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Seed Cotton Yield and Yield Attributes of Cotton as Influenced by Intercropping, Weed Control and Fertility Management Practices in Rainfed Vidarbha

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Abstract

Two years field experiment was carried out at the Agronomy Research Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS), during *kharif* 2007-08 and 2008-09 with an object to study the effect of intercropping, weed control and fertility management practices on seed cotton yield and yield attributes of cotton. Results indicated that the treatment of cotton + pigeonpea registered significantly greater seed cotton yield during both the years of experimentation and in pooled analysis. Intercropping of cotton + blackgram (I_1), cotton + pigeonpea (I_3), cotton + clusterbean (I_4) and cotton + cowpea (I_5) being par recorded significantly more number of picked bolls plant^{-1} (2007-08) and cotton + blackgram (I_1) recorded significantly higher number of picked bolls plant^{-1}over other treatments of intercropping (2008-09). Intercropping of cotton + blackgram (I_1), cotton + cowpea (I_5) and cotton + clusterbean (I_4) being par marked higher seed cotton yield plant^{-1} over the other treatments of intercropping (2008-09). Normal weeding recorded significantly higher values for seed cotton yield, number of bolls picked plant^{-1} and seed cotton yield plant^{-1} during both the years. In case of fertility management, increased dose of RDF increased the seed cotton yield, number of bolls picked plant^{-1} and seed cotton yield plant^{-1} during the years of experimentation.

Keywords: Seed Cotton Yield, Yield Attributes, Intercropping, Weed and Fertility Management Practices.

Introduction

Cotton being a long duration, wide spaced, slow growing at early stage offers a great scope for intercropping of short duration, fast growing, non-competitive intercrops with dissimilar growth habit and productive that utilize the available resources very efficiently and effectively. Intercropping enables crop diversification within agro eco-region and ensures better return to the growers. Similarly, growing short duration intercrops in cotton does not affect the crop yield of base crop of cotton, minimize the losses, helps to safe guard the economy of farmer through extra yields of companion crop and protects from adverse climatic risk, improves soil fertility through biological fixation of nitrogen extraction from component crop of legume (Willey, 1979). Though the intercropping can be potential biological tool to manage weeds, the system itself not ensures complete weed control. Intercropping along with minimum cultural methods of weed control that will be helpful in limiting crop weed competition and economical one. Besides, various factors responsible for low yield, major one is nutrient management. Adequate nutritional supply is essential for higher yields. Considering this fact the present investigation was undertaken.

Material and Methods

Two years field experiment was carried out at the Agronomy Research Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS), during *kharif* 2007-08 and 2008-09. The experimental site was fairly levelled and uniform in topography. The soil was medium black cotton belongs to *vertisols*. It was clayey in texture and moderately alkaline in nature (p^H 8.3), medium in organic carbon (0.51 %) and available potassium (239.41 kg ha^{-1}), low in available nitrogen (169.76 kg ha^{-1}) and phosphorous (28.68 kg ha^{-1}) and slightly calcarious. The total rainfall received during 2007-2008 in 23rd - 52 nd MW at Akola centre was771.0 mm

in 43 rainy days, it was said to be normal year. Whereas, during 2008-2009 the total rainfall recorded was 528.2 mm in 42 rainy days and it was stated to be abnormal year. It was deficit by 30.70 % as against normal rainfall of 762.8 mm. Soon after sowing to flowering and boll development stage weather had adversely affected the cotton yields. An American *hirsutum* variety AKH-8828 and popular intercrops varieties were used in replacement series of experiment (Anonymous, 2007). Treatment combinations were 36 with 12 Main plots (A) Intercropping (6) viz., I_1- Cotton + blackgram (1:1), I_2- Cotton + soybean (1:1), I_3- Cotton + pigeonpea (6: 2), I_4- Cotton + clusterbean (1:1),I_5-Cotton + cowpea (1:1), I_6- Cotton + marigold (1:1) and (B) Weed management (2) W_1- No weeding and W_2- Normal weeding at 25 and 50 days after sowing and three Sub plots (C) Fertilizer management (3) F_1- 75 % Recommended dose of fertilizer (37.5, 18.75, 18.75 kg NPK ha^{-1}) to base crop of cotton, F_2- 100 % Recommended dose of fertilizer (50, 25 , 25 kg NPK ha^{-1}) to base crop of cotton and F_3-125 % Recommended dose of fertilizer (62.5, 31.25, 31.25 kg NPK ha^{-1}) to base crop of cotton. The experiment was laid out in split plot design with three replications and crop was sown at the spacing of 45 × 30 cm distance. The gross plot size was 6.30 m × 3.60 m, net 5.40 m × 3.00 m and recommended dose of fertilizers of cotton was 50, 25, 25 kg NPK ha^{-1} with no fertilizers to the intercrops.

