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Effect of weed management and fertility levels on population and dry matter of weeds in summer okra [*Abelmoschus esculentus* (L.) Moench.] under North Gujarat conditions

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Abstract

A field experiment was carried out during summer season of 2008 on a loamy sand soil at Regional Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, District: Banaskantha (Gujarat) to study the eight weed management practices *i.e.*, Unweeded control (W₀), Weed free (*i.e.*, Hand Weeding at 20, 40 and 60 DAS) (W₁), Hand weeding at 20 and 40 DAS (W₂), Interculturing at 20 and 40 DAS (W₃), Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha (Blanket application) (W₄), W₄ + Interculturing at 20 DAS (W₅), W₄ + Interculturing at 40 DAS (W₆) and W₄ + Hand Weeding at 40 DAS (W₇) along with two fertility levels *i.e.*, 75% recommended dose of NPK (*i.e.*, 112.5 - 37.5 - 37.5 NPK kg/ha) (F₁) and 100% recommended dose of NPK (*i.e.*, 150 - 50 - 50 NPK kg/ha) (F₂) on okra [*Abelmoschus esculentus* (L.) Moench.] crop. Results shows that the weeds population at 20 and 40 DAS were found significantly lowest under treatment (W₇) *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (W₄) + Hand Weeding at 40 DAS (3.20, 2.75, 2.99 and 5.07 per m²) and (W₅) *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (W₄) + interculturing at 20 DAS (2.84, 2.72, 2.58 and 4.60 per m²), respectively. Besides providing weed free condition through the season Hand weeding at 20, 40 and 60 DAS was found more effective in recording the less dry weight of weeds (37.87 g/m² and 230 kg ha⁻¹) as well as higher weed control efficiency (82.04 and 77.03%). Hand weeding at 20 and 40 DAS and pre-emergence application of pendimethalin @ 1.0 kg a.i. ha⁻¹ + H.W. at 40 DAS were found at par with this respect.

Keywords: Pendimethalin, hand weeding, interculturing, weed population, weed dry matter and weed control efficiency

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench.] belongs to the family Malvaceae, is one of the important vegetable crop of subtropical and tropical regions. It is widely grown all over India for its immature tender fruits, which are used as vegetable in a variety of ways. The roots and stems of okra are used for clearing the cane juice in the manufacture of jaggery and sugar as a organic bleaching agent (Chauhan, 1972 and Singh, 1988) [2, 8]. Weed management is one of the most serious problems in modern intensive farming, as the total loss of crop yield, increased cost of cultivation would cause a greater economic loss. Weeds always offer severe competition with crop in early stage of crop growth and cause considerable reduction in the crop yield. Crop yield losses due to weeds have been estimated to the tune of 49 to 100 per cent (Singh *et al.*, 1982; Tiwari *et al.*, 1985 and Adejonwo *et al.*, 1991) [7, 10, 1].

Materials and Methods

A field experiment was conducted during *summer* season of the year 2008 with okra crop (cv. Parbhani Kranti) at Regional Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, The soil of the site had the characteristics as follows, well drained, loamy sand, sand 85.34%, silt 8.19%, clay 6.47%, pH 7.7, EC 0.07 dSm¹ and Organic carbon 0.15%. Available Nitrogen 138 kg ha⁻¹, Available phosphorus 22 kg ha⁻¹ and Available potassium 279 kg ha⁻¹. The included eight weed management practices *i.e.*, Unweeded control (W₀), Weed free (*i.e.*, Hand Weeding at 20, 40 and 60 DAS) (W₁), Hand weeding at 20 and 40 DAS (W₂), Interculturing at 20 and 40 DAS (W₃), Pre-emergence

