 DAS	1.72 (2.95)	1.99 (3.97)	3.32 (10.99)	3.39 (11.48)	3.35 (11.24)	3.77 (14.21)
T <sub>6</sub>	Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25DAS	5.55 (30.77)	5.57 (30.97)	5.14 (26.45)	5.37 (28.86)	5.17 (26.68)	5.62 (31.53)
T <sub>7</sub>	1 IC at 8-10DAS + Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25 DAS	4.76 (22.65)	4.91 (24.18)	4.98 (24.85)	5.12 (26.21)	4.96 (24.60)	5.11 (26.13)
T <sub>8</sub>	Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25 DAS +1 HW +1 IC at 40-45 DAS	1.78 (3.18)	2.04 (4.18)	3.34 (11.18)	3.42 (11.71)	3.40 (11.56)	3.79 (14.42)
T <sub>9</sub>	1 HW + 1 IC at 20 DAS	3.95 (15.60)	4.18 (17.47)	4.87 (23.71)	4.91 (24.18)	4.78 (22.84)	4.96 (24.65)
T <sub>10</sub>	2 HW + 2 IC at 20 and 40 DAS	1.28 (1.65)	1.38 (1.92)	2.91 (8.46)	3.15 (9.93)	3.07 (9.47)	3.35 (11.25)
T <sub>11</sub>	Weed free	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
T <sub>12</sub>	Weedy check	6.16 (38.00)	6.40 (41.02)	6.24 (38.93)	6.59 (43.52)	6.11 (37.42)	6.35 (40.38)
S.Em. ±		0.1962	0.24	0.16	0.19	0.21	0.17
C.D. at 5 %		0.5649	0.70	0.48	0.56	0.62	0.50
C.V. %		11.59	13.61	8.18	9.36	10.55	8.05

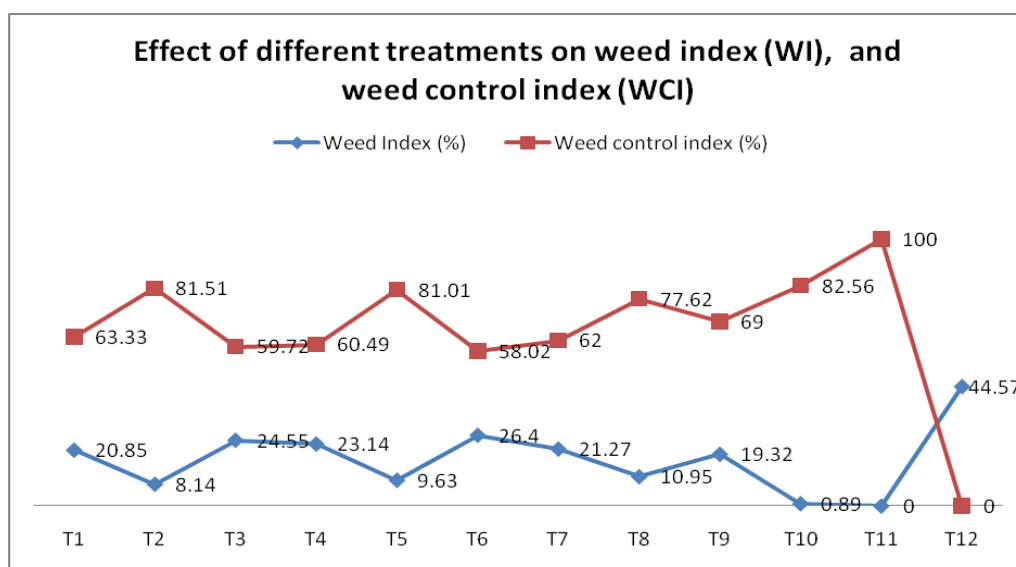
Square root transformation ( $\sqrt{X}$ )

