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Effect of intercrops and fertilizer levels on yield and quality of different cotton (*Gossypium hirsutum* L.) genotypes under rainfed conditions

G.M. KOTE*, A. N. GIRI, S.P. KAUSALE AND D.M. LOMTE
Dept. of Agronomy, Cotton Research Scheme, Marathwada Agricultural University, PARBHANI (M.S.) INDIA

ABSTRACT

A field experiment was carried out at Parbhani during *Kharif* seasons of 2001 and 2002, to evaluate the effect of intercrops and fertilizer levels on yield and quality of different cotton genotypes under rainfed conditions. All cotton genotypes (NHH 44, PHH 316 and PH 348) were found equally effective in producing seed cotton yield. Newly released cotton hybrid PHH 316 and variety PH 348 recorded significant effect on quality parameters like ginning percentage and halo length over NHH 44 under intercropped situation during both the years. Cotton intercropped with black gram produced higher seed cotton yield than cotton intercropped with soybean. Intercrops did not produce appreciable effect on quality parameters. Increasing fertilizer level from 50% recommended fertilizer dose of both the crops (RFDB) to 100% RFDB showed positive response in respect of seed cotton yield. Recommended dose of fertilizers of both the crops on area basis (RFDB) enhanced the ginning percentage and halo length significantly than 75% and 50% RFDB. Further, application of 75% RFDB also improved the ginning percentage and halo length than 50% RFDB. Cotton genotypes grown as a sole crop produced significantly higher seed cotton yield than intercropped cotton. Cotton hybrid PHH 316 grown as a sole crop recorded higher ginning percentage and halo length than sole NHH 44 during both the years. Interaction effects indicated that NHH 44 + blackgram, NHH 44 + soybean, PH 348 + blackgram as well as PH 348 + soybean with recommended fertilizer dose of both the crops on area basis produced at par seed cotton yields with application of 75% recommended fertilizer dose of both the crops on area basis of the respective cropping system. However, PHH 316 with either blackgram or soybean intercropping with recommended fertilizer dose of the respective cropping system on area basis produced significantly higher seed cotton yield than lower fertilizer level of the respective intercropping system.

Key words : Cotton genotypes, Intercrops, Fertilizer levels, Seed cotton yield, Ginning percentage, Halo length.

INTRODUCTION

Cotton is an important cash of Maharashtra grown mostly under rainfed situations. Textile industry is the backbone of industrial economy of India and cotton is the basic raw material of the industry. The oil content in cotton seed ranges form 19 to 22% depending on cultivars.

In Maharashtra, rainfed cotton cultivation has always become a challenging task on account of adverse climatic factors, especially under uncertain and erratic precipitation coupled with high humidity and cloudy situations creating severe pest problems resulting in unstable production of cotton every year.

To overcome the problem, intercropping has been considered as a safeguard against total failure of any one particular crop. Intercropping as an agronomic strategy for fibre, oil and pulse is an attractive preposition for the farmers. Legumes having wonderful ability to fix atmospheric nitrogen and add large amount of organic matter and improve the soil fertility.

Cotton plant being heavy feeder needs proper manuring and fertilization for its successful cultivation. It shows better response to N, P_2O_5 and even K_2O in deficient soils. The excessive use of the nitrogenous fertilizers results into luxuriant vegetative growth and make the crop more susceptible to pests specially bollworm and sucking pest complex. Hence, timely and balanced use of fertilizer nutrients is essential to sustain high yields and for increasing the productivity. With this intention an experiment entitled "Effect of intercrops and fertilizer levels on yield and quality of different cotton (*Gossypium hirsutum*) genotypes under rainfed conditions" was planned during *Kharif* seasons of 2001 and 2002 respectively.