application of Pendimethalin @ 1.0 kg a.i./ha (Blanket application) (W_4), W_4 + Interculturing at 20 DAS (W_5), W_4 + Interculturing at 40 DAS (W_6) and W_4 + Hand Weeding at 40 DAS (W_7) along with two fertility levels *i.e.*, 75% recommended dose of NPK (*i.e.*, 112.5-37.5-37.5 NPK kg/ha) (F_1) and 100% recommended dose of NPK (*i.e.*, 150-50-50 NPK kg/ha) (F_2) in a Randomized Block Design with factorial concept with four replications. Application rate of N, P_2O_5 and K_2O ($kg\ ha^{-1}$) were supplied through Urea, DAP and MOP. A common seed rate of $10\ kg\ ha^{-1}$ was used. The rainfall was received during crop season was 500 mm in 23 rainy days during 2008. Weed population counts were taken by placing an iron quadrat at random measuring 1.0 square metre area in each net plot at 20 and 40 DAS. The number of monocots, dicots and sedges, falling within the quadrat were counted separately and recorded. The weed samples were collected at 60 and 80 DAS in each plot from $1.0\ m^2$ area and expressed as g/m^2 and $kg\ ha^{-1}$. These samples were sundried and then finally dried in the electrical oven at $60^\circ C$ for 48 hours. The dry weight was recorded when samples attained a constant weight.

Weed control efficiency

The weed control efficiency was calculated by using the following formula.

$$WCE = \frac{DWC - DWT}{DWC} \times 100$$

Where, DWC and DWT were the weed dry weight in control and treated plots, respectively.

Other agronomic practices were carried out as and when required as per recommendation.

Results and discussion

Effect on monocot weeds population at 20 and 40 DAS

A perusal of data presented in table 1 revealed that significantly the lowest monocot weed population at 20 DAS was noted with treatment W_7 *i.e.*, W_4 + Hand Weeding at 40 DAS ($3.20\ per\ m^2$) but it was also found at par with treatment W_5 *i.e.*, W_4 + Interculturing at 20 DAS ($3.22\ per\ m^2$), W_6 *i.e.*, W_4 + Interculturing at 40 DAS ($3.26\ per\ m^2$) and W_4 *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (Blanket application) $3.27\ per\ m^2$, respectively. The less monocot weed count at 20 DAS was observed due to herbicidal effect on weeds. These results are in close proximity with finding of Vashistha *et al.* (1974)^[11], Kumar and Choudhary (2004)^[3].

At 40 DAS (Table 2) indicated that the lowest monocot weeds ($2.84\ per\ m^2$) were noted under pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + Interculturing at 20 DAS (W_5) but it was found at par with treatments W_1 (H.W. at 20, 40 and 60 DAS) and W_2 (H.W. at 20 and 40 DAS). Lower monocot weed population was found in these treatments due to effective control of weeds by pendimethalin and hand weeding and interculturing. In addition to this dense crop canopy might have and smothering effect on weeds. These findings corroborate the results reported by Vashistha *et al.* (1974)^[11], Saimbhi *et al.* (1994), Kumar and Choudhary (2004)^[3].

Effects on dicot weed population at 20 and 40 days after sowing

A perusal of data presented in Table 1 & 2 revealed that significantly the lowest dicot weed population at 40 DAS was

noted with treatment W_7 *i.e.*, W_4 + Hand Weeding at 40 DAS ($2.75\ per\ m^2$), but it was also found at par with treatment W_5 *i.e.*, W_4 + Interculturing at 20 DAS ($2.77\ per\ m^2$), W_6 *i.e.*, W_4 + Interculturing at 40 DAS ($2.84\ per\ m^2$) and W_4 *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (Blanket application) $2.85\ per\ m^2$, respectively. The lower dicot weed counts at 20 DAS was observed due to herbicidal effect on weeds. The highest dicot weeds ($5.56\ per\ m^2$) was observed under treatments W_0 (Unweeded control). It was due to absence of herbicidal application and hand weeding till 20 DAS. These results are in close vicinity with the findings of Vashistha *et al.* (1974), Saimbhi *et al.* (1994), Kumar and Chaudhary (2004).

