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Original Research Article

Studies on Soil Plant Narrations in Intercropped *kharif* legumes with Bt Cotton under Rainfed Condition

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A B S T R A C T

A field experiment was carried out during kharif season of 2009-10 on medium deep black soil at Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri to find out the best profitable Bt cotton based intercropping system under rainfed condition. Experiment results revealed that treatment Bt cotton + green gram (T_4), Bt cotton + soy bean (T_3), Bt cotton + black gram (T_8), Bt cotton + cow pea under paired row (T_6), Paired row planting (T_5) and sole Bt cotton (T_1) were at par with each other registered significantly maximum seed cotton yield (22.76, 22.02, 20.43, 19.78, 19.52 and 18.32 q ha^{-1}, respectively) over treatments Bt cotton + pigeon pea (T_2) and Bt cotton + cluster bean (T_7) i.e. (17.68 and 17.15 q ha^{-1}). Treatments T_4 Bt cotton + green gram recorded maximum cotton equivalent yield (CEY) and water use efficiency (WUE) i.e. (2412 kg ha^{-1} and 5.00 kg ha^{-1} mm^{-1}) over rest of the treatments. However, sole Bt cotton recorded lowest CEY and WUE (1832 kg ha^{-1} and 3.80 kg ha^{-1} mm^{-1}). In respect of B: C ratio, treatments T_4 recorded maximum B:C ratio (2.03) followed by T_2 (2.01), T_3 (1.81), T_6 (1.76) and T_8 (1.74). However, treatment T_1 i.e. sole Bt cotton registered minimum benefit cost ratio (1.60). Available nitrogen and potassium status in soil increased with all legume intercropping treatments compared to sole Bt cotton.

Keywords

Bt cotton, Intercrops, WUE and profitability

Introduction

Cotton is one of the important crop in Maharashtra and is grown in about 91.58 lakh ha with a total production of 270 lakh bales. The low productivity is due to being grown mostly as rainfed. In this context, efficient utilization of rain water plays an important role which can be achieved by various soil management practices and legume intercropping effecting a better builds up of water and nutrient in soil and reduce weed population, run off and conserve more moisture in root zone. Therefore the present study was undertaken to study the soil plant narrations in intercropped kharif legumes with Bt cotton under rainfed condition.

Materials and Methods

A field experiment was conducted on medium deep black soil of Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during kharif season of 2009-10. The experiment was laid out in randomized block design replicated thrice. The gross plot size was 9.0 x 7.2 $m^{2.}$ Eight treatments viz., T_1: Sole cotton (Bt), T_2: Cotton + Pigeon pea (8 : 2), T_3: Cotton +

Soybean (1:1), T_4: Cotton + Green gram (1:1), T_5: Paired row planting (60:120), T_6: Intercropping of cotton with cowpea under paired row, T_7: Cotton + Cluster bean (1:1) and T_8: Cotton + Black gram (1:1) were studied. Bt cotton was sown at 90 x 90 $cm^{2,}$ whereas intercrops viz., pigeon pea and cowpea and cluster bean sown at 90 x 30 cm^2 and soy bean, green gram and black gram sown at 90 x 10 $cm^{2,}$ respectively in between lines of Bt cotton. Fertilizers were applied as basal dose, just below the seeds while sowing (20 % N and full P_2O_5 and K_2O) of cotton RDF (125: 62.5:62.5 kg NPK ha^{-1}), whereas 40 % N after 30 DAS and remaining 40 % N after 60 DAS. No separate fertilizer was applied for intercrops. The Bt cotton variety RCH-2 was used for sowing. The intercrops varieties pigeon pea (Vipula), soy bean (JS-335), green gram (Vaibhav), cowpea (VCM-8), cluster bean (Sadafully) and black gram (TPU-4) were used for sowing. The precipitation received during crop season was 482.10 mm in 29 rainy days. Plant protection schedule was followed for control of sucking pest only.

