



Effect of Manures and Biopesticides on Growth, Yield and Fibre Quality of Cotton (*Gossypium Hirsutum* L.)

E Aruna P Radhika and B Sahadeva Reddy

Department of Agronomy Regional Agricultural Research Station, Nandyal – 518 502

ABSTRACT

A field experiment was conducted on fixed site during three consecutive kharif seasons of 2006-08 in vertisols of Regional Agricultural Research station, Nandyal, Andhra Pradesh. The experiment was laid out in split plot design with plant protection measures main plots and sources of nutrients as sub plots and replicated thrice. The treatments were imposed on same site for three years. The main plot treatments consisted of plant protection with chemicals and plant protection with bio pesticides. The sub plot treatments were FYM 10 t ha⁻¹, vermicompost 2.5 t ha⁻¹, green manure @15 kg ha⁻¹, FYM @ 5 t ha⁻¹ + vermicompost @ 1.25 t ha⁻¹, FYM @ 5 t ha⁻¹ + green manure @15 kg ha⁻¹, vermicompost @1.25 t ha⁻¹ + green manure @15 kg ha⁻¹, FYM 3.3 t ha⁻¹ + vermicompost 0.85 t ha⁻¹ + green manure @ 15 kg ha⁻¹, Recommended dose of fertilizer (40-20-20 kg NPK ha⁻¹) and control i.e. no application of either chemical or organic fertilizers. The results indicated that, plant protection either with chemicals or bio pesticides did not significantly influence the growth, yield and quality of cotton. Application of nutrients either with fertilizers or organic manures like FYM, vermicompost, or green manure either singly or in combination on equal nutrient basis as that of recommended fertilizer dose recorded similar kapas yield. Increased uptake of NPK was observed with application of recommended dose of fertilizers compared to manures in the first year. In the succeeding year, cotton supplied with only organic manures recorded nutrient uptake on par with chemical fertiliser.

Key words : Bio pesticides, Growth, Hirsutum cotton, Manure, Quality, Yield.

Cotton, the most important fibre crop of India plays a dominant role in its agrarian and industrial economy. Area under cotton cultivation in India is 11 million hectares with a production of 25 lakh bales in 2010-11 (Anonymous, 2011). The modern cotton production technology relies heavily on the use of fertilizers and chemicals. Cotton cultivated on 5% cultivable land consumes 54% of total pesticides used in Indian agriculture leaving immense ecological and human hazards as reported by world health organization (Tarhalkar *et al.*, 1996). Use of chemicals at such a scale causes a lot of hazards to man i.e environmental pollution, soil health and poor profitability in cotton farming. This has basically prompted the demand for organic or ecofriendly or green cotton. Now the organic cotton represents 1.1% of global cotton production and India ranks top among the twenty three organic cotton producing countries (LaRhea Pepper, 2011) with production of 10-15 lakh bales. With these points in view, the present experiment was taken up to study the effect of different sources of nutrients and type of plant protection measures on growth and yield of cotton.

MATERIAL AND METHODS

A field study was carried out during kharif seasons of 2006-08 at the Regional Agricultural Research Station, Nandyal, Andhra Pradesh. The soil was deep black, low in available nitrogen (250, 210, 183 kg ha⁻¹) high in available phosphorus (67.6, 90, 105 kg ha⁻¹) and potassium (525, 496, 394 kg ha⁻¹) with PH 9.81, 9.31, 8.93 and EC 0.29, 0.23, 0.157 dS m⁻¹ respectively during the experimental period i.e. 2006-2008. The experiment was laid out in split plot design with plant protection treatments as main plots and sources of nutrients as subplots and replicated thrice. The treatments were imposed on the same site for three years. The main plot treatments consisted of plant protection with chemicals and plant protection with bio pesticides. The sub plot treatments were FYM 10 t ha⁻¹, vermicompost 2.5 t ha⁻¹, green manure @15 kg ha⁻¹, FYM @ 5 t ha⁻¹ + vermicompost @ 1.25 t ha⁻¹, FYM @ 5 t ha⁻¹ + green manure @15 kg ha⁻¹, vermicompost @1.25 t ha⁻¹ + green manure @15 kg ha⁻¹, FYM 3.3 t ha⁻¹ + vermicompost 0.85 t ha⁻¹ + green manure @ 15 kg ha⁻¹, Recommended dose of fertilizer (40-20-20 kg NPK ha⁻¹) and control

