

Original Research Article

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## Effect of Intra Row Spacing and Weed Management in Cotton (*Gossypium hirsutum* L.) under South Gujarat Conditions

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### ABSTRACT

#### Keywords

Cotton, Weed management, and Spacing

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Field experiments were conducted at Instructional Farm, Navsari Agricultural University, Navsari during kharif and summer seasons of 2010-11 and 2011-12 to know the effect of intra row spacing and weed management in cotton under heavy rainfall zone of South Gujarat. Various growth and yield attributing characters of cotton were significantly affected due to different levels of spacing and weed management practices. Weed population at 20,40,60,90 DAS and at harvest and dry weight of total weeds at harvest were significantly lowest with wider spacing ( $S_3$ ) and markedly higher under weedy check ( $W_1$ ). Dry weight of weeds at harvest differed significantly in all the treatments and remained in  $W_4 < W_3 < W_5 < W_6 < W_2 < W_7 < W_1$  order of their significance.

### Introduction

Cotton, the king of fiber, is one of the momentous and an important cash crop exercising profound influence on economics and social affairs of the world. Any other fiber crop cannot be compared with cotton for its fiber quality. Due to this significant importance cotton is also known as “White Gold”. Cotton is one of the most popular crops among farmers of the world. It is one of the few crop species that were domesticated in both the old and new World possessing great importance as a multipurpose crop that supplies five basic products: lint, oil, seed meal, hulls and linters. Even today, it

occupies an outstanding position in the textile industry despite of the pressure of manmade fibers and blended fibers. India produces 106.82 lakh bales of cotton and the average productivity of cotton in Gujarat is 693 kg/ha which is higher than the national average (Anon., 2011) but lower than the world average. The soil and climatic conditions of Gujarat are well suited for the cultivation of this crop and there is huge scope for area expansion. Weeds are recognized as the most unique problem in cotton crop because they are naturally hardy, self sown and highly competitive hence strive hard with cotton crop for water, nutrients, light and space resulting in poor performance of this crop

Sandhu *et al.*, (1996). They also impair the quality of produce if allowed to grow. Wider spacing and slow initial growth of cotton makes weed management most important concern in its cultivation. Starting with hand man has tried stone tools, hand tools, bullock and tractor drawn implements for managing weeds. Research evidences indicate that neither of these methods are found completely effective in controlling variety of weed growing in this crop. Though mechanical methods are simple and effective they are not feasible every time looking to soil and crop conditions and also due to their time consuming and laborious nature. With the advent of potent weedicides, bioagents integrated weed management has been seen as the best and cost effective management of weeds. Integrated approach is one of the options where judicious combination of two or more methods is adopted. According to Chander *et al.*, (1997) herbicide alone in combination with one hand weeding reduced the dry weight and nutrient uptake by weeds significantly. Spark (1997) reported pendimethalin, glyphosate, quizalofop -p-ethyl and sodium pyriothiac as promising potent herbicides in cotton cultivation. Shetty (1997) confirmed that use of herbicides is the only management possible where manual or mechanical weed control is difficult because of wet soil conditions.

### **Materials and Methods**

The experiment was conducted at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during the kharif and summer seasons of both years 2010 -11 and 2011-12. The experimental field during the course of experimentation was uniform and fairly leveled. Geographically, the College Farm is situated at 20° 27' N and 72° 54' E latitude and longitude coordinates with an elevation of 10 meters above the mean sea level. Navsari falls