Results and Discussion

Effect on seed cotton yield and CEY

Data in Table 1 indicated that the treatments Bt cotton + green gram (T_4), Bt cotton + soy bean (T_3), Bt cotton + black gram (T_8), Bt cotton + cow pea under paired row (T_6), Paired row planting (T_5) and sole Bt cotton (T_1) were at par with each other registered significantly maximum seed cotton yield (22.76, 22.02, 20.43, 19.78, 19.52 and 18.32 q ha^{-1}, respectively) over treatments Bt cotton + pigeon pea (T_2) and Bt cotton + cluster bean (T_7) i.e. (17.68 and 17.15 q ha^{-1}). In respect of yield of various intercrops, Cluster bean recorded maximum yield (8.50 q ha^{-1}) followed by green gram (4.35 q ha^{-1}), soy bean (3.82 q ha^{-1}), pigeon pea (3.51 q ha^{-1}), cow pea (2.45 q ha^{-1}) and black gram (1.85 q ha^{-1}), respectively.

Economics

Table 1 indicated that the treatments T_4, $T_{2,}$ T_3, T_7 and T_6 recorded significantly highest gross monetary returns (Rs. 72360, Rs. 71440, Rs. 64890 ha^{-1}, Rs. 70260 and Rs. 63510 ha-1, respectively), net monetary returns (Rs. 36710, Rs. 35940, Rs. 29040 ha^{-1}, Rs. 28990 and Rs. 27360 ha-1, respectively) over rest of the treatments. However, treatment T_1 i.e. sole Bt cotton recorded significantly lowest gross monetary returns and net monetary returns (Rs. 54960 and 20710 ha^{-1}, respectively).

In respect of B: C ratio, treatments T_4 recorded maximum B: C ratio (2.03) followed by T_2 (2.01), T_3 (1.81), T_6 (1.76) and T_8 (1.74). However, treatment T_1 i.e. sole Bt cotton registered minimum benefit cost ratio (1.60).

WUE

From Table 2, it was revealed that the treatments T_4 Bt cotton + green gram recorded maximum cotton equivalent yield (CEY) and water use efficiency (WUE) i.e. (2412 kg ha^{-1} and 5.00 kg ha^{-1} mm^{-1}) over rest of the treatments. However, sole Bt cotton recorded lowest CEY and WUE (1832 kg ha^{-1} and 3.80 kg ha^{-1} mm^{-1}).

Fertility status

From the data in Table 3, it was observed that available nitrogen increased with legume intercropping treatments as compared to sole cotton crop. Similarly, the available potassium also increased with intercropped treatments. Treatments Bt cotton + green gram (22.76 q ha^{-1}), Bt cotton + soy bean (22.02 q ha^{-1}), Bt cotton + black

gram (20.43 q ha^{-1}), Bt cotton + cow pea under paired row (19.78 q ha^{-1}), Paired row planting (19.52 q ha^{-1}) and sole Bt cotton (18.32 q ha^{-1}) were at par with each other registered significantly maximum seed cotton yield over treatments Bt cotton + pigeon pea (17.68 q ha^{-1}) and Bt cotton + cluster bean (17.15 q ha^{-1}). This increased level of seed cotton yield in legumes might be due to buildup of nitrogen and potassium status in soil and its slowly availability during crop season. Gadade *et al.,* (2006) reported that soybean was promising intercrops in India. Similar results were also reported earlier by Asewar *et al.,* (2008). Seed cotton yield increased with intercropped kharif legumes also reported by Sethi *et al.,* (1992) at Akola that seed cotton equivalent yield was increased by 20.7 per cent with growing green gram as intercrops as compared to sole cotton. Gross monetary returns, net monetary returns and B: C ratio maximum by treatments Cotton intercropped with legumes also reported by Asewar *et al.,* (2008) in respect of Bt cotton + green gram systems (Table 1). Intercropping of various legumes viz., pigeon pea, cowpea, cluster bean, soy bean, green gram and black gram (Table 3) improved the available nitrogen level in the soil. Similar results were also reported by Giri *et al.,* (1979) and Kote *et al.,* (2005).

It is concluded that the Bt cotton + green gram intercropping (1:1) recorded maximum seed cotton equivalent yield (24.12 q ha^{-1}), net monetary returns (Rs. 36710 ha^{-1}) and B: C ratio (1: 2.03).