Results and Discussion

Seed Cotton Yield

The seed cotton yield ha^{-1} (Table 1) during 2007-08 was higher (12.59 q ha^{-1}) than 2008-09 (10.63 q ha^{-1}). The average pooled seed cotton yield was (11.61 q ha^{-1}).

Effect of Intercropping

During 2007-08, treatments of cotton + pigeonpea and cotton + blackgram being par recorded significantly highest seed cotton yield over other treatments. Treatment of cotton + cowpea was significantly superior over cotton + clusterbean, cotton + soybean and cotton + marigold. During 2008-09, cotton + pigeonpea recorded significantly highest seed cotton yield over other treatments of intercropping. Treatment of cotton + blackgram recorded second best position. Treatments of cotton + cowpea and cotton + soybean being par produced significantly more seed cotton yield ha^{-1} over the rest of treatments.

In pooled analysis, cotton + pigeonpea resulted in greater production of seed cotton yield over other treatments. Treatment of cotton + blackgram stood at second position followed by the treatment of cotton + cowpea. Treatments of cotton + clusterbean and cotton + soybean being par recorded higher seed cotton yield than the treatment of cotton + marigold. Cotton + redgram intercropping was multitier crop combination harvest solar energy efficiently beside the deeper root system explored the moisture and nutrient from deeper section of soil. Similar results were reported by Pothiraj and Srinivasan (1993). Seed cotton yield recorded significantly more in cotton + pigeonpea system because of more number of cotton plants in the plot. Cotton intercropped with blackgram significantly increased seed cotton yield in individual year and in pooled also. It might be due to the least depressing effect of blackgram in cotton because of its short duration (Balsubramaniyan *et* al., 1994), no competition for natural resources (Tomar *et al*., 1994), complementary effect (Harisudan *et al*., 2009) and more availability of nitrogen through decay of root nodules (Umarani et al., 1984). Reduction in other cotton based intercropping might be due to medium to long duration of intercrops, their spreading habit coupled with smothering effect on cotton in early stages (Tomar *et al*. 1997). But yield reduction was well compensated by intercrop yields. Similar results were reported by Patel *et al.* (2006).

Effect of weed management

During both the years of study and in pooled analysis, normal weeding treatment gave significantly higher seed cotton yield than the treatment of no weeding. Weeding increased seed cotton yield, it might be due to the effective control of weeds and elimination of competition for light, nutrients, moisture etc. Similar results were reported by Agrawal *et al*. (2007).

Effect of Fertility Management

During both the years of study, treatments of 125 % RDF and 100 % RDF being par recorded significantly higher seed cotton yield than 75 % RDF to base crop of cotton. In pooled analysis every additional dose of RDF to cotton was found significantly superior to its lower dose of RDF in recording higher seed cotton yield in 2007-08, 2008-09 and in pooled analysis. Similar results were reported by Kubsad *et al.* (2004) and Kote *et al*. (2005).

Effect of Interaction

Interaction effects of intercropping × weed management × fertility management (I×W×F) were found significantly superior in recording higher seed cotton yield ha^{-1} in pooled analysis. Treatment combination of intercropping of cotton + pigeonpea with normal weeding under 100 % RDF and 125 % RDF ($I_3W_2F_2$ and $I_3W_2F_3$) being par recorded significantly greater seed cotton yield ha^{-1} over other treatment combinations (Table 2). Increase in yield under efficient weed control with increasing level of fertilizers was owing to reduced depletion of nutrients by weeds and concomitant increase in nutrient uptake by crop ultimately resulted in marked improvement in yield (Rathi and Tiwari, 1981)

Yield Attributes

Data in respect of number of picked bolls $plant^{-1}$, boll weight and seed cotton yield $plant^{-1}$ as influenced by different treatments are presented in Table 3.

Number of Bolls Picked Plant $^{-1}$

Data in respect of mean number of picked bolls $plant^{-1}$ was 17.56 during 2007-08 and 13.56 during 2008-09.