under agro -ecological situation -III of South Gujarat heavy rainfall zone, which is characterized by fairly warm summer, mild winter and warm humid monsoon with heavy rainfall. The rainfall in this region is heavy and normally commences from the second fortnight of June and ends by the middle of September. Pre -monsoon rains in the last week of May or in the first week of June are not uncommon. Most of the precipitation is received from South -West monsoon concentrating in the months of July and August. The annual mean rainfall received during the monsoons was 1400 mm distributed in 50 rainy days. The winter season sets in usually towards the end of October. The temperature starts declining in first fortnight of November and becomes the lowest either in the month of December or January and hence, these two months are the coldest months of the year. The summer commences from the middle of February and prolongs up to first fortnight of June. From February onwards the temperature starts rising and reaches the maximum in the months of April and May which are the hottest months of the year. The soil of College Farm has been placed under the group Ustochrepts, sub group Vertiustochrepts, sub -order orchrepts and order Inceptisols with Jalalpur series and classified as “Deep Black” soils. Soil are deep, moderately drained having good water holding capacity. It also cracks heavily on drying and expands on wetting. The predominant clay mineral is montmorillonite. Twenty-one treatment combinations consisting of three spacings *viz.* S<sub>1</sub> -120 x 30 cm, S<sub>2</sub> -120 x 45 cm and S<sub>3</sub> - 120 cm x 60 cm and seven weed management practices *i.e.* W<sub>1</sub> - Un weeded control, W<sub>2</sub> - glyphosate @ 1.0 kg/ha protected spraying at 30 and 60 DAS, W<sub>3</sub> - pendimethalin @ 1.0 kg/ha pre emergence + hand weeding at 30 and 60 DAS, W<sub>4</sub> - weed free, W<sub>5</sub> - pendimethalin @ 1.0 kg/ha + quizalotop-P-ethyl @ 0.05 kg/ha at 30 DAS, W<sub>6</sub> -

pyrithiobac sodium @ 0.05 kg/ha + hand weeding at 30 DAS and W<sub>7</sub> - pyrithiobac sodium @ 0.05 kg/ha + quizalofop -P-ethyl @ 0.05 kg/ha at 30 DAS were evaluated in split plot design with three replications. Weed population of monocots, dicots and sedges was recorded from one square meter area.

## Results and Discussion

The prominent weed flora observed in weedy plot of the experiment was *Echinochloa crusgalli* and *Cynodon dactylon* among the monocot weeds, *Cyperus rotundus* L. among the sedges and *Amaranthus viridis* L., *Digera arvensis*, *Portulaca oleracea* and *Alternanthera sessilis* among the dicot weeds during both the years.

The results on weed population, dry weight of weeds, as influenced by various treatments of spacing and weed management included in this investigation entitled, “ Effect of intra row spacing and weed management in cotton and their weed attributes weed index and weed control efficiency under south Gujarat condition. are presented in this chapter.

The data recorded for various characters during the course of investigation along with statistical inferences have been presented and significant effects are described at a length to provide a quick grasp of the trends. Weed population at harvest. Mean data on weed population of monocots, dicots and sedges recorded from one square metre area at an early growth stage. Effect of spacing effects on weed population (monocots, dicots and sedges) due to spacing at harvest were found to be significant during both the years and in pooled results. Significantly the lowest weed population of monocot, dicot and sedges were observed in wider plant spacing of S<sub>3</sub>(120 x 60 cm), however was statistically at par with S<sub>2</sub>. The highest number of all weed flora were recorded in lowest spacing (S<sub>1</sub>) Effect of

weed management The differences in monocot, dicot and sedges were found to be significant. The lowest number of monocot, dicot and sedges were recorded with W<sub>3</sub> (Pendimethalin @ 1.0 kg/ha pre emergence + hand weeding in at 30 and 60 DAS) but it remained at par with W<sub>5</sub> (Pendimethalin @ 1.0 kg/ha + quizalotop -P-ethyl @ 0.50 kg/ha at 30 DAS) While the highest number of weed flora were recorded with to unweeded control (W<sub>1</sub>). Effect of spacing

