



Effect of herbicides on growth, weed control efficiency and seed cotton yield of HDPS cotton

S. R. ANMULWAD*, P. G. INGOLE, M. D. YENPREDDIWAR, A. N. PASLAWAR AND A. S. DEOTALU

Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola- 444 104

*E-mail : satishanmulwad@gmail.com

ABSTRACT : A field experiment was conducted during the rainy season of 2014-2015 on Vertisol, to study the effect of different pre and post emergence weedicides on high density planting system (HDPS) cotton among the tested weedicides, the highest seed cotton yield (1741 kg /ha) was recorded with weed free check followed by pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha fb hoeing at 30 DAS and one hand weeding at 45 DAS. The highest weed-control efficiency (96.08) was recorded with weed free check followed by pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha fb hoeing at 30 DAS and one hand weeding at 45 DAS. The SCY was maximum due to more number of plants of AKH 081/unit area. The plant population was 1.55 lakh /ha sown on broad bed furrow system.

Key words : Cotton, herbicide, weed control

Cotton (*Gossypium hirsutum* L.) is an important commercial crop of India grown for its lint used as a major textile fibre, which is aptly called as “White Gold”. It is contributing upto 85 per cent of raw material to the textile industry. Critical period of crop weed competition is 60 to 70 days from sowing. The weed problem gets more severe due to certain unforeseen factors such as inefficient weeding or interculture coupled with continuous rains during early crop growth period. Initial period of cotton growth needs to be protected from weeds competition.

To improve cotton productivity high density planting system may be desirable for increasing plant population/ha which may results in to increase in seed cotton yield /ha. At national level, the emphasis on high density system in cotton is initiated to increase cotton productivity. Traditionally cotton was sown in lines using locally fabricated seed drills. The distance between rows ranged from 30 to 60 cm. Several research experiments conducted later

indicated that with increase in plant density yield/unit area increased to an upper limit. The optimum plant density in this parabolic (density yield) relationship was a function of the genotype, soil type, climate and management. Concerted efforts on high density planting system using straight varieties were initiated at Central Institute for Cotton Research (CICR), Nagpur along with co operative centres. Development of HDPS for maximizing the productivity of rainfed cotton with 125 per cent RDF would be needed to meet the increased requirements of the crop under HDPS with a population of 1.55 lakhs/ha. An ideal variety having better adaptation to high-density planting is the first step for successful HDPS. Genotype AKH081 popularly called PKV081 was found most suitable for HDPS based on yield, morphological features, earliness, tolerance to sucking pests and boll weight. (Venugopalan *et al.*, 2013).

Losses caused by weeds in cotton ranges from 50 to 85 per cent depending upon the

nature and intensity of weeds. Weeds primarily compete for nutrients, moisture and sunlight and space during the early crop growth period than at later stage. The critical period of weed competition in cotton was found to be 15 to 60 days. Being a slow growing crop, cotton suffers from heavy weed competition just after emergence.

The primary function of herbicides is to protect agricultural crop from infestation of weeds especially in early stages and to prevent arable land from being over grown by plants over indigenous to the ecosystem. The chemical known as herbicides are mainly synthetic organic compounds with broad molecular configuration having as a common property of their ability of selectivity killing or inhibiting the growth of plant.

The weeds (annual and perennial) in cotton can be effectively controlled by combining cultural method and pre or post emergence application of herbicide like pendimethalin, quizalofop ethyl, pyriithiobac sodium etc. Therefore, the use of herbicide at sowing of crop and later as post emergence could prove efficient and economical for timely weed control in HDPS cotton.