i.e. no application of either chemical or organic fertilizers. The nitrogen content of FYM is 0.4 percent and that of vermicompost is 1.6 per cent. The organic manures were applied on equal nitrogen basis as that of recommended fertilizer i.e. 40 kg N ha⁻¹. FYM and vermicompost were applied two days before sowing. Green manure crop was sown in inter rows of cotton at the time of sowing of cotton and incorporated at 45 DAS. As it is grown only in inter rows of cotton, only 15 kg ha⁻¹ was used. Hirsutum cotton variety Narasimha was sown on 16th June, 4th July and 22nd July respectively in 2006, 2007 and 2008 with a spacing of 60 cm x 30cm. All recommended package of practices were followed. A total of 536.6, 1233.6 and 661.7 mm rain fall was received respectively in 2006, 2007 and 2008 during crop period. Trichoderma viridae (4g/lit) , neem oil (5 ml/lit) were used as bio pesticides.

RESULTS AND DISCUSSION

Growth and yield characters:

Plant height and number of bolls per plant and boll weight were not significantly influenced by plant protection either with chemicals or bio pesticides during the period. Seed cotton yield also followed similar trend. But, during 2007, higher seed cotton yield was recorded with chemical plant protection compared to protection with bio pesticides. This might be due to quick protection offered by chemicals as there was severe mealy bug attack during the year. Sivalingaiah (2007) also reported no significant effect of pest management practices on seed cotton yield. Plant height was not influenced by treatments during two years. Number of bolls per plant was not influenced by treatments during 2008. Application of recommended dose of fertilizer recorded higher number of bolls per plant during 2007. Boll weight was not influenced by treatments during 2008. In 2007, application of recommended dose of fertilizers resulted in larger bolls compared to other treatments. The treatments did not significantly influence the kapas yield in two years. During 2007, higher kapas yield was recorded with recommended dose of fertilizers compared to manures. Control treatment i.e. application of no manures and fertilizers recorded lower kapas yield during 2008. Ginning percentage and oil percentage in seed were not significantly

influenced by either plant protection with chemicals or biopesticides. Sources of nutrients did not significantly influence ginning percentage. Organic manures recorded high oil percentage in seed during 2007 compared to fertilizer application. But in 2008, though high oil percentage was recorded with vermicompost + green manure, consistent trend was not observed.

Fibre quality:

Plant protection either with chemicals or bio pesticides did not significantly influence fibre quality of cotton. Solunki *et al.* (2010) also reported insignificant effect of plant protection measures on fibre quality. Different nutrient sources did not significantly influence the cotton fibre quality characters like staple length, uniformity ratio, strength and micronaire value. Mehta *et al.* (2009) also noticed that different nutrient sources could not exert much effect on quality of cotton fibre. Rao and Janawade (2009) reported that change in quality is controlled more by the genetic makeup than the nutrient status of the plant.

Nutrient uptake:

Plant protection either with chemicals or bio pesticides did not significantly influence the nutrient uptake. Among the nutrient sources, application of recommended dose of fertilizers recorded higher NPK uptake during 2007. Mehta *et al.*, 2009 reported higher N uptake with application of 100% recommended N through chemical fertilizer. In the succeeding year, application of organic manures like FYM, vermicompost or green manure either singly or in combination as equal N basis as that of recommended dose of nitrogen recorded on par NK uptake as that of chemical fertilizer application. Significantly higher P uptake was observed with green manure application in 2008. The increased uptake could be attributed to the increased availability of nutrients in the soil. These results are in conformity with Rao and Janawade (2009). Control treatment i.e application of no manures and fertilizers recorded lower NPK uptakes.

It can be concluded that, plant protection either with chemicals or bio pesticides can control pest under normal conditions i.e. just above ETL

Table 1. Effect of manures and bio pesticides on growth and yield of hirsutum cotton.