The lowest dicot weeds ($2.72\ per\ m^2$) at 40 DAS were noted with pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + interculturing at 20 days after sowing (W_5), but it was at par with the treatments W_1 (H.W. at 20, 40 and 60 DAS) and W_2 (H.W. at 20 and 40 DAS) over W_0 (unweeded control). The lowest dicot weeds ($2.72\ per\ m^2$) were observed under pendimethalin treated condition at this stage of crop growth due to complete elimination of weeds by herbicide. The findings are also in accordance with those reportedly are Vashistha *et al.* (1974), Saimbhi *et al.* (1994), Kumar and Choudhary (2004)^[3].

Effect on sedge weeds population at 20 and 40 days after sowing

A perusal of data presented in Table 1&2 revealed that significantly the lowest sedge weed population at 20 DAS was noted with treatment W_7 *i.e.*, W_4 + Hand Weeding at 40 DAS ($2.99\ per\ m^2$), but it was also found at par with treatment W_6 *i.e.*, W_4 + Interculturing at 40 DAS ($3.02\ per\ m^2$), W_5 *i.e.*, W_4 + Interculturing at 20 DAS ($3.03\ per\ m^2$) and W_4 *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (Blanket application) $3.04\ per\ m^2$, respectively. This might be due to the effective weed control at early stage of crop growth by herbicidal application.

At 40 DAS (Table 2) indicated that the lowest sedge weeds ($2.58\ per\ m^2$) were recorded under pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + interculturing at 20 DAS (W_5) but it was found at par with treatment W_1 (H.W. at 20, 40 and 60 DAS) and W_2 (H.W. at 20 and 40 DAS). The lowest sedge weeds were observed under treatment W_5 might be due to effective control of sedge weeds by pendimethalin as pre-emergence since beginning and weeds those escaped from herbicidal control were removed by interculturing at 20 DAS. The highest sedge weeds were observed under treatment W_0 (Unweeded control). It was due to absence of herbicidal application and hand weeding. These findings are in close conformity with the findings of Vashistha *et al.* (1974)^[11], Saimbhi *et al.* (1994), Kumar and Choudhary (2004)^[3].

Effect on total weed population at 20 and 40 days after sowing

A perusal of data presented in Table 1&2 revealed that significantly the lowest total weed population at 40 DAS was noted with treatment W_7 *i.e.*, W_4 + Hand Weeding at 40 DAS ($5.07\ per\ m^2$), but it was also found at par with treatment W_5 *i.e.*, W_4 + Interculturing at 20 DAS ($5.13\ per\ m^2$), W_6 *i.e.*, W_4 + Interculturing at 40 DAS ($5.20\ per\ m^2$) and W_4 *i.e.*, pre-emergence application of pendimethalin @ 1.0 kg a.i./ha (Blanket application) $5.21\ per\ m^2$, respectively. The lower total weed counts at 20 DAS was observed due to herbicidal effect on weeds. The highest total weeds ($10.69\ per\ m^2$) were

observed under treatments W_0 (Unweeded control). It was due to absence of herbicidal application and hand weeding till 20 DAS. These results are in close vicinity with the findings of Vashistha *et al.* (1974) [11], Saimbhi *et al.* (1994), Kumar and Chaudhary (2004).

The lowest total weeds (4.60 per m^2) at 40 DAS were noted with pre-emergence application of pendimethalin @ 1.0 kg a.i / ha + interculturing at 20 days after sowing (W_5), but it was at par with the treatments W_1 (H.W. at 20, 40 and 60 DAS) and W_2 (H.W. at 20 and 40 DAS) over W_0 (unweeded control). The lowest total weeds (4.60 per m^2) were observed under pendimethalin treated condition at this stage of crop growth due to complete elimination of weeds by herbicide. The findings are also in accordance with those reportedly are Vashistha *et al.* (1974) [11], Saimbhi (1994), Kumar and Choudhary (2004) [3].