A field experiment was conducted during the rainy season of 2013-2014 at Cotton Research Station, Dr. P.D.K.V. Akola. The soil was clayey in texture and natural in reaction. The soil having organic carbon 4.70 g /kg, pH 8.9, EC 0.30 d/Sm, available N, P and K 225, 14.4 and 342 kg /ha, respectively. The experiment consisting of eight treatment combinations was carried out in three replications with randomized block design. The treatments were Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha fb hoeing at 30 DAS and one hand weeding at 45 DAS, quizalofopethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage) fb hoeing

at 45 DAS, pyriithiobac sodium 10 EC @ 0.075 kg a.i./ha POE 20-25 DAS (2-4 leaf weed stage) fb hoeing at 45 DAS, pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha fb quizalofop ethyl 10 EC @ 0.075 kg a.i./ha POE 20-25 DAS(2-4 leaf weed stage), pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha fb pyriithiobac sodium 10 EC @ 0.075 kg a.i./ha POE 20-25 DAS (2-4 leaf weed stage), pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha fb quizalofop ethyl 10 EC @ 0.060 kg a.i. /ha + pyriithiobac sodium 10 EC POE @ 0.062 kg a.i. /ha POE (tank mix) (2-4 leaf weed stage), weed free check and weedy check.

The crop was sown at 60 x 10 cm spacing on BBF with gross plot of 6.0 x 4.8m in third week of July with variety AKH 081 and harvested in fourth week of December crop was fertilized with a uniform dose of 60 kg N + 30 kg P₂O₅ + 30 kg K₂O /ha. The sowing was delay because of late onset of monsoon and dry spell at the time of boll development stage. Weed control operations were accomplished as per treatments. Weeds of experimental field were identified and their intensity was recorded and weed control efficiency, weed biomass measured after drying of weeds.

Major five species of weeds belonging to different groups were identified. Their occurrence and intensity varied due to different treatments. Intensity (%) of weeds varied due to different weedicides and hoeing as per treatments. Maximum weed infestation was observed in weedy check and the dominant weeds were *Commelina benghalensis*, *Elusiana* spp., *Cyperus rotundus* L., *Digera arvensis* and *Parthenium hysterophorus*. The intensity of all weeds significantly reduced by pre emergence application of pendimethalin than all other treatments including weedy check at early growth stage of crop (20 DAS). It may be because the pre emergence herbicides checked the

Table 1. Effect of weed control treatments on weed intensity, weed biomass and weed control efficiency (WCE) in HDPS cotton

Treatments	Weed intensity/m ²				Weed biomass (kg/ha)	WCE (%)	Weed index (%)
	15 days after sowing		60 days after sowing				
	Monocot	Dicot	Monocot	Dicot			
	Total	Total	Total	Total			
T₁ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i./ha <i>fb</i> hoeing at 30 DAS and one hand weeding at 45 DAS	3.24(10.13)	2.33(5.06)	3.94(15.19)	1.93(3.33)	4.10(16.33)	90.41	7.02
T₂ - Quizalofop ethyl 10 EC @ 0.075 kg a.i./ha POE 20-25 DAS (2-4 leaf weed stage) <i>fb</i> hoeing at 45 DAS	6.13(37.06)	4.35(18.4)	7.48(55.46)	2.91(8.00)	5.76(32.67)	82.70	26.22
T₃ - Pyriithiobac sodium 10 EC @ 0.075 kg a.i./ha POE 20-25 DAS (2-4 leaf weed stage) <i>fb</i> hoeing at 45 DAS	5.97(35.20)	4.77(22.4)	7.62(57.6)	3.53(12.00)	5.73(32.33)	89.57	32.85
T₄ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Quizalofop-ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage)	3.50(11.73)	2.41(5.33)	4.17(17.06)	3.29(10.33)	5.42(29.00)	81.66	43.25
T₅ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Pyriithiobac sodium 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage).	3.45(11.47)	2.76(7.2)	4.38(18.67)	3.76(13.67)	5.75(32.67)	81.66	39.02
T₆ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Quizalofop-ethyl 10 EC @ 0.060 kg a.i. /ha + Pyriithiobac sodium 10 EC POE @ 0.062 kg a.i. /ha POE (tank mix) (2-4 leaf weed stage).	3.33(10.66)	2.46(5.60)	4.06(16.26)	3.02(8.66)	5.05(24.99)	83.59	34.75
T₇ - Weed free check (2 hoeing <i>fb</i> 2 Weeding)	5.79(33.06)	4.74(22.13)	7.45(55.19)	1.95(3.33)	3.89(14.67)	96.08	-
T₈ - Weedy check CD (p=0.05)	5.97(35.20)	4.59(20.8)	7.51(56.00)	5.82(33.33)	9.30(86.00)	-	85.42
	0.491	0.628	0.68	0.397	0.41	-	-

Upper values are transformed value $\sqrt{x + 0.5}$. Figure in parentheses are original values.

emergence of weeds, resulting in reduced intensity of weeds.