Effect of Intercropping

During 2007-08, treatments of intercropping viz., cotton + blackgram, cotton + pigeonpea, cotton + clusterbean and cotton + cowpea being par recorded significantly more number of picked bolls plant^{-1} over other treatments of intercropping. Other treatments of intercropping namely, cotton + soybean and cotton + marigold were found equally effective in registering more number of picked bolls plant^{-1}. During 2008-09, intercropping of cotton + blackgram recorded significantly higher number of picked bolls plant^{-1}over other treatments of intercropping. Other treatments like cotton + clusterbean and cotton + cowpea eing par recorded significantly greater number of picked bolls plant^{-1} over the treatments of cotton + soybean, cotton + clusterbean and cotton + marigold. Treatments of cotton + soybean and cotton + pigeonpea being par recorded significantly more number of picked bolls plant^{-1} than the treatment of cotton + marigold. Increased number of bolls picked plant^{-1} due to intercrop of blackgram in cotton was reported by many workers namely, Sharma (2002), Turkhede (2010). The increase in number of bolls picked plant^{-1}. It might be due to increased photosynthetic efficiency on account of higher nitrogen status of soil as an additional advantage of nitrogen fixation by legume root nodules in intercropping (Agrawal and Porwal, 2006).

Effect of Weed Management

Normal weeding treatment produced more number of picked bolls plant^{-1} than the treatment of no weeding during both the years of experimentation. Maximum values of yield attributing characters like number of bolls picked plant^{-1} were reported in two hand weeding treatment. Effective weed control treatment minimized the losses caused by weed growth thereby leading to improvement in yield attributes and enhancement in crop yield.

Effect of Fertility Management

Treatments of 100 % RDF and 125 % RDF of base crop of cotton being par gave more number of picked bolls plant^{-1} than 75 % RDF of base crop of cotton during 2007-08 only. Number of picked bolls plant^{-1} was increased with the increase in fertilizer levels. These results were in conformity of Kalyankar (2001), Suresh *et al.* (2004), Kubsad *et al.* (2004), Kote *et al.* (2005) and Tengade (2008). However, treatment differences of fertility management tried under study did not influence more on number of picked bolls plant^{-1} during 2008-09.

Boll Weight

The mean boll weight was greater during 2007-08 (3.80 g) as compared to 2008-09 (2.50 g).

Effect of Intercropping, Weed Management and Fertility Management

Boll weight of cotton was not affected significantly due to different treatments of intercropping (Tomar *et al*. (1997), Tengade (2008) and Anonymous (2009).

Seed Cotton Yield Plant^{-1}

Mean seed cotton yield plant^{-1} (Table 3) was greater during first year (66.48 g plant^{-1}) than second year (33.78 g plant^{-1}).

Effect of intercropping

Seed cotton yield plant^{-1} was not influenced significantly due to different treatments of intercropping during 2007-08. Similar type of results were reported by Deshmukh *et al*. (1987). During 2008-09, treatments of intercropping of cotton + blackgram, cotton + cowpea and cotton + clusterbean being par marked higher seed cotton yield plant^{-1} over the other treatments of intercropping. Treatments of cotton + soybean and cotton + pigeonpea being par recorded significantly greater seed cotton yield plant^{-1} than the treatment of cotton + marigold. The increase in seed cotton yield plant^{-1} due to legume crop, it might be due to symbiotic nitrogen fixation. The result obtained in the line of work reported by Patra *et al.* (1990).

Effect of Weed Management

Normal weeding treatment resulted in production of more seed cotton yield plant^{-1} at the level of significance than the treatment of no weeding during both the years of study. The seed cotton yield plant^{-1} increased due to weed control in cotton based system reported by Gnanavel and Babu (2008). Hand weeding twice not only control the weeds but also create the favourable environment for growth and recorded higher values of yield attributes. Higher seed cotton yield obtained under hand weeding twice was obviously due to cumulative effect of reduced weed competition and higher values of yield attributes. Similar results were reported by Baldev Ram *et al.* (2005).

Effect of Fertility Management

Fertility management treatments attempted under study were found not significant during both the years of study in recording greater seed cotton yield plant^{-1}.