Effect on dry weight of weeds at 60 and 80 days after sowing

Data on dry weight of weeds at 60 and 80 days after sowing are presented in table 3 revealed that weed free treatments W_1 (H.W. at 20, 40 and 60 DAS) were most effective in minimizing weed infestation and recorded significantly less dry weight of weeds (37.87 g/ m^2 at 60 DAS and 230.76 kg/ha

at 80 DAS) but it was found at par with treatment W_2 (H.W. at 20 and 40 DAS) and W_7 (W_4 + H.W. at 40 DAS) over unweeded control (W_0). The combined effect of herbicide (pendimethalin) and hand weeding resulted into lower weed counts and ultimately reduced the dry weight of weeds. These findings are in close conformity with those reported by Singh and Batra (1994) [9], Patel *et al.* (2004) [4].

Effect on weed control efficiency at 60 and 80 DAS

Data on weed control efficiency at 60 DAS and 80 DAS are presented in Table 3 revealed that the highest weed control efficiency (82.04 and 77.03%) was noted under weed free treatment W_1 (H.W. at 20, 40 and 60 DAS), but it was found at par with treatments W_2 (H.W. at 20 and 40 DAS) 79.24 per cent and 73.07 per cent and W_7 (W_4 + H.W. at 40 DAS) 78.91 and 72.44 per cent, respectively over unweeded control (W_0). The higher weed control efficiency under treatments W_1 , W_2 and W_7 was due to effective control of weeds from the field. The combined effect of herbicide and hand weeding resulted in remarkable less dry weight of weeds (Table 3) observed under these treatments were responsible for higher weed control efficiency. These findings are akin to report of Shaikh *et al.* (2002) [6] and Patel *et al.* (2004) [4].

Table 1: Weed population/ m^2 at 20 days after sowing in summer okra cv. Parbhani Kranti as influenced by weed management and fertility levels

Treatment	Monocot	Dicot	Sedge	Total
Weed management				
W_0 : Unweeded control	8.23 (67.25)	5.56 (30.50)	4.07 (16.12)	10.69 (113.87)
W_1 : Weed free (<i>i.e.</i> , Hand Weeding at 20, 40 and 60 DAS)	8.17 (66.25)	4.76 (22.25)	4.05 (15.96)	10.24 (104.46)
W_2 : Hand weeding at 20 and 40 DAS	8.03 (64.00)	5.07 (25.25)	3.99 (15.46)	10.25 (104.71)
W_3 : Interculturing at 20 and 40 DAS	8.04 (64.25)	5.02 (24.75)	3.93 (14.98)	10.22 (103.98)
W_4 : Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha (Blanket application)	3.27 (10.25)	2.85 (7.60)	3.06 (8.85)	5.21 (26.70)
W_5 : W_4 + Interculturing at 20 DAS	3.22 (9.91)	2.77 (7.18)	3.04 (8.78)	5.13 (25.87)
W_6 : W_4 + Interculturing at 40 DAS	3.26 (10.17)	2.84 (7.57)	3.05 (8.79)	5.20 (26.53)
W_7 : W_4 + Hand Weeding at 40 DAS	3.20 (9.75)	2.75 (7.10)	2.99 (8.45)	5.07 (25.30)
S.Em. \pm	1.36	0.67	0.32	1.74
C.D. at 5%	3.86	1.89	0.90	4.94
Fertility levels (NPK kg ha⁻¹)				
F_1 : 75% of recommended dose	6.13 (37.11)	4.06 (16.06)	3.54 (12.04)	8.13 (65.54)
F_2 : 100% recommended dose (<i>i.e.</i> , 150-50-50 NPK kg/ha)	6.23 (38.34)	4.10 (16.32)	3.56 (12.23)	8.19 (66.57)
S.Em. \pm	0.68	0.33	0.16	0.87
C.D. at 5%	NS	NS	NS	NS

DAS = Days after Sowing. NS = Non-Significant.

