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EFFECT OF INTIGRATED WEED MANAGEMENT PRACTICES ON SEED COTTON YIELD AND ECONOMICS OF HIGH DENSITY PLANTING SYSTEM OF COTTON

M. D. Yenpreddiwar[1], P.G. Ingole[2], A.N. Paslawar[3], V.M. Bhale[4] and J. P. Deshmukh

ABSTRACT

A field experiment was conducted at cotton research unit, Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola to study the efficacy of different herbicides on productivity of high density planting system in cotton during *kharif* season of year 2014 and 2015 in randomized block design with ten treatments and 3 replications consisting 4 herbicides (Pendimethalin as pre-emergence and quazalofop ethyl, pyrithiobac sodium and glyfosate as post emergence) with or without combination with cultural practices, weed free check, mulching of green gram and control as weedy check. The results of the experiment revealed that, treatment of weed free check showed their significance and superiority over rest of the treatments with significantly highest yield and yield attributing characters viz., seed cotton yield plant^{-1}, number of bolls plant^{-1}, boll weight and boll yield m^{-2}. The next treatments were pendimethalin 38.7 CS PE 1.25 a. i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS followed by hoeing at 15-20 DAS + directed spray of glyphosate @ 1.50 a.i. kg ha^{-1} at 45 DAS. Where as seed index was found non significant. Consequently seed cotton and stalk yield ha^{-1} were comparable within weed free check and pendimethalin + cultural practices treatment. Considering the B:C ratio, higher value was noted in treatment weed free check (2.18) followed by hoeing at 15-20 DAS + directed spray of glyphosate @ 1.50 a.i. kg ha^{-1} at 45 DAS (2.09) and application of pendimethalin 38.7 CS PE 1.25 a. i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS (2.04).

(Key words : Weeds, herbicides, seed cotton yield and economics)

INTRODUCTION

Cotton crop has very high potential of lint i.e. 750-850 kg ha^{-1}. However, the average yield of cotton lint in India is 524 kg ha^{-1}, which is considered to be very low as compared to world average i.e. 725 kg ha^{-1}(Anonymous 2014). Cotton being a rainy season crop suffers severely due to infestation of several weeds resulting in yield losses up to 85 per cent depending on weed species, their density and period of weed competition (Deshpande *et al.,* 2006). The use of herbicides or chemicals has assumed a grate significance, particularly in intensive agriculture due to their ability of providing quick and effective eradication of weeds and economical weed management in term of time money and labour. A new molecule present in market viz., pendimethalin 38.7 CS and glyphosate 71 G. However, quazalopof ethyl and pyrithiobac sodium are also utilized under cotton production system. Infestation of Bt cotton by boll worm complex and climatic changes cause decline in cotton production during last 2-3 years. Thus, a new approach to target high level production of cotton under high density (1,66,666 plants ha^{-1}) planting system (HDPS) may results in to increase in seed cotton yield ha^{-1}. Intercultural operations are limited in HDPS due to early closer of canopy of cotton plants. Hence, weed management becomes more critical, nevertheless early closer of canopy reduce weed competition . In this view, it is essential to generate information of different weed managements practices in term of yield and monetary benefit under HDPS cotton.

MATERIALS AND METHODS

The present investigation "Efficacy of different herbicides on productivity of HDPS cotton" was undertaken during *kharif* season of 2014-15 and 2015-16 on clay soil at the farm of Cotton Research Unit, Dr. PDKV., Akola in randomized block design with ten treatments replicated thrice. In this trial one pre emergence weedicide and three post emergence herbicides were used. The treatments consists of pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* hoeing at 30 DAS and one hand weeding at 45 DAS, quizalofop-ethyl 5 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS, pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS, pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* quizalofop-ethyl 5 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage), pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb*

1 Ph. D Student, Deptt. Of Agronomy, Dr. P.D.K.V., Akola
2. Professor, Deptt. Of Agronomy, Dr. P.D.K.V., Akola
3. Cotton Agronomist, Dr . P.D.K.V., Akola
4. Head, Deptt. of Agronomy, Dr. P.D.K.V., Akola
5. Assoc. Professor, Deptt. Of Agronomy, Dr. P.D.K.V., Akola

pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} PoE (2-4 leaf weed stage), pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* quizalofop-ethyl 5 EC @ 0.060 kg a.i. ha^{-1} + pyrithiobac sodium 10 EC POE @ 0.062 kg a.i. ha^{-1} POE (tank mix) (2-4 leaf weed stage), weed free check, weedy check (No weed control), *In –situ* mulching of greengram and Hoeing at 15-20 DAS *fb* Glyphosate 71 G @ 1.5 kg ha^{-1} at 45 DAS. Application of pendimethalin was done on next day of sowing and post –emergence herbicides as per treatments using hand operated knapsack sprayer fitted with flat fan nozzle. Cotton seed variety AKH 081 was sown in broad bed furrow (BBF) with tractor at spacing of 60 x 10 cm on 18 th July 2014 and 18th June 2015 with seed rate of 20 kg ha^{-1}, RDF 60:30:30 NPK kg ha^{-1}. half N and full P and K applied at sowing and 50 % N was applied at square initiation stage. The rain fall of season was 560.9 and 591 mm in 26 and 29 rainy days and no rain fall received after 9 September and 18 September during 2014 and 2015 respectively. Monsoon was delayed by one month in 2014, whereas monsoon onset was timely but dry spell of 25 days occurred after germination. Five plants were selected to take observations on boll number $Plant^{-1}$ and seed cotton yield $plant^{-1}$. Similarly, observations on boll weight and seed index were recorded. Seed cotton yield $plot^{-1}$ and ha^{-1} also recorded. Plant population/m^2 recorded and converted in to ha^{-1}. Data were subjected to statistical analysis as per method suggested by Panse and sukhatme (1967).

RESULTS AND DISCUSSION

The pooled mean (2 Year) data are presented in table1. Data revealed that plant population ha^{-1} under different weed control treatments in HDPD cotton showed non significant. Seed cotton yield $plant^{-1}$ differed significantly due to weed control treatments. The weed free check recorded significantly more seed cotton yield $plant^{-1}$ (15.99 g) and boll number $plant^{-1}$ (5.86) and boll yield m^{-2} (232.75 g) over rest of the treatments. In the herbicidal treatments, application of pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS recorded significantly highest SCY $plant^{-1}$ (14.84 g) and boll number $plant^{-1}$ (5.36) and boll yield/m^2 (215.76) followed by hoeing at 15-20 DAS + spray of glyfosate at 45 DAS. however, weight of boll was also significantly higher with weed free check (2.69 g), but found at par with pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS (2.65 g), *In-situ* mulching of green gram in cotton (2.58 g) and hoeing at 15-20 DAS + spray of glyfosate 71 g @1.5 a.i. kg ha^{-1} at 45 DAS (2.55 g). The seed index was found non significant among the treatments studied. Whereas lower value were recorded with weedy check treatment. The increase in number of bolls $plant^{-1}$ with boll size were reflected in seed cotton yield and boll yield m^{-2} might be due to efficient utilization of moisture, nutrients and sunshine by cotton crop with proper aeration in the root zone which enabled crop plant to explore their maximum potential in presence of various less competition offer by weeds under these weed management practices.

The pooled mean data (Table 2) revealed that, seed cotton yield ha^{-1} differed significantly due to weed control treatments. The significantly highest seed cotton yield (2297 kg ha^{-1}) was recorded in weed free check and over rest of the treatments, but this treatment was found at par with the application of pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS (2134 kg ha^{-1}). Next to these two treatments, treatment was hoeing at 15-20 DAS + spray of glyfosate 71 g @1.5 a.i. kg ha^{-1} at 45 DAS (1920 kg ha^{-1}). Similar trend was observed in stalk yield ha^{-1}. However, lint yield recorded significantly highest values with weed free check followed by pendimethalin and glyphosate + cultural practices treatment over rest of the treatments. Weedy check having lowest seed cotton yield (581 kg ha^{-1}). Nalini *et al.* (2011) reported that weed free treatment significantly enhanced seed yield over weedy check and followed by the application of pendimethalin 38.7 EC of 2.0 kg ha^{-1} + Hand weeding at 30 DAS followed earthing up at 45 DAS. Choudhary *et al.* (2013) showed that, weed free check followed by treatment of glyphosate spray at 45 DAS gave higher seed cotton yield in Bt cotton.

The data of economics indicated that, the maximum gross returns and net monetary returns calculated when crop was kept free from weed during critical growth period with weed free check (GMR Rs.84884 ha^{-1}) and (NMR Rs.46921 ha^{-1})followed by application of pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS (GMR Rs.79245 ha^{-1}) and (NMR Rs. 41388 ha^{-1}) and hoeing at 15-20 DAS + spray of glyfosate 71 g @1.5 a.i. kg ha^{-1} at 45 DAS (GMR Rs.72085 ha^{-1})and (NMR Rs. 38223 ha^{-1}). The lowest GMR and negative return in NMR recorded with weedy check. However, highest B:C ratio of 2.18 was calculated in weed free check followed by hoeing at 15-20 DAS + spray of glyfosate 71 g @1.5 a.i. kg ha^{-1} at 45 DAS (2.09) and pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS (2.04). These results are in conformity with the findings of Patel *et al.* (2014), who reported maximum profit over control was in weed free plot followed by PE application of pendimethalin 900 g ha^{-1} *fb* IC + HW at 30 and 60 DAS. Similar findings narrated by Mankar *et al.* (2013), who reported that weed free treatment recorded higher GMR, NMR and B:C ratio in mustard. Paslawar *et al.* (2015) reported that pre-emergence application of pendimethlin + cultural practices gave higher return in cotton over different weed management practices.