MATERIALS AND METHODS

A field experiment was carried out at Cotton Research sscheme, MAU, Parbhani, during *Kharif* seasons of 2001 and 2002. The soil of the experimental field was vertisol having low available nitrogen, medium in available phosphorus, fairly rich in available potassium and the pH was normal for crop growth. The experiment was laid out in split plot design with eighteen treatments consisting of 6 combinations of 3 cotton genotypes (NHH 44, PHH 316 and PH 348) and 2 intercrops (blackgram and soybean) in main plots and 3 fertilizer levels (100%

* Author for correspondence. Present Address : Dept. of Agronomy, Dr. P.D.K.V., AKOLA (M.S.) INDIA

recommended fertilizer dose of both the crops on area basis i.e. 100 % REDB, 75% RFDB and 50 % RFDB) in sub plots, with additional 5 treatments of sole crop of cotton genotypes and intercrops and were replicated thrice. The experimental plot was sown on 21st July and 30th June during 2001 and 2002, respectively. Rainfall received during respective years was 1092.3 mm and 780.0 mm in 42 and 39 rainy days respectively. The recommended fertilizer dose (NPK) for NHH 44, PHH 316, PH 348, blackgram and soybean was 80: 40 : 40, 100 : 50: 50, 50 : 25 : 25, 25 : 50 : 0 and 30 : 60 : 0 kg/ha, respectively.

RESULTS AND DISCUSSION

Effect on seed cotton yield

Cotton genotypes

The data given in Table 1 revealed that seed cotton yield was influenced significantly due to different cotton genotypes. During 2001-2002, cotton hybrids i.e. PHH 316 and NHH 44 were at par and recorded significantly higher seed cotton yield than cotton variety PH 348. Whereas during 2002-2003, cotton variety PH 348 has recorded highest seed cotton yield which was significantly more than PHH 316 and was at par with NHH 44. Further both cotton hybrids i.e. NHH 44 and PHH 316 were at par with each other. The trend was exactly similar in respect of yield attributes viz., number of picked bolls and yield per plant (g). However, in pooled analysis, the results were not evident. The expression of yield of different genotypes varied with the seasonal changes. Hybrids performed better even under late sown situations coupled with heavy showers received during early vegetative growth stage resulting in severe attack of sucking pests than straight variety PH 348 during first year. Whereas during second year, the precipitation was subnormal which has affected the vegetative growth of the hybrids compared to straight genotype PH 348. Such type of findings was also reported by Dhoble *et al*. (1992) and Ravankar *et al*. (1994).

Intercrops

Cotton intercropped with blackgram produced significantly more no. of picked bolls, yield per plant and seed cotton yield (kg/ha) than cotton intercropped with soybean during individual years and in pooled results also. Similar effect of intercrops on seed cotton yield was reported by Wankhade *et al*. (2000) and Kalyankar (2001).

Fertilizer Levels

Every higher level of fertilizer application resulted in significant increase in number of picked bolls, yield per plant and seed cotton yield than it's lower level. It may by due to increased availability of nutrients which helped the plant to attain it's maximum yield potential. Similar results were reported earlier by Manjappa *et al*. (1997) and Tomar *et al*. (2000).

Sole Cotton Vs intercropped cotton

The differences in seed cotton yield due to sole cotton and intercropped cotton were significant during second year and in pooled results. Late sowing coupled with heavy precipitation during seedling stage resulted in poor growth of cotton, hence the effect was not observed during first year. However, during second year and in pooled results all cotton genotypes grown as a sole crop produced equal seed cotton yield and proved better than cotton intercropped with blackgram and soybean i.e. intercropped cotton. Similar results were reported earlier by Padhi *et al*. (1993) and kalyankar (2001).

Interaction effects

In pooled results, interaction effect of cotton genotype x fertilizer level had significant effect on seed cotton yield (Table 2). Genotypes NHH 44 and PH 348 with recommended fertilizer dose of both the crops on area basis produced at par seed cotton yield with their 75% RFDB and were at par with PHH 316 fertilized with recommended fertilizer dose of both the crops on area basis.

Interaction effect of intercrop x fertilizer level had significant effect on seed cotton yield (Table 3). Intercropping of blackgram in cotton with 100% recommended fertilizer dose of both the crops on area basis resulted in significantly higher seed cotton yield than intercropping of blackgram with 75% as well as 50% RFDB and intercropping of soybean with all the levels of RFDB.