Table.1 Seed cotton yield (q /ha), cotton equivalent yield (CEY) and economics of different treatments as influenced by various intercropping treatments

Treatments	Seed cotton yield (q/ha)	Cotton equivalent yield (CEY) (kg/ha)	Cost of cultivation (Rs/ha)	Gross monetary returns (Rs/ha)	Net monetary returns (Rs/ha)	B:C ratio
T_1 - Sole cotton (Bt)	18.32	18.32	34250	54960	20710	1.60
T_2 - Cotton + Pigeon pea (8 : 2)	17.68 (3.51)	23.81	35500	71440	35940	2.01
T_3 - Cotton + Soybean (1:1)	22.02 (3.82)	21.63	35850	64890	29040	1.81
T_4 - Cotton + Green gram (1:1)	22.76 (4.35)	24.12	35650	72360	36710	2.03
T_5 - Paired row planting (60:120)	19.52	19.52	35100	58560	23460	1.67
T_6- Intercropping of cotton + Cowpea under paired row	19.78 (2.45)	21.17	36150	63510	27360	1.76
T_7-Cotton + Cluster bean (1:1)	17.15 (8.50)	23.42	41270	70260	28990	1.70
T_8 - Cotton + Black gram (1:1)	20.43 (1.85)	20.66	35620	61990	26370	1.74
S.E. ±	2.68	2.68	-	3355	3355	0.09
C.D. at 5 %	4.65	4.65	-	10176	10176	0.29
General mean	**19.43**	**21.58**	**-**	**64746**	**28572**	**1.79**

(Figures in parentheses indicated the yield of intercrops).

N.B.: Selling rate of farm produce as per market rate:

i. Cotton – Rs. 3000/q; ii. Pigeon pea – Rs. 4700/q; iii. Soy bean - Rs. 2600/q
iv. Green gram - Rs. 4000/q; v. Cow pea - Rs. 3500/q' vi. Black gram - Rs. 3800/q
vii. Cluster bean – Rs. 1800/q

Table.2 Effect of different intercropping treatments on water use efficiency (kg ha^{-1} mm^{-1})

Treatments	Cotton equivalent yield (CEY) (kg ha^{-1})	Consumptive Use (CU) (mm)	Water Use Efficiency (WUE) (kg ha^{-1} mm^{-1})
T_1 - Sole cotton (Bt)	1832	482.10	3.80
T_2 - Cotton + Pigeon pea (8 : 2)	2381	482.10	4.94
T_3 - Cotton + Soybean (1:1)	2163	482.10	4.49
T_4 - Cotton + Green gram (1:1)	2412	482.10	5.00
T_5 - Paired row planting (60:120 cm)	1952	482.10	4.05
T_6- Intercropping of cotton + Cowpea under paired row	2117	482.10	4.39
T_7-Cotton + Cluster bean (1:1)	2342	482.10	4.86
T_8 - Cotton + Black gram (1:1)	2066	482.10	4.29
S.E. $\pm$	268	-	-
C.D. at 5 %	465	-	-
General mean	**2158**	**482.10**	**4.48**

Table.3 Initial and final fertility status of experimental field as influenced by kharif legumes

Treatments	Available N (kg/ha)		Available P_2O_5 (kg/ha)		Available K_2O (kg/ha)	
	Initial	Final	Initial	Final	Initial	Final
T_1 - Sole cotton (Bt)	162	149	10.58	10.24	578	615
T_2 - Cotton + Pigeon pea (6 : 8)		165		12.56		640
T_3 - Cotton + Soybean (1:1)		170		12.38		664
T_4 - Cotton + Green gram (1:1)		174		11.10		680
T_5 - Paired row planting (60:120)		145		10.85		610
T_6- Intercropping of cotton + Cowpea under paired row		167		12.23		632
T_7-Cotton + Cluster bean (1:1)		154		09.50		651
T_8 - Cotton + Black gram (1:1)		171		11.42		672

References

Asewar, B. V. A. S. Jadhav and Khan, Y. A., 2008. Effect of in-situ water management and intercropping systems on yield of rainfed cotton. J. Cotton Res. Dev. 22(2): 173-75.

Gadade, D. Blaise and Rao, M. R. K., 2006. Intercropping in India- A Review. J. Cotton Res. Dev. 20: 58-63.

Giri, A. N., 1979. Studies on planting pattern, intercropping and N economy to hybrid H-4 cotton under rainfed conditions. Ph. D. Thesis (Unpub.), M. A. U., Parbhani.

Kote, G. M. A. N. Giri and Kausale, S. P., 2005. Nutrient concentration and uptake of different cotton genotypes as influenced by intercrops and fertilizer level under rainfed conditions. J. Cotton Res. Dev. 19(2): 188-90.

Sethi, H. N. G. Bharad and Badkal, B. G., 1992. Biomass production of cotton varieties as influenced by inter crops. Indian J. Agron. 37: 451-55.