Note: Data in parentheses refers to actual weed population.

Table 2: Weed population/ m^2 at 40 days after sowing in summer okra cv. Parbhani Kranti as influenced by weed management and fertility levels

Treatment	Monocot	Dicot	Sedge	Total
Weed management				
W_0 : Unweeded control	9.95 (98.67)	6.55 (42.48)	6.38 (40.20)	13.48 (181.35)
W_1 : Weed free (<i>i.e.</i> , Hand Weeding at 20, 40 and 60 DAS)	4.92 (23.78)	3.35 (10.78)	3.50 (11.75)	6.84 (46.31)
W_2 : Hand weeding at 20 and 40 DAS	4.93 (23.80)	3.37 (10.85)	3.51 (11.80)	6.85 (46.45)
W_3 : Interculturing at 20 and 40 DAS	6.64 (43.67)	5.49 (29.76)	4.55 (20.26)	9.68 (93.49)
W_4 : Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha (Blanket application)	6.73 (44.90)	5.74 (2.54)	5.54 (32.45)	10.50 (109.89)
W_5 : W_4 + Interculturing at 20 DAS	2.84 (7.60)	2.72 (6.90)	2.58 (6.15)	4.60 (20.65)
W_6 : W_4 + Interculturing at 40 DAS	6.72 (44.76)	5.57 (30.55)	4.37 (18.67)	9.71 (93.98)
W_7 : W_4 + Hand Weeding at 40 DAS	6.72 (44.65)	5.57 (30.55)	4.28 (17.86)	9.66 (93.06)
S.Em. \pm	1.34	0.81	0.64	1.38
C.D. at 5%	3.80	2.30	1.82	3.91
Fertility levels (NPK kg ha⁻¹)				
F_1 : 75% of recommended dose	6.45 (41.14)	4.96 (24.10)	4.50 (19.74)	9.24 (84.95)
F_2 : 100% recommended dose (<i>i.e.</i> , 150-50-50 NPK kg/ha)	6.50 (41.82)	5.00 (24.50)	4.53 (20.05)	9.26 (85.35)

S.Em.±	0.67	0.41	0.32	0.69
C.D. at 5%	NS	NS	NS	NS

DAS = Days after Sowing. NS = Non Significant

Note: Data in parentheses refers to actual weed population.

Table 3: Dry weight of weeds and weed control efficiency in summer okra cv. Parbhani Kranti as influenced by weed management and fertility levels

Treatment	At 60 DAS (g/m ²)	At 80 DAS (kg/ha)
Weed management		
W ₀ : Unweeded control	210.80	1004.65
W ₁ : Weed free (<i>i.e.</i> , Hand Weeding at 20, 40 and 60 DAS)	(82.04)* 37.87	(77.03)* 230.76
W ₂ : Hand weeding at 20 and 40 DAS	(79.24) 43.76	(73.07) 270.54
W ₃ : Interculturing at 20 and 40 DAS	(61.73) 80.67	(50.18) 500.50
W ₄ : Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha (Blanket application)	(52.25) 100.65	(38.20) 620.87
W ₅ : W ₄ + Interculturing at 20 DAS	(56.89) 90.87	(46.77) 534.76
W ₆ : W ₄ + Interculturing at 40 DAS	(61.69) 80.76	(58.12) 420.76
W ₇ : W ₄ + Hand Weeding at 40 DAS	(78.91) 44.45	(72.44) 276.87
S.Em.±	2.93	16.71
C.D. at 5%	8.32	47.45
Fertility levels (NPK kg ha⁻¹)		
F ₁ : 75% of recommended dose	78.87	478.03
F ₂ : 100% recommended dose (<i>i.e.</i> , 150-50-50 NPK kg/ha)	93.59	486.89
S.Em.±	1.46	8.35
C.D. at 5%	4.16	NS

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