The results presented in (Table 2) revealed that effect of various spacing was significant during both the years as well as in pooled results, where S<sub>3</sub>(120 x 60 cm) was recorded significantly the lowest dry weight of weeds at 60 DAS and it remained statistically at par with S<sub>2</sub> (120 x 45 cm). The highest dry weight of weeds was recorded to W<sub>1</sub> (unweeded control) Wider spacing (S<sub>3</sub>) recorded significantly the lowest dry weight of weeds at harvest (252.95, 255.19 and 254.07 kg/ha) in first year, second year and in pooled, respectively) which was superior to S<sub>2</sub> and S<sub>1</sub> during both the years and in pooled results. The data in Table-3 indicated that significantly the lowest dry weight of weeds (146.11, 147.78 and 146.9 kg/ha, in first, second year and in pooled results, respectively) were recorded in weed free treatment (W<sub>4</sub>) which was at par with W<sub>3</sub> and W<sub>5</sub> in first year and second year, only

The response with respect to dry weight of weed at harvest was observed in the order W<sub>4</sub>< W<sub>3</sub>< W<sub>6</sub>< W<sub>2</sub>< W<sub>7</sub>< W<sub>1</sub> throughout the investigation period Interaction of spacing and weed management on number of monocot, dicot and sedge of weeds were found non significant during both the years as well as in pooled results Dry weight of weeds at harvest Interaction was found non-significant during both the years and in pooled results..

**Table.1** Weed population m<sup>-2</sup> in cotton at harvest days after sowing as influenced by various treatments of spacing and weed

Treatments	monocot			dicot			sedge		
	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled
<b>Spacing (S)</b>									
<b>S<sub>1</sub>-120 cm x 30 cm</b>	3.23 (9.95)	3.23 (9.96)	3.23 (9.95)	2.75 (7.11)	2.80 (7.38)	2.78 (7.24)	4.98 (24.33)	4.70 (21.60)	<b>4.84</b> <b>(22.96)</b>
<b>S<sub>2</sub>-120 cm x 45 cm</b>	3.11 (9.22)	3.19 (9.69)	3.15 (9.45)	2.75 (6.05)	2.59 (6.22)	2.57 (6.13)	4.94 (24)	4.59 (20.60)	<b>4.77</b> <b>(22.3)</b>