Interaction effect of cotton genotypes x intercrop x fertilizer level had significant effect on seed cotton yield (Table 4). All cotton genotypes (NHH 44, PHH 316 and PH 348) with both the intercrops (blackgram and soybean) fertilized with recommended fertilizer dose of both the crops on area basis recorded at par seed cotton yields. Further NHH 44 + blackgram with either recommended fertilizer dose and 75% RFDB recorded at par seed cotton yields. Similar type of results with soybean intercrop was also noted by the said hybrid. PHH 316 intercropped with either blackgram or soybean with recommended fertilizer dose of both the crops on area basis recorded significantly higher seed cotton yields than their respective lower fertilizer levels. PH 348 exhibited similarly as that of NHH 44 in respect of intercrops

Table 1: Yield attributes and seed cotton yield as influenced by various treatments

Treatment	No. of picked bolls/plant		Yield/plant (g)		Seed Cotton Yield (kg/ha)		
	01-02	02-03	01-02	02-03	01-02	02-03	Pooled
Cotton Genotypes (G)							
NHH 44	10.2	25.9	20.5	53.4	339.0	844.0	591.5
PHH 316	10.6	24.4	21.3	52.2	356.0	804.0	580.0
PH 348	9.0	27.6	17.8	54.6	300.0	921.0	610.5
CD (P=0.05%)	0.8	2.1	1.7	1.6	28.7	79.1	NS
Intercrops (I)							
Blackgram	10.6	26.9	21.2	55.6	353.0	893.0	623.0
Soybean	9.3	25.1	18.5	51.2	310.0	832.5	556.0
CD (P=0.05%)	0.6	1.7	1.4	1.3	23.5	64.6	52.5
Fertilizer level (F)							
100% RFDB	11.4	27.8	23.3	17.9	390.0	988.0	689.0
75% RFDB	9.7	25.9	19.3	53.1	321.0	848.0	584.5
50% RFDB	8.7	24.2	17.0	49.3	283.0	733.0	508.0
CD (P=0.05%)	0.7	1.5	1.2	2.3	18.9	34.2	41.9
Interactions							
G x I CD (P=0.05%)	NS	NS	NS	NS	NS	NS	NS
G x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS	98.0
I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS	54.5
G x I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS	120.9
Sole Cotton vs intercropped cotton							
Sole NHH 44	11.8	29.8	23.8	59.6	356.0	1015.0	685.5
Sole PHH 316	12.6	29.4	25.8	58.2	375.0	964.0	669.5
Sole PH 348	9.8	30.4	19.4	61.4	323.0	1186.0	704.5
Intercropped cotton	9.9	26.0	19.9	53.4	332.0	856.0	594.0
CD (P=0.05%)	1.7	3.1	3.1	3.5	NS	104.2	86.5

Table 2 : Interaction effects (G x F) on seed cotton yield (pooled)

Genotypes	Fertilizer levels		
	100% RFDB	75% RFDB	50% RFDB
NHH 44	681.0	587.0	506.5
PHH 316	686.0	560.0	494.5
PH 348	700.5	607.0	523.5

CD (P=0.05%) 98.0

Table 3 : Interaction effects (I x F) on seed cotton yield (pooled)

Intercrops	Fertilizer levels		
	100% RFDB	75% RFDB	50% RFDB
Blackgram	721.5	560.0	494.5
Soybean	656.5	560.0	478.0

CD (P=0.05%) 54.5

Table 4 : Interaction effects (G x I x F) on seed cotton yield (Pooled)

Cropping Systems	Fertilizer levels		
	100% RFDB	75% RFDB	50% RFDB
NHH 44 + blackgram	713.5	614.0	546.0
NHH 44 + soybean	648.5	560.0	467.0
PHH 316 + blackgram	714.5	586.5	512.5
PHH 316 + soybean	657.5	533.5	476.0
PH 348 + blackgram	737.0	626.5	556.5
PH 348 + soybean	663.0	587.0	491.0

CD (P=0.05%) 120.9

Table 5 : Quality parameters of cotton in various treatments (2001-02)