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Table-1
Seed cotton yield and yield attributes as influenced by different treatments during 2007-08 and 2008-09

Treatments		Seed cotton yield (q ha^{-1})			Yield attributes of cotton					
					Number of picked bolls plant^{-1}		Boll weight (g)		Seed cotton yield plant^{-1} (g)	
I) Main plot		**2007-08**	**2008-09**	**Pooled**	**2007-08**	**2008-09**	**2007-08**	**2008-09**	**2007-08**	**2008-09**
A) Intercropping (6)										
I_1	Cotton + blackgram (1:1)	14.30	12.04	13.17	18.84	16.97	3.74	2.58	70.56	43.00
I_2	Cotton + soybean (1:1)	11.13	9.93	10.53	16.68	13.23	3.94	2.57	66.16	33.86
I_3	Cotton + pigeonpea (6:2)	14.42	13.40	13.92	17.63	12.54	3.68	2.42	64.50	30.10
I_4	Cotton + clusterbean (1:1)	12.35	9.79	11.07	17.44	14.89	3.96	2.41	67.72	35.68
I_5	Cotton + cowpea (1:1)	13.39	10.77	12.08	19.16	15.41	3.67	2.47	70.67	38.64
I_6	Cotton + marigold (1:1)	9.98	7.86	8.92	15.63	8.30	3.81	2.55	59.28	21.38
S. E. (m) ±		0.31	0.32	0.23	0.68	0.51	0.14	0.06	3.48	2.68
C. D. at 5%		0.92	0.94	0.66	1.99	1.49	NS	NS	NS	7.87
B) Weed management (2)										
W_1	No weeding	11.83	9.32	10.58	15.49	11.93	3.79	2.45	58.67	30.63
W_2	Normal weeding (2 hoeings + 2 weedings at 25 and 50 DAS)	13.36	11.94	12.65	19.64	15.19	3.82	2.55	74.29	36.92
S. E. (m) ±		0.18	0.18	0.13	0.39	0.29	0.08	0.04	2.01	1.55
C. D. at 5%		0.53	0.54	0.38	1.15	0.86	NS	NS	5.88	4.54
II) Sub plot										
C) Fertility management (3)										
F_1	75 % RDF of base crop of cotton	11.38	9.32	10.35	16.76	13.11	3.75	2.47	64.97	31.97
F_2	100 % RDF of base crop of cotton	12.90	10.92	11.91	17.79	13.76	3.9	2.54	66.32	34.73
F_3	125 % RDF of base crop of cotton	13.51	11.66	12.58	18.14	13.81	3.75	2.49	68.15	34.63
S. E. (m) ±		0.23	0.22	0.14	0.37	0.28	0.06	0.05	1.42	1.45
C. D. at 5%		0.67	0.64	0.39	1.04	NS	NS	NS	NS	NS
D) Interaction effects										
Intercropping x weed management (I x W)										
S. E. (m) ±		0.31	0.24	0.21	0.96	0.72	0.2	0.09	4.91	3.8
C. D. at 5%		-	-	-	-	-	-	-	-	-
Intercropping x fertility management (I x F)										
S. E. (m) ±		0.24	0.22	0.17	0.89	0.68	0.15	0.12	3.49	3.56
C. D. at 5%		-	-	-	-	-	-	-	-	-
Weed management x fertility management (W x F)										
S. E. (m) ±		0.37	0.35	0.18	0.52	0.39	0.08	0.07	2.01	2.06
C. D. at 5%		-	-	0.33	-	-	-	-	-	-
Intercropping x Weed management x fertility management (I x W x F)										
S. E. (m) ±		1.09	1.02	0.47	1.26	0.96	0.21	0.17	4.93	5.03
C. D. at 5%		-	-	1.34	-	-	-	-	-	-
GM		**12.59**	**10.63**	**11.61**	**17.56**	**13.56**	3.8	2.5	66.48	33.78

Table 2
Seed cotton yield (q ha-1) as influenced by intercropping × weed management × fertility management interactions (Pooled)

Treatments	Intercropping × weed management × fertility management		
IxWxF	F_1	F_2	F_3
I_1W_1	10.73	11.78	13.34
I_1W_2	12.90	15.34	14.94
I_2W_1	8.39	9.27	10.17
I_2W_2	11.15	12.30	11.89
I_3W_1	12.28	13.16	14.28
I_3W_2	12.73	15.30	15.76
I_4W_1	8.39	9.80	11.94
I_4W_2	10.73	13.09	12.49
I_5W_1	8.97	11.29	12.32
I_5W_2	12.30	14.27	13.35
I_6W_1	7.34	8.20	8.75
I_6W_2	8.26	9.13	11.82
S. E. (m) ±		0.47	
C. D. at 5%		1.34	