<b>S<sub>3</sub>-120 cm x 60 cm</b>	2.99 (8.49)	3.05 (8.82)	3.02 (8.65)	2.50 (5.77)	2.53 (5.94)	2.52 (5.85)	4.81 (22.73)	4.39 (18.80)	<b>4.61</b> <b>(20.76)</b>
<b>S.Em±</b>	0.22	0.19	0.20	0.09	0.19	0.14	0.55	0.37	<b>0.46</b>
<b>C.D at 5%</b>	0.76	0.66	0.71	0.30	0.64	0.47	1.57	1.27	<b>1.42</b>
<b>C.V.%</b>	10.70	9.24	9.97	6.31	13.07	9.69	10.68	8.25	<b>9.46</b>
<b>Weed management practices (W)</b>									
<b>W<sub>1</sub>- Unweeded control</b>	4.11 (16.46)	4.13 (16.60)	4.12 (16.53)	3.68 (13.11)	3.63 (12.73)	3.66 (12.92)	6.58 (42.89)	6.10 (36.78)	<b>6.35</b> <b>(39.83)</b>
<b>W<sub>2</sub> - Glyphosate@1.0kg/ha protected spraying at 30 and 60 DAS</b>	3.76 (13.66)	3.75 (13.59)	3.75 (13.62)	3.23 (9.99)	3.20 (9.80)	3.22 (9.89)	5.07 (25.22)	5.26 (27.22)	<b>5.16</b> <b>(26.22)</b>
<b>W<sub>3</sub>- Pendimethalin@1.0kg/hapre-emrgence + hand weeding at 30 and 60 DAS</b>	1.98 (3.44)	2.04 (3.69)	2.01 (3.56)	2.05 (3.71)	2.07 (3.82)	2.06 (3.76)	2.52 (5.90)	2.46 (5.60)	<b>2.5</b> <b>(5.75)</b>
<b>W<sub>4</sub>- Handweeding and inter culturing at 20, 40 and 60 DAS (weedfree)</b>	1.81 (2.81)	1.86 (2.98)	1.84 (2.89)	1.91 (3.17)	2.05 (3.73)	1.98 (3.45)	2.07 (3.80)	2.10 (3.94)	<b>2.09</b> <b>(3.87)</b>
<b>W<sub>5</sub> -Pendimethalin @ 1.0kg/ha + quizalofop-p ethyl @ 0.05kg/haat 30 DAS</b>	2.01 (3.58)	2.10 (3.92)	2.06 (3.75)	2.09 (3.90)	2.1 (3.92)	2.1 (3.91)	2.64 (6.49)	2.64 (6.50)	<b>2.64</b> <b>(6.49)</b>
<b>W<sub>6</sub>- Pyrithiobac sodium @ 0.04 +hand weeding at 30 DAS</b>	3.61 (12.54)	3.62 (12.65)	3.61 (12.59)	2.37 (5.15)	2.24 (4.53)	2.31 (4.84)	5.36 (28.25)	4.97 (24.22)	<b>5.1</b> <b>(26.23)</b>
<b>W<sub>7</sub>- Pyrithiobac sodium @ 0.04 + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS</b>	3.76 (13.67)	3.75 (13.61)	3.76 (13.64)	2.64 (6.48)	2.75 (7.08)	2.69 (6.78)	6.17 (37.58)	5.72 (32.33)	<b>5.95</b> <b>(34.95)</b>
<b>S.Em±</b>	0.32	0.34	0.33	0.38	0.38	0.38	0.94	0.91	<b>0.92</b>
<b>C.D at 5%</b>	0.93	0.96	0.94	1.08	1.08	1.08	2.70	2.61	<b>2.65</b>
<b>C.V.%</b>	10.38	10.61	10.49	17.35	17.32	17.33	11.94	13.44	<b>12.69</b>
<b>Interaction</b>	NS	NS	NS	NS	NS	NS	NS	NS	NS