Treatments	Ginning (%)	Halo length (mm)	Seed index (g)	Lint index (g)	Earliness index	Harvest index
Cotton genotypes (G)						
NHH 44 (G_1)	35.22	24.47	6.42	3.49	0.73	0.25
PHH 316 (G_2)	37.97	26.86	7.09	4.34	0.75	0.25
PH 348 (G_3)	37.27	26.10	6.65	3.95	0.68	0.24
CD (P=0.05%)	1.15	0.83	NS	NS	NS	NS
Intercrops (I)						
Blackgram (I_1)	37.16	26.03	6.83	4.09	0.76	0.25
Soybean (I_2)	36.46	25.59	6.60	3.74	0.68	0.24
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Fertilizer levels (F)						
100% RFDB (F_1)	38.44	27.40	6.91	4.32	0.76	0.26
75% RFDB (F_2)	36.88	25.78	6.73	3.93	0.73	0.25
50% RFDB (F_3)	35.10	24.24	6.52	3.53	0.67	0.24
CD (P=0.05%)	1.32	1.36	NS	NS	NS	NS
Interactions						
G x I CD (P=0.05%)	NS	NS	NS	NS	NS	NS
G x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
G x I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Sole cotton vs intercropped cotton						
Sole NHH 44	35.60	24.52	7.00	3.87	0.82	0.26
Sole PHH 316	38.40	27.48	7.60	4.74	0.85	0.27
Sole PH 348	37.60	26.74	7.20	4.34	0.76	0.26
Intercropped cotton	36.81	25.81	6.72	3.92	0.72	0.25
CD (P=0.05%)	1.95	2.03	NS	NS	NS	NS

and fertilizer levels.

Effect on quality parameters

Cotton genotypes

The data given in Table 5 and 6 revealed that the differences in quality parameters like ginning percentage and halo length were significant due to different cotton genotypes. Newly released cotton hybrid PHH 316 and variety PH 348 recorded significantly more ginning percentage and halo length (mm) than NHH 44 under intercropped situation. It may be due to the genetic constitution of the genotypes. The remaining quality parameters viz., seed index, lint index, earliness index and harvest index were not significant due to different cotton genotypes. These parameters are almost fixed for each variety or a hybrid with very little effect played by the environmental factors which may remain common for each variety or a hybrid during it's life period. Similar results were reported earlier by Dhoble *et al*. (1989).

Intercrops

All quality parameters were not affected by cotton intercropped with either blackgram or soybean. The quality parameters are governed by genetic factors and remained more or less constant under different intercropping systems. Similar finding were reported

Table 6 : Quality parameters of cotton in various treatments (2002-03)

Treatments	Ginning (%)	Halo length (mm)	Seed index (g)	Lint index (g)	Earliness index	Harvest index
Cotton genotypes (G)						
NHH 44 (G_1)	36.01	24.78	7.31	3.87	0.54	0.37
PHH 316 (G_2)	38.15	27.36	6.87	4.51	0.49	0.36
PH 348 (G_3)	37.43	26.45	7.05	4.22	0.58	0.38
CD (P=0.05%)	0.87	1.57	NS	NS	NS	NS
Intercrops (I)						
Blackgram (I_1)	37.48	26.73	7.18	4.38	0.54	0.38
Soybean (I_2)	36.91	25.67	6.97	4.01	0.52	0.37
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Fertilizer levels (F)						
100% RFDB (F_1)	38.69	27.56	7.22	4.56	0.55	0.38
75% RFDB (F_2)	37.22	26.17	7.07	4.19	0.53	0.37
50% RFDB (F_3)	35.76	24.77	6.93	3.86	0.52	0.37
CD (P=0.05%)	1.25	1.22	NS	NS	NS	NS
Interactions						
G x I CD (P=0.05%)	NS	NS	NS	NS	NS	NS
G x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
G x I x F CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Sole cotton vs intercropped cotton						
Sole NHH 44	36.20	24.81	7.80	4.09	0.60	0.39
Sole PHH 316	38.60	27.69	7.20	4.90	0.55	0.38
Sole PH 348	37.80	26.87	7.40	4.50	0.60	0.40
Intercropped cotton	37.20	26.20	7.07	4.19	0.53	0.37
CD (P=0.05%)	2.28	2.44	NS	NS	NS	NS

earlier by Giri (1979) and Aziz (1988).

Fertilizer levels

Every higher level of fertilizer application recorded significantly higher ginning percentage and halo length (mm) over it's lower level. Fertilizer levels had no significant influence on seed index, lint index, earliness index and harvest index. Non-significant effect of fertilizer levels was reported earlier by Chhabra *et al.* (1995).

Sole cotton Vs intercropped cotton

Newly released sole cotton hybrid PHH 316 has noted highest ginning percentage and halo length (mm) which was significantly more than sole NHH 44 and was at par with sole PH 348 and intercropped cotton. It indicates that these parameters are not affected by different intercrops. Seed, lint, earliness and harvest indices were not influenced significantly either by growing cotton as a sole crop or inter crop. The present findings are in agreement to results reported earlier by Aziz (1988) and Kalyankar (2001).

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