Among post emergence herbicides The pendimethalin controlled the *Commelina benghalensis*, *elusiana* spp., *Cyperus rotundus*, *Cyanotis axillaris* and *Cyanotis axillaris* at initial period Quizalofop ethyl controlled *Cynodon dactylon*, *Cyperus rotundus*, *Elusiana* spp. and pyriithiobac sodium controlled the *Parthenium hysterophorus*, *Achyranth esaspera*, *Tridex procumbense* and *Euphorbia geniculate* was effective against both monocot and dicot weeds. Similar finding were reported by Singh and Kokate (2010), Nalini *et al.*, (2011), Prabhu *et al.*, (2011), Hiremath *et al.*, (2013) and Chaudhari *et al.*, (2013).

In general the dry weight of weeds increased with the increase in weed population. Only slightly variation was observed due to different species. The highest dry matter of weeds was recorded under weedy check at harvest. At this stage, the lowest weed dry matter was recorded in weed free check because weed removal. Out of the herbicides applied, pre emergence application of pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* hoeing at 30 DAS and one hand weeding at 45 DAS resulted in the maximum reduction in weed dry matter followed by pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* quizalofop ethyl 10 EC @ 0.060 kg a.i. /ha + pyriithiobac sodium 10 EC POE @ 0.062 kg a.i. /ha POE (tank mix). The highest weed control efficiency (WCE) (96.08%) was found in weed free check followed by pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* hoeing at 30 DAS and one hand weeding at 45 DAS.

The lowest weed index (7.02) in HDPS cotton was noticed in pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* hoeing at 30 DAS and one hand weeding at 45 DAS while significantly higher weed index (85.42) was observed in weedy

check (T_8) and was followed by Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* Quizalofop ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage). Weed index is directly related to the reduction in yield due to weed population and weed dry weight.

The yield and yield attributes, *viz.*, plant height, sympodia and boll/plant, dry matter of plant, biological yield, SCY, seed index were significantly influenced by different weed control treatments (Table 2). The highest values of these parameters over weedy check were higher in weed free check. Among herbicides, an application of pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* hoeing at 30 DAS and one hand weeding at 45 DAS had maximum values of these parameters, followed by Quizalofop ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage) *fb* hoeing at 45 DAS. Higher level of these parameters could be attributed to low competition between plant and weeds and clean cultivation resulted into higher bolls/sqm and boll weight.

The weed free check treatment significantly enhanced the seed yield (1741 kg/ha) over the weedy check (257 kg /ha). Among the herbicide treatments maximum SCY kg/ha recorded in pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha *fb* hoeing at 30 DAS and one hand weeding at 45 DAS followed by Quizalofop ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage) *fb* hoeing at 45 DAS. Nalini *et al.*, (2011), Patel *et al.*, (2013), Nithya and Chinnagounder (2013), Chaudhari *et al.*, (2013) and Madhu *et al.*, (2014). The maximum SCY of AKH081 due to more plants per unit area but also less competition due to weed management in initial period and good growth of cotton leads to higher retention of bolls and its boll weight and ultimately yield.