**Table.2** Weed population m<sup>-2</sup> in cotton at harvest days after sowing as influenced by various treatments of spacing and weed management

Treatments	monocot			dicot			Sedge		
	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled
<b>Spacing (S)</b>									
S <sub>1</sub> -120 cm x 30 cm	4.57 (20.44)	4.53 (20.04)	4.55 (20.24)	4.62 (20.88)	4.56 (20.31)	4.59 (20.59)	5.43 (29.01)	5.44 (29.19)	<b>5.44</b> <b>(29.1)</b>
S <sub>2</sub> -120 cm x 45 cm	4.44 (19.29)	4.43 (19.19)	4.44 (19.24)	4.46 (19.44)	4.42 (19.09)	4.44 (19.26)	5.30 (27.62)	5.25 (27.09)	<b>25.27</b> <b>(7.35)</b>
S <sub>3</sub> -120 cm x 60 cm	4.40 (18.90)	4.38 (18.69)	4.39 (18.79)	4.34 (18.42)	4.40 (18.89)	4.37 (18.65)	5.07 (25.22)	5.03 (24.82)	<b>25.05</b> <b>(5.02)</b>
S.Em±	0.31	0.42	0.36	0.42	0.51	0.46	0.73	0.73	<b>0.73</b>
C.D at 5%	0.88	1.46	1.17	1.46	1.76	1.61	2.53	2.53	<b>2.53</b>
C.V.%	7.30	9.87	8.58	9.86	11.82	10.84	12.29	12.24	<b>12.26</b>
<b>Weed management practices (W)</b>									
W <sub>1</sub> - Unweeded control	6.47 (41.44)	6.50 (41.78)	6.48 (41.61)	6.25 (38.59)	6.32 (39.49)	6.28 (39.04)	7.57 (56.89)	7.59 (57.22)	<b>7.58</b> <b>(57.055)</b>
W <sub>2</sub> - Glyphosate@1.0kg/ha protected spraying at 30 and 60DAS	4.85 (23.10)	4.73 (21.88)	4.79 (22.49)	5.11 (25.63)	5.13 (25.86)	5.12 (25.74)	6.10 (36.78)	6.12 (37.0)	<b>6.11</b> <b>(36.89)</b>
W <sub>3</sub> - Pendimethalin@1.0kg/hapre-emrgence + hand weeding at 30 and 60 DAS	2.40 (5.28)	2.35 (5.05)	2.38 (5.16)	2.4 (5.26)	2.46 (5.58)	2.43 (5.42)	2.53 (5.95)	2.56 (6.08)	<b>2.55</b> <b>(6.015)</b>
W <sub>4</sub> - Handweeding and inter culturing at 20, 40 and 60 DAS (weed free)	2.1 (4.00)	2.08 (3.83)	2.10 (3.91)	2.34 (5.00)	2.18 (4.29)	2.26 (4.64)	2.02 (3.60)	2.17 (4.25)	<b>2.10</b> <b>(3.925)</b>
W <sub>5</sub> -Pendimethalin @ 1.0kg/ha + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS	2.44 (5.50)	2.45 (5.54)	2.45 (5.52)	2.64 (6.49)	2.50 (5.76)	2.57 (6.12)	2.75 (7.11)	2.95 (8.21)	<b>2.85</b> <b>(7.66)</b>
W <sub>6</sub> - Pyrithiobac sodium @ 0.04 +hand weeding at 30 DAS	5.15 (26.11)	5.09 (25.44)	5.12 (25.77)	4.27 (17.74)	4.24 (17.51)	4.25 (17.62)	6.10 (36.78)	6.03 (35.89)	<b>36.06</b> <b>(6.33)</b>
W <sub>7</sub> - Pyrithiobac sodium @ 0.04 + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS	5.55 (30.41)	5.50 (29.86)	5.53 (30.13)	6.1 (36.82)	6.15 (37.40)	6.13 (37.11)	6.43 (40.89)	6.43 (40.89)	<b>46.43</b> <b>(0.89)</b>
S.Em±	0.53	0.67	0.6	0.57	0.54	0.55	1.34	1.44	<b>1.39</b>
C.D at 5%	1.52	1.92	1.72	1.63	1.54	1.58	3.84	4.12	<b>3.98</b>
C.V.%	8.12	10.39	9.255	8.71	8.15	8.43	14.73	15.77	<b>15.25</b>
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS

**Table.3** Dry weight of weeds in cotton 60 90 an d at harvest days after sowing as influenced by various treatments of spacing and weed management

