

Response of hybrid cotton (DHH-11) to *in situ* green manuring and nitrogen levels in northern transitional tract of Karnataka

ANAND S. KAMBLE*, Y.B. PALLED AND R.F. CHANNAGOUDAR

Institute of Organic Farming, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

ABSTRACT

A field experiment was conducted during *kharif* 2002, at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study "Response of hybrid cotton to *in situ* green manuring and nitrogen levels in Northern Transitional tract of Karnataka" under rainfed condition on black clay loam soil. Experiment was laid out in a randomized complete block design with factorial concept. There were 12 treatment combination of four green manuring crops (Lucerne, Sunhemp, Dhaincha and Horse gram) and 3 nitrogen levels (100%, 75% and 50% RDN) with a control treatment (sole cotton with RDF alone). Lucerne green manuring recorded significantly higher seed cotton yield (1549 kg/ha) with ginning percentage of 37.7 over all other green manuring crops. Application of 100 per cent of RDN recorded significantly higher seed cotton yield (1535 kg/ha) over 75 per cent (1343 kg/ha) and 50 per cent RDN (1225 kg/ha). Interaction effect between green manuring crop and nitrogen levels was significant. Lucerne green manuring with 100 per cent RDN recorded significantly higher seed cotton yield (1869 kg/ha) over all other treatment combinations. The sole cotton with RDF recorded significantly lower seed cotton yield (1180 kg/ha) than all other green manure crops with 100% RDN. Lucerne green manuring recorded significantly higher dry matter yield and nitrogen uptake (92.7 kg/ha) than other green manuring crops. Lucerne green manuring with 100 per cent RDN recorded maximum net returns of Rs. 22,3611 ha and B:C ratio of 2.37.

Key words : Hybrid cotton, Green manures, Nitrogen

INTRODUCTION

India has a unique place among the cotton growing countries of the world. All the four lint bearing *Gossypium* spp are grown commercially under diverse ecosystem over 91.65 lakh ha and with production of 188.78 lakh bales in India. India ranks 4th in world cotton production with an estimated 60 million people being involved in its cultivation. Cotton is a important commercial crop of Karnataka and cultivated on an area of 4.78 lakh ha with production of 6.77 lakhs bales (Anon., 2003).

Cotton crop is the 4th largest consumer of fertilizers in the country. Commercial fertilizer do increase productivity but their increasing costs, associated environmental hazards and lack of sustainability in yield is raising concern in cotton production. This has renewed the interest in the use of organic sources like FYM, compost, green manures and crop residues.

The traditional source of FYM is become scare as it is being used as a source of fuel. Under this circumstance green manuring has been recognized as the most efficient agronomic practice for stimulating various biological transformations in the soil leading to improved soil fertility. Hybrid cotton is widely grown in black soil of transitional tract of Dharwad. There is a decline in yield level due to improper use of chemical fertilizers and lack of organic matter addition to soil. Hybrid cotton being widely spaced crop, there is a lot of scope to grow green manuring crops as intercrops without much effect on main crop.

Hence, a field experiment was carried out on vertisols

during *kharif* 2002, at Main Agricultural Research Station, Dharwad to study "Response of hybrid cotton (DHH-11) to *in situ* green manuring and nitrogen levels".

MATERIALS AND METHODS

A field experiment was conducted at main agricultural research station, University of Agricultural Sciences, Dharwad during *kharif* 2002. Experiment was laid out in a randomized complete block design with factorial concept. There were 12 treatment combinations comprising of four green manuring crops (lucerne, sunhemp, dhaincha and horse gram) and 3 nitrogen levels (100%, 75% and 50% RDN) with a control treatment (sole cotton with RDF alone). The soil was clay loam and have neutral pH, low in available nitrogen, medium in organic carbon and phosphorus content and higher in available potassium. The rainfall received during cropping period was only 180.30 mm which was insufficient to raise a good crop. Sowing of both cotton and green manuring crops was done on 28 June, 2002. Cotton was sown by hand dibbling in the rows marked at 90 cm apart with an intra row spacing of 60 cm. Green manuring crops were sown at 1:2 row proportion in shallow furrows between the rows marked for sowing of hybrid cotton uniformly using a recommended seed rate. A recommended fertilizer dose of 150 : 75 : 75 kg N, P₂O₅ and K₂O / ha were applied for both cotton and green manuring crops in respective area basis. The cutting of all the green manuring crops except lucerne was done

only once at 50% flowering. Lucerne was cut initially at 45 DAS and subsequently with 25 days cutting intervals during cropping period. Totally three cuttings were made and green matter was uniformly spread between cotton rows. Observation on growth, yield parameters and nutrient uptake of intercrops were recorded. Economics of green manuring in hybrid cotton was worked out.

RESULTS AND DISCUSSION

Lucerne green manuring recorded significantly higher seed cotton yield (1549 kg/ha) and ginning per cent over all other green manuring crops. The extent increase in seed cotton yield (Table 1) with lucerne green manuring than sunhemp, dhaincha and horse gram was 14.15, 19.25 and 22.35 per cent, respectively. This is attributed to higher sympodial branches and number of bolls per plant in lucerne green manuring over all other green manuring crops. The higher values of yield components of cotton in lucerne green manuring could be traced back to higher value of physiological characters both in vegetative and reproductive phase of the crop growth. The results are inconformity with findings of Biradar and Palled (2003).