It is concluded that, among herbicides treatments, even though glyphosate treatment showed highest B:C ratio, it is quit important to note that improper spraying of glyphosate can cause injury to crop plants. Similarly, land free of weeds through critical growth period require huge labour and practically impossible due to erratic rainfall and labour problem. Thus, there is need to control of weeds at initial stage through chemical weed management and keeping favorable condition through physical weed control methods. On these circumstances, application of pendimethalin 38.7 CS PE @ 1.25 a.i. kg ha^{-1} + hoeing at 30 DAS + hand weeding at 45 DAS is an alternative and safe, economical weed control method in HDPS cotton.

Table1. Plant population ha^{-1}, seed cotton yield plant^{-1}, boll no. plant^{-1}, weight of boll^{-1}, boll yield m^{2} and seed index of HDPS cotton as influenced by different weed management practices (pooled mean of 2 years 2014-15)

	Treatments	Plant population ha^{-1} at harvest (lakh)	Seed cotton yield plant^{-1} (g)	Boll number plant^{-1}	Boll yield/ m^{-2} (g)	Weight of boll^{-1} (g)	Seed index (g)
T_1	Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* hoeing at 30 DAS and one hand weeding at 45 DAS.	1.46	14.84	5.36	215.76	2.65	7.65
T_2	Quizalofop ethyl 5 EC@ 0.075kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS	1.45	11.28	4.63	164.01	2.36	7.41
T_3	Pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS	1.44	11.09	4.62	162.05	2.30	7.43
T_4	Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Quizalofop ethyl 5 EC @ 0.075 kg a.i. ha POE (2-4 leaf weed stage)	1.47	10.26	4.30	148.22	2.27	7.39
T_5	Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage).	1.47	11.00	4.85	158.53	2.21	7.58
T_6	Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Quizalofop ethyl 5 EC @ 0.060 kg a.i. ha^{-1} + Pyrithiobac sodium 10 EC POE @ 0.062 kg a.i. ha^{-1} POE (tank mix) (2-4 leaf weed stage).	1.45	11.75	5.05	169.90	2.26	7.39
T_7	Weed free check (2weeding *fb* 2 hoeing)	1.46	15.99	5.86	232.75	2.69	7.66
T_8	Weedy check	1.44	3.86	1.61	54.83	2.31	7.34
T_9	*In- situ* mulching of Greengram in cotton.	1.44	12.76	4.91	182.79	2.58	7.71
T_{10}	Hoeing at 15-20 DAS *fb* Glyphosate 71 G @ 1.50 kg a.i. ha^{-1} as directed spray at 45 DAS	1.46	13.29	5.17	192.81	2.55	7.63
SE(m) ±		0.02	0.27	0.10	3.94	0.08	0.14
CD at 5%		-	0.79	0.29	11.62	0.24	-

Table 2. Yield and economics of HDPS cotton as influenced by different weed management practices (pooled mean of 2 years 2014-15)

Treatments	Seed cotton yield (kg ha^{-1})	Cotton stalk yield kg ha^{-1}	Lint yield (kg ha^{-1})	Gross monetary return (Rs. ha^{-1})	Net monetary return (Rs. ha^{-1})	Benefit : cost ratio
Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* hoeing at 30 DAS and one hand weeding at 45 DAS.	2134	3377	769	79245	41388	2.04
Quizalofop ethyl 5 EC@ 0.075kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS	1616	2620	579	61677	28396	1.83
Pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage) *fb* hoeing at 45 DAS	1582	2549	571	62966	28263	1.79
Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Quizalofop ethyl 5 EC @ 0.075 kg a.i. ha POE (2-4 leaf weed stage)	1442	2353	508	59984	24964	1.69
Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Pyrithiobac sodium 10 EC @ 0.075 kg a.i. ha^{-1} POE (2-4 leaf weed stage).	1562	2426	553	63823	26860	1.70
Pendimethalin 38.7 CS PE @ 1.25 kg a.i. ha^{-1} *fb* Quizalofop ethyl 5 EC @ 0.060 kg a.i. ha^{-1} + Pyrithiobac sodium 10 EC POE @ 0.062 kg a.i. ha^{-1} POE (tank mix) (2-4 leaf weed stage).	1677	2667	607	67568	29275	1.73
Weed free check (2weeding *fb* 2 hoeing)	2297	3433	834	84884	46921	2.18
Weedy check	581	860	206	23791	-820	0.92
In- situ mulching of Greengram in cotton.	1824	2893	658	69167	32799	1.88
Hoeing at 15-20 DAS *fb* Glyphosate 71 G @ 1.50 kg a.i. ha^{-1} as directed spray at 45 DAS	1920	3020	695	72085	38223	2.09
SE(m) ±	78	60	13	1615	1408	-
CD at 5%	233	176	39	4763	4153	-

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