Table 2. Effect of weed control treatments on yield attributing parameter and yield of HDPS cotton

Treatments	Plant height (cm)	Sympodia/plant	Boll/plant	Dry matter (kg/ha)	Biological yield (kg/ha)	SCY (kg/ha)	Seed index (g)
T₁ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> hoeing at 30 DAS and one hand weeding at 45 DAS.	48.73	7.33	4.70	28.27	5452	1626	7.75
T₂ - Quizalofop ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage) <i>fb</i> hoeing at 45 DAS	43.17	6.6	4.48	22.53	4697	1293	7.20
T₃ - Pyriothion sodium 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage) <i>fb</i> hoeing at 45 DAS	42.67	6.2	4.26	18.91	4033	1177	7.28
T₄ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Quizalofop ethyl 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage)	43.17	6.8	3.77	22.79	4560	988	7.38
T₅ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Pyriothion sodium 10 EC @ 0.075 kg a.i. /ha POE 20-25 DAS (2-4 leaf weed stage).	41.13	6.4	3.89	20.66	4239	1069	7.75
T₆ - Pendimethalin 38.7 EC PE @ 1.25 kg a.i. /ha <i>fb</i> Quizalofop ethyl 10 EC @ 0.060 kg a.i. /ha + Pyriothion sodium 10 EC POE @ 0.062 kg a.i./ha POE (tank mix) (2-4 leaf weed stage).	40.97	6.1	4.12	21.63	4256	1136	7.70
T₇ - Weed free check (2 Hoeing <i>fb</i> 2 Weeding)	51.67	8.2	4.81	31.44	5999	1741	7.96
T₈ - Weedy check	34.40	4.8	1.06	8.06	3705	257	6.92
CD (p=0.05)	5.99	0.83	0.82	4.87	1004	252	-

ACKNOWLEDGEMENT

The author are duly acknowledge Director CICR, PI TMCI.4 and Director of Research Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola for providing facilities as during investigation.

REFERENCES

Chaudhari D. P., Paslawar, A. N., Deotalu, A. S. and Khairnar, C. B. 2013. Effect of weedicides on growth, weed control efficiency and yield of *Bt* cotton. *Annals Plant Physiology* **27** : 96-100.

- Hiremath Rajanand, Gurappa, S. Yadahalli, Basavaraj M. Chittapur, Ayyanna D. Siddapur, Vidyavathi, G. Yadahalli, Bheemasen Rao G. Koppalkar, 2013.** Integrated weed management in *Bt* cotton (*Gossypium hirsutum* L.) under UKP command area of Karnataka *Acta Biologica Indica*, **2** : 400-05.
- Madhu, G., Srinivasulu K., Prasuna Rani P. and Rao, A. S. 2014.** Economics of rainfed *Bt* cotton as influenced by sequential application of herbicides. *J. Cotton Res. Dev.* **28** : 257-59.
- Nalini K., Muthukrishnan R. and Chinnusamy, C. 2011.** Evaluation of Pendimethalin 38.7 EC on Weed Management in Winter Irrigated Cotton. *Madras Agric. J.*, **98** : 165-68.
- Nithya, Chinnusamy and Chinnagounder Chinnusamy, 2013.** Evaluation of weed control efficacy and seed cotton yield in transgenic cotton. **3** : ISSN - 2249-555X.
- Patel, J. G., Raj, V. C., Kumar, V., Sutaria, C. M. and Usadadiya, V. P. 2013.** Integrated weed management in *bt* cotton (*Gossypium hirsutum* L.) *Internat. Jour. Agri. Inno. Res.* **2** : ISSN (Online) 2319-1473.
- Prabhu, G., Halepyati, A. S., Pujari, B. T. and Desai, B. K. 2011.** Integrated weed management in *Bt* cotton (*Gossypium hirsutum* L.) under irrigated conditions. *Karnataka J. Agric. Sci.* **24** : 529-30.
- Singh, M. and Kokate, K. D. 2010.** Weed management and its effect on Cotton (*Gossypium hirsutum* L.). *Aun. PI Plotec. Sci.* **18** : 484-87.
- Venugopalan, M. V., Prakash, A. H., Kranthi, K. R., Deshmukh, Rachana, Yadav, M. S. and Tandulkar, N. R. 2013.** Evaluation of cotton genotypes for high density planting systems on rainfed vertisols of Central India. *World Cotton Res. Conf. Tech. Pros.*

Received for publication : March 16, 2016

Accepted for publication : December 19, 2016