Treatments	60das			90das			At- harvest		
	1 year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled
<b>Spacing (S)</b>									
<b>S<sub>1</sub>-120 cm x 30 cm</b>	4.84 (23.01)	4.94 (24.00)	4.89 (23.50)	5.35 (28.14)	5.41 (28.81)	5.38 (28.475)	16.90 (285.14)	16.96 (287.29)	<b>16.93</b> <b>(286.21)</b>
<b>S<sub>2</sub>-120 cm x 45 cm</b>	4.81 (22.67)	4.88 (23.33)	4.84 (23)	5.29 (27.52)	5.37 (28.43)	5.33 (27.975)	16.51 (272.14)	15.58 (274.48)	<b>16.54</b> <b>(273.31)</b>
<b>S<sub>3</sub>-120 cm x 60 cm</b>	4.72 (21.86)	4.80 (22.57)	4.76 (22.21)	5.10 (25.57)	5.17 (26.33)	5.14 (25.95)	15.92 (252.95)	15.99 (255.19)	<b>15.95</b> <b>(254.07)</b>
<b>S.Em±</b>	0.48	0.53	0.50	0.75	0.84	0.795	9.53	9.53	<b>9.53</b>
<b>C.D at 5%</b>	1.37	1.52	1.44	2.15	2.41	2.28	27.35	27.35	<b>27.35</b>
<b>C.V.%</b>	9.66	10.27	9.96	12.62	13.76	13.19	16.17	16.04	<b>16.10</b>
<b>Weed management practices (W)</b>									
<b>W<sub>1</sub>- Unweeded control</b>	5.77 (32.89)	5.84 (33.67)	5.81 (33.28)	6.35 (39.89)	6.41 (40.67)	6.38 (40.28)	19.88 (395.0)	19.96 (398.0)	<b>19.92</b> <b>(396.5)</b>
<b>W<sub>2</sub> - Glyphosate@1.0kg/ha protected spraying at 30 and 60 DAS</b>	5.12 (25.78)	5.19 (26.44)	5.15 (26.11)	5.53 (30.11)	5.59 (30.78)	5.56 (30.44)	17.48 (305.33)	17.57 (308.33)	<b>17.53</b> <b>(306.83)</b>
<b>W<sub>3</sub>- Pendimethalin@1.0kg/hapre-emrgence + hand weeding at 30 and 60 DAS</b>	4.36 (18.56)	4.44 (19.22)	4.40 (18.89)	4.60 (21.22)	4.80 (22.56)	4.73 (21.89)	14.71 (216.11)	14.79 (218.33)	<b>14.75</b> <b>(217.22)</b>
<b>W<sub>4</sub>- Handweeding and inter culturing at 20, 40 and 60 DAS (weed free)</b>	3.42 (11.22)	3.51 (11.83)	3.46 (11.52)	3.92 (14.89)	3.99 (15.44)	3.95 (15.16)	12.10 (146.11)	12.16 (147.48)	<b>12.13</b> <b>(146.79)</b>
<b>W<sub>5</sub> -Pendimethalin @ 1.0kg/ha + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS</b>	4.57 (20.44)	4.64 (21.11)	4.61 (20.77)	4.88 (23.33)	5.02 (24.78)	4.95 (24.05)	15.84 (250.56)	15.90 (252.33)	<b>15.87</b> <b>(251.44)</b>
<b>W<sub>6</sub>- Pyrithiobac sodium @ 0.04 +hand weeding at30 DAS</b>	4.90 (23.56)	4.96 (24.11)	4.93 (23.83)	5.22 (26.78)	5.28 (27.44)	5.28 (27.11)	16.31 (265.56)	16.36 (267.33)	<b>16.33</b> <b>(266.44)</b>
<b>W<sub>7</sub>- Pyrithiobac sodium @ 0.04 + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS</b>	5.24 (27.0)	5.30 (27.67)	5.27 (27.33)	5.64 (31.33)	5.72 (32.33)	5.68 (31.83)	17.64 (311.0)	17.71 (313.33)	<b>17.68</b> <b>(312.16)</b>
<b>S.Em±</b>	0.74	0.74	0.74	0.80	0.77	0.78	9.45	9.47	<b>9.46</b>
<b>C.D at 5%</b>	2.12	2.12	2.12	2.28	2.22	2.25	27.11	27.17	<b>27.14</b>
<b>C.V.%</b>	9.76	9.43	9.59	8.81	8.35	8.58	10.50	10.44	<b>10.47</b>
<b>Interaction</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

**Table.4** Weed control efficiency and weed index in cotton as influenced by various treatments of spacing and weed management