Among the nitrogen levels, application of 100 per cent nitrogen recorded significantly higher seed cotton yield (1535 kg/ha) and ginning percentage over the rest of the nitrogen levels. The extent of increase in seed cotton yield with 100 per cent RDN over 75 and 50 per cent RDN was 17.35 and 21.83 per cent, respectively. This is mainly due to higher values of sympodial branches and number of bolls per plant brought about by higher values of growth components like total dry matter production and its accumulation in reproductive parts and higher values of leaf area index. Similar response to nitrogen application in cotton was also reported by Biradar and Palled (2003) and Gumaste (1981).

Seed cotton yield and ginning percentage were significantly influenced by the interaction effect of green manuring crops and nitrogen levels. Lucerne green manuring with 100 per cent RDN recorded significantly higher seed cotton yield (1869 kg/ha) and ginning percentage over all other treatment combinations and sale cotton with RDF alone. The seed cotton yield at RDF alone was at par with sunhemp and horse gram green manuring with 50 per cent RDN and dhaincha green manuring with 75 per cent RDN. This is because of higher number of sympodial branches and number of bolls per plant. Lucerne green manuring with 100 per cent RDN enriched the soil fertility with increased organic nitrogen content and organic matter and has helped for better nutrient uptake resulting in higher seed cotton yield. These

Table 1: Sympodial branches, number of bolls per plant, seed cotton yield (kg/ha) and ginning percentage of cotton as influenced by green manuring crops and nitrogen levels

	Sympodial branches per plant at harvest			Number of bolls per plant at harvest			Seed cotton yield (kg/ha)			Ginning percentage						
	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean				
G ₁	21.1	20.3	18.5	19.9	50.7	48.9	49.2	49.6	1869	1417	1362	1549	38.0	37.8	37.3	37.7
G ₂	19.3	18.6	17.5	18.5	50.1	45.7	45.0	46.9	1442	1422	1206	1357	38.1	33.2	31.7	34.3
G ₃	19.7	17.7	17.2	18.2	49.6	45.1	44.3	46.3	1462	1287	1147	1299	37.1	33.6	32.6	34.5
G ₄	19.5	17.1	17.8	18.1	49.4	45.7	44.2	46.4	1366	1246	1185	1266	37.5	33.1	32.9	34.5
Mean	19.39	18.4	17.7	17.3	49.9	46.4	45.7	43.7	1535	1343	1225	1180	37.7	34.4	33.6	34.5
Mean of control (sole cotton)				17.3												29.9
For comparison	S.E.±	C.D. (P=0.05)			S.E.±	C.D. (P=0.05)			S.E.±	C.D. (P=0.05)			S.E.±	C.D. (P=0.05)		
Green manures (G)	0.39	1.15														
Nitrogen levels (N)	0.34	0.99														
G x N	0.58	NS														
Control v/s rest of treatments	1.14	2.36			2.68	5.53			21.0	43.0			0.84	1.68	2.83	5.84

Note:

Green manures
G₁ - Lucerne
G₂ - Sunhemp
G₃ - Dhaincha
G₄ - Horsegram

Nitrogen levels
N₁-100 %RDN
N₂ - 75% RDN
N₃- 50% RDN

NS - Non-significant

Table 2 : Dry matter yield (t/ha), nitrogen uptake (kg/ha), phosphorous uptake (kg/ha) and potassium uptake (kg/ha) of green manuring crops as influenced by nitrogen levels to cotton

	Dry matter yield (t/ha)				Nitrogen uptake (kg/ha)				Phosphorous uptake (kg/ha)				Potassium uptake (kg/ha)			
	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean	N ₁	N ₂	N ₃	Mean
	C.D. (P=0.05)				S.E.±				C.D. (P=0.05)				S.E.±			
G ₁	4.17	3.37	3.00	3.51	116.6	87.4	74.2	92.7	12.6	9.12	7.85	9.85	38.3	31.5	23.1	30.9
G ₂	3.97	2.93	2.70	3.20	105.8	74.4	67.7	82.3	13.3	8.84	7.30	9.82	39.6	29.7	25.4	31.5
G ₃	3.20	2.63	2.97	2.93	80.7	62.3	69.5	70.8	11.2	8.53	8.97	9.58	29.4	24.1	24.4	25.9
G ₄	2.43	2.23	2.10	2.26	57.4	51.7	51.7	53.6	7.68	6.29	4.87	6.28	20.3	17.2	16.4	18.0
Mean	3.44	2.79	2.69		90.1	65.8	65.8		11.2	8.20	7.25		31.9	25.6	22.3	
For comparison	C.D. (P=0.05)				S.E.±				C.D. (P=0.05)				S.E.±			
Green manures(G)	0.44				4.22				12.3				1.73			
Nitrogen levels(N)	0.38				3.66				10.7				1.49			
G x N	NS				7.32				NS				NS			

Note:
 Green manures
 G₁ - Lucerne
 G₂ - Sunnhemp
 G₃ - Dhaincha
 G₄ - Horsegram

Nitrogen levels
 N₁-100 %RDN
 N₂ - 75% RDN
 N₃- 50% RDN

NS - Non significant

results are in confirmation with the findings of Tarhalkar and Venugopalan (1995).