Figures in parenthesis are retransformed values

**Table.2** Effect of different treatments on grain and stover yield of cowpea

Treatments		Grain yield (kg ha <sup>-1</sup> )	Stover yield (kg ha <sup>-1</sup> )
T <sub>1</sub>	Fluchloralin @ 0.6 kg ha <sup>-1</sup> PRE +1 HW + 1 IC at 25-30 DAS	1262.73	1481.48
T <sub>2</sub>	Pendimethalin @ 0.5 kg ha <sup>-1</sup> PRE +1 HW + 1 IC at 25-30 DAS	1465.50	1921.29
T <sub>3</sub>	Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS	1203.70	1435.18
T <sub>4</sub>	1 IC at 8-10DAS + Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS	1226.15	1456.01
T <sub>5</sub>	Quizalofop-ethyl @ 0.04 kg ha <sup>-1</sup> POST at 20-25 DAS +1HW + 1 IC at 40-45 DAS	1441.66	1900.46
T <sub>6</sub>	Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25DAS	1174.07	1348.61
T <sub>7</sub>	1 IC at 8-10DAS + Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25 DAS	1256.02	1479.16
T <sub>8</sub>	Imazethapyr @ 0.075 kg ha <sup>-1</sup> POST at 20-25 DAS +1 HW +1 IC at 40-45 DAS	1422.22	1872.68
T <sub>9</sub>	1 HW + 1 IC at 20 DAS	1287.04	1493.06
T <sub>10</sub>	2 HW + 2 IC at 20 and 40 DAS	1581.02	1981.48
T <sub>11</sub>	Weed free	1595.37	2096.53
T <sub>12</sub>	Weedy check	884.26	1002.31
S.Em. ±		95.55	118.70
C.D. at 5 %		275.09	341.75
C.V. %		14.52	14.62

**Figure.1** Effect of different treatments on weed index (WI), and weed control index (WCI)



Treatment T<sub>11</sub> (weed free) with 100 per cent weed control index (WCI) was closely followed by treatments T<sub>10</sub> (2 HW + 2 IC at 20 and 40 DAS), T<sub>2</sub> (pendimethalin at 0.5 kg ha<sup>-1</sup> pre-emergence + 1 HW + 1 IC at 25-30 DAS), T<sub>5</sub> (quizalofop- ethyl at 0.04 kg ha<sup>-1</sup> post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) and T<sub>8</sub> (imazethapyr at 0.075 kg ha<sup>-1</sup> as post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS) having weed control index of 82.56, 81.51, 81.01 and 77.62 per cent, respectively.

Grain yield of cowpea was significantly influenced due to different weed control treatments tried in this experiment. The treatment T<sub>11</sub> (weed free) established its superiority by recording significantly higher grain yield 1595.37 kg ha<sup>-1</sup> (Table 2). However, in different integrated treatments, it was found statistically at par with treatments T<sub>10</sub> (2 HW + 2 IC at 20 and 40 DAS 1581.02 kg ha<sup>-1</sup>), T<sub>2</sub> (pendimethalin at 0.5 kg ha<sup>-1</sup> pre-emergence + 1 HW + 1 IC at 25-30 DAS 1465.50 kg ha<sup>-1</sup>), T<sub>5</sub> (quizalofop- ethyl at 0.04 kg ha<sup>-1</sup> post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS 1441.66 kg ha<sup>-1</sup>) and T<sub>8</sub> (imazethapyr at 0.075 kg ha<sup>-1</sup> as post-emergence at 20-25 DAS + 1 HW + 1 IC at 40-45 DAS 1422.22 kg ha<sup>-1</sup>), in descending order. Single application of herbicide not found sufficient to control weed and significantly yield loss in cowpea. Cowpea farmer can replace 20-25 DAS 1 HW + 1 IC cultural practices with suitable herbicide to get same yield. Stover yield also show same pattern as grain yield. Results obtained are in conformity with the findings of Madukwe *et al.*, (2012) and Gupta *et al.*, (2016).

In conclusion, integrated weed management is better approach for reduce the yield losses in cowpea due to weeds. Cowpea farmer can replace 20-25 DAS (1 HW + 1 IC) cultural practices with suitable herbicide to get same yield.

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