Treatments	Weed control efficiency			Weed index		
	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled	1 <sup>st</sup> year	2 <sup>nd</sup> year	Pooled
<b>Spacing (S)</b>						
S <sub>1</sub> -120 cm x 30 cm	34.16	33.96	34.05	15.00	14.52	<b>14.75</b>
S <sub>2</sub> -120 cm x 45 cm	30.69	30.93	30.80	13.88	14.39	<b>14.13</b>
S <sub>3</sub> -120 cm x 60 cm	29.51	29.82	29.66	11.49	11.56	<b>11.52</b>
S.Em±	0.95	0.95	0.95	0.43	0.45	<b>0.44</b>
C.D at 5%	2.72	2.72	2.72	1.48	1.57	<b>0.63</b>
C.V.%	13.88	13.85	13.86	14.60	15.42	<b>15.01</b>
<b>Weed management practices(W)</b>						
W <sub>1</sub> - Unweeded control	0.00	0.00	0.0	29.04	29.44	<b>29.24</b>
W <sub>2</sub> - Glyphosate@1.0kg/ha protected spraying at 30 and 60 DAS	22.71	22.31	22.51	16.02	17.33	<b>16.67</b>
W <sub>3</sub> - Pendimethalin@1.0kg/ha pre-emergence + hand weeding at 30 and 60 DAS	44.22	45.21	44.71	6.37	5.83	<b>6.09</b>
W <sub>4</sub> - Handweeding and inter culturing at 20, 40 and 60 DAS (weed free)	63.95	62.88	62.92	0.00	0.00	<b>0.00</b>
W <sub>5</sub> -Pendimethalin @ 1.0kg/ha + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS	36.41	36.56	30.49	8.33	8.42	<b>8.37</b>
W <sub>6</sub> - Pyriithiobac sodium @ 0.04 +hand weeding at 30 DAS	32.66	32.78	32.72	12.49	11.35	<b>11.91</b>
W <sub>7</sub> - Pyriithiobac sodium @ 0.04 + quizalofop-p ethyl @ 0.05kg/ha at 30 DAS	21.20	21.23	21.21	21.93	22.05	<b>21.99</b>
S.Em±	1.46	1.45	1.45	0.45	0.71	<b>0.59</b>
C.D at 5%	4.18	4.15	4.15	1.30	2.03	<b>2.07</b>
C.V.%	13.89	13.84	13.86	14.43	15.75	<b>13.24</b>
Intrraction	NS	NS	NS	NS	NS	NS

Weed control efficiency (WCE) (%) and Weed index (%) a perusal of data in (Table 4) revealed that the highest weed control efficiency (62.91 %) was recorded under weed free (W4) while it was the lowest (44.71 %) with Pendimethalin @ 1.0 kg/ha pre emergence + hand weeding effect in at 30 and 60 DAS (W 3). The responses of different weed management practices in term of weed control efficiency on pooled basis was found in order of merit as W4< W3< W5< W6< W2 < W7< W1 at harvest. The data showed significant influence of various weed management treatments on weed index. Pendimethalin @ 1.0 kg/ha pre-emergence + hand weeding at 30 and 60 DAS (W3) recorded the lowest weed index (61%) and most effective in controlling the weeds followed by (W 5). The response of different weed management practices in term of weed index on pooled basis was found in order of merit as W3< W5< W6< W2< W7< W1.

Effect on weed population, dry weight of weeds, weed control efficiency and weed index. It is evident from (Table 1 to 3) that all weed management practices effectively controlled monocot, dicot and sedges weeds in cotton crop at harvest during both the years. Similarly dry weight of weeds at harvest in cotton was also reduced appreciably in all the weed management practices as compared to unweeded control (W1). the lowest number of monocot, dicot and sedge were recorded with pendimethalin @ 1.0 kg/ha pre emergence + hand weeding at 30 and 60 DAS but remained at par with pendimethalin @1.0 kg /ha + quizalofop -p-ethyl @ 0.05 kg/ha at both the years and in the pooled results Similar trend was observed at harvest. In case of herbicides, all herbicides were found almost equally effective either alone or in mixture or in conduction with H.W as compared to unweed control (W1) to reduce weed population. Comparison of monocot, dicot and sedges weed population