Lucerne green manuring recorded significantly higher nitrogen uptake (92.7 kg/ha) than dhiancha (70.8 kg/ha) and horse gram (53.6 kg/ha) green manuring crop but it was at par with sunhemp (82.3 kg/ha) green manuring crop (Table 2). This is mainly because of higher dry matter yield by lucern green manuring crop. Phosphorus uptake was more in Lucerne (9.85 kg/ha) green manuring crop compared to horse gram (6.28 kg/ha) but it was at par with sunhemp (9.82 kg/ha) and dhaincha (9.58 kg/ha) green manuring crop. Potassium uptake was more in sunhemp (31.5 kg/ha) green manuring crop over dhaincha (25.9 kg/ha) and horse gram (18.0 kg/ha). However, it was at par with lucerne (30.9 kg/ha). Application of 100 per cent RDN recorded significantly higher uptake of nitrogen (90.1 kg/ha), Phosphorus (11.2 kg/ha) and potassium (31.9 kg/ha) over 75 and 50 per cent RDN. This is mainly attributed to higher dry matter yield in this treatment. These results are in conformity with the findings of Biradar and Palled (2003) and Gumaste (1981). The interaction effect between green manuring crops and

Table 3: Economics of different treatments

Treatments	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B.C. ratio
T ₁ Lucerne with 100% RDN	31778	9417	22361	2.37
T ₂ Lucerne with 75% RDN	24089	9242	14847	1.61
T ₃ Lucerne with 50% RDN	23154	9067	14087	1.55
T ₄ Sunnhemp with 100% RDN	24508	8394	15781	1.92
T ₅ Sunnhemp with 75% RDN	24174	8219	15955	1.94
T ₆ Sunnhemp with 50% RDN	20513	8044	12469	1.55
T ₇ Dhaincha with 100% RDN	24859	8394	16465	1.96
T ₈ Dhaincha with 75% RDN	21873	8219	13 829	1.72
T ₉ Dhaincha with 50% RDN	19487	8044	11268	1.37
T ₁₀ Horse gram with 100% RDN	23222	8394	14828	1.77
T ₁₁ Horse gram with 75% RDN	21176	8219	12957	1.58
T ₁₂ Horse gram with 50% RDN	20150	8044	12106	1.50
T ₁₃ Control (sole cotton with RDF)	20070	8042	12029	1.50
S.E. ±	1244	-	1230	0.14
C.D. (P=0.05)	3632	-	3592	0.41

Note: RDN - Recommended dose of nitrogen
 RDF - Recommended dose of fertilizer

nitrogen levels with respect to nitrogen, phosphorus and potassium uptake by green manuring crops were not significant.

Among the different treatment combinations, lucerne green manuring with 100 per cent RDN recorded higher gross returns (Rs. 31,778), Net returns (Rs. 22,361) and B:C ratio (2.37) over all other treatment combinations and sole cotton with RDF alone (Table 3). This is mainly due to higher seed cotton yield in this treatment combination. These results are in conformity with findings of Vithal and Gurumukhi (1996) and Kagi *et al.* (1996).

It may be concluded that lucerne green manuring with 100 per cent RDN to cotton resulted in significantly higher seed cotton yield, nutrient uptake, net returns and B:C ratio compared to sole cotton with RDF alone.

REFERENCES

- Anonymous (2003).** Fully Revised Estimate of Principal Crops in Karnataka for the Year 2000-01. Directorate of Economics and Statistics, Bangalore, pp: 136.
- Biradar, I.B. and Palled, Y.B. (2003).** Evaluation of green manuring cover crops for their suitability as year long field covers in hybrid cotton. *Karnataka J. agric. Sci.*, **16**(1):113-115
- Gumaste, S.K. (1981).** Studies on intercropping of lucerne with cotton (cv. VARLAXMI) and hybrid sorghum (cv. CSH-5). Ph.D Thesis University of Agricultural Sciences, Bangalore.
- Kagi, S.S., Meli, S.S. and Babalad, H.B. (1996).** Performance of soybean as intercrop in chilli and chilli + cotton mixed cropping systems under rainfed condition. *Karnataka J. agric. Sci.*, **9** : 217-221
- Tarhalkar, P.P. and Venugopaln, M.Y. (1995).** Effect of organic recycling of fodder legumes in stabilizing productivity of rainfed cotton on marginal lands. *Tropical agric.*, **72** :73-75.
- Vithal, B.M. and Gurumukhi, D.R. (1996).** Cost of cultivation of cotton. *J. Indian Soc. Cotton Improvement*, **3** : 75-78.

Received : February, 2009; Accepted : May, 2009