had indicated that monocot and sedges weed population were remarkably lower in quizalofop -p- ethyl treatment, while dicot weed population was reduced with pendimethalin application next to combined application of pendimethalin with quizalofop -p- ethyl. The results are in agreement with the finding of Koshiya (2010). Data on dry-weight of weeds recorded at harvest (Table - 3) indicated that all the treatments of weed management were differing significantly among each other and independent in their effect on dry weight of weeds and they remained in the order of their significance W4 < W3< W5< W6 W2< W7< W1 during both the years and also in pooled data. The result showed that pendimethalin or quizalofop -p-ethyl were not sufficient to reduce weed competition throughout crop life. For better weed control pendimethalin or quizalofop -p-ethyl coupled with post emergence herbicides or H.W or I.C found most effective throughout crop life. These treatments also recorded higher weed control efficiently (Table-4) as compared to treatments W1, W7 and W6 indicating their superiority with respect to weed management. Various weed management treatments showed better weed control efficiency and weed index (Table 24 to 25). The highest weed control efficiency (62.91%) at harvest was recorded under treatment W4 (weed free) W3 (44.71) and W5 (36.48%). This might be due to effective weed control achieved under effective method of weed management in term of reduced biomass of weeds and higher weed control efficiency. Looking to weed index which is the indicator of losses in seed cotton yield due to presence of weeds was the lowest (6.1%) under pendimethalin @ 1.0 kg/ha pre -emergence + hand weeding at 30 & 60 DAS followed by treatment w5 pendimethalin @ 1.0 kg/ha + quizalofop -p-ethyl @ 0.50 kg / ha at 30 DAS with 8.37% and 11.92% respectively. Almost similar results were also reported by Anon., (1992), Deshpande *et al.*,



(2006) and Sarkar (2006). Conclusion and Acknowledgment All the weed management practices recorded appreciably higher values of growth and yield attributing characters, yield and uptake of nutrients. They controlled the weeds effectively as compared to unweeded control. Weed free (W4), pendimethalin @ 1.0 kg/ha pre emergence + hand weeding at 30 and 60 DAS (W 3), pendimethalin @ 1.0 kg/ha + quizalofop -P-ethyl @ 0.05 kg/ha at 30 DAS (W5), significantly influenced most of the growth attributes of cotton viz., the plant height and number of branches per plant and recorded higher values for these characters and found superior to rest of the weed management practices. Treatment of weed free (W4) recorded significantly higher number of bolls per plant, seed cotton yield and stalk yield closely followed by pendimethalin @ 1.0 kg/ha pre emergence + hand weeding at 30 and 60 DAS (W3) and pendimethalin @ 1.0 kg/ha + quizalofop -P-ethyl @ 0.05 kg/ha at 30 DAS (W5). Among different weed management practices, the maximum seed cotton yield (kg/ha) was reported under weed free (W4), followed by pendimethalin @ 1.0 kg/ha pre emergence + hand weeding in 30 and 60 DAS (W 3) and being at par with pendimethalin @ 1.0 kg/ha + quizalofop-P-ethyl @ 0.05 kg/ha at 30 DAS (W5) with respect to stalk yield (kg/ha). Based on number of boll per plant and increase in seed cotton yield (kg/ha) of cotton were in the order W4, W3, W5, W6, W2, W7 and W1 according to the merit. The effect of various weed management practices on harvest index was found to be non significant. Weed population and dry weight of weeds were significantly higher under un weeded control (W1). Significantly lower weed population at 20, 40, 60, 90 and At harvest were observed in pendimethalin @ 1.0 kg/ha pre emergence + hand weeding in at 30 and 60 DAS (W3) followed by pendimethalin @ 1.0 k g/ha +

quizalofop-P-ethyl @ 0.05 kg/ha at 30 DAS (W5). So far dry weight of weeds at harvest is concerned all the treatment of weed management differed from each other and remained in W4 < W3 < W5 < W6 < W2 < W7 < W1 in order of their significances in pooled result.

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