Treatments	Plant height(cm)		No. of bolls per plant		Boll weight (gm)		Kapas yield (Kg/ha ⁻¹)						
	2007	2008	mean	2007	2008	mean	2006	2007					
	2008	mean	2007	2008	mean	2007	2008	mean					
Plant protection													
Chemical plant protection	59.0	109.3	84.15	17.1	25.1	21.10	2.63	4.21	3.42	1324	363	840	842
Protection with biopesticides	58.0	92.2	75.10	15.0	23.5	19.25	2.61	4.42	3.51	1325	268	778	790
S.Em ⁺	4.6	4.1	-	0.4	0.6	-	0.1	0.2	-	38.6	5.11	47.8	30
C.D.(P=0.05)	NS	NS	-	NS	NS	-	NS	NS	-	NS	31.0	NS	NS
Nutrient sources													
FYM @ 10 t ha ⁻¹	56.2	96.8	76.50	14.8	24.0	19.40	2.53	4.51	3.52	1418	273	809	833
Vermicompost @ 2.5tha ⁻¹	60.3	93.8	77.05	19.6	23.3	21.45	2.54	4.52	3.53	1378	328	800	835
Green manure @15 kgha ⁻¹	56.9	99.3	78.10	14.5	24.7	19.60	2.52	4.33	3.42	1347	288	774	803
FYM@ 5t + vermicompost 1.25 t ha ⁻¹	57.0	108.9	82.95	14.9	24.0	19.45	2.68	4.10	3.39	1337	351	861	849
FYM 5t ha ⁻¹ + green manure	61.4	99.4	80.40	15.3	25.9	20.60	2.72	4.50	3.61	1278	306	834	784
Vermicompost @ 1.25tha ⁻¹	58.3	102.2	80.25	15.2	24.7	19.95	2.75	4.44	3.59	1278	312	760	813
+green manure													
FYM @ 3.3tha ⁻¹ + vermicompost @0.8tha ⁻¹ + green manure	59.1	108.3	83.70	18.7	24.9	21.80	2.79	4.62	3.70	1301	312	860	824
RDF (40-20-20 kg NPK ha-1)	61.4	103.3	82.35	22.6	26.5	24.55	2.83	4.10	3.46	1284	461	790	845
Control	55.4	95.9	75.65	12.0	21.1	16.55	2.67	4.08	3.37	1373	205	580	719
S.Em ⁺	2.1	5.2	-	0.5	1.6	-	2.3	0.2	-	48.8	17.46	62	18.27
C.D.(P=0.05)	NS	NS	-	1.5	4.8	-	0.1	NS	-	NS	50.0	179	63.24

Table 2. Effect of manures and bio pesticides on fibre quality of hirsutum cotton.

Treatments	Staple length (mm)			Strength (g/tex)			Uniformity (%)			Micronaire value(10 ⁶ g/inch)		
	2007	2008	mean	2007	2008	mean	2007	2008	mean	2007	2008	mean
Plant protection	24.58	23.75	24.16	18.94	16.58	17.76	45.13	44.19	44.66	4.53	4.35	4.44
Chemical plant protection	24.53	25.74	25.13	18.58	18.11	18.34	45.43	43.63	44.53	4.52	4.03	4.27
Protection with biopesticides	0.20	0.03	-	0.56	1.33	-	0.36	0.53	-	0.05	0.09	-
S.Em±	NS	0.19	-	NS	NS	-	NS	NS	-	NS	NS	-
C.D.(P=0.05)												
Nutrient sources												
FYM @ 10 t ha ⁻¹	24.01	24.35	24.18	18.50	18.10	18.30	45.62	44.50	45.06	4.46	4.00	4.23
Vermicompost @ 2.5tha ⁻¹	24.60	23.03	23.81	19.71	16.53	18.12	45.63	44.50	45.06	4.52	4.13	4.32
Green manure @15 kgha ⁻¹	24.27	23.78	24.02	18.08	17.10	17.59	44.97	44.50	44.73	4.46	4.10	4.28
FYM@ 5t + vermicompost 1.25 t ha ⁻¹	24.88	24.76	24.82	18.61	17.30	17.95	44.78	44.67	44.72	4.60	4.15	4.37
FYM 5t ha ⁻¹ + green manure	24.61	24.71	24.66	18.43	17.08	17.75	45.43	43.50	44.46	4.62	4.36	4.49
Vermicompost @ 1.25tha ⁻¹	24.62	24.10	24.36	18.70	17.60	18.15	45.48	43.83	44.65	4.43	4.51	4.47
+green manure												
FYM @ 3.3tha ⁻¹ + vermicompost @0.8tha ⁻¹ + green manure	24.83	25.91	25.37	18.61	18.80	18.70	45.03	42.17	43.60	4.51	4.18	4.34
RDF (40-20-20 kg NPK ha-1)	24.57	26.41	25.49	19.06	18.98	19.02	44.83	43.83	44.31	4.54	4.21	4.37
Control	24.60	23.63	25.11	19.13	14.66	16.89	45.72	43.67	44.69	4.60	4.06	4.33
S.Em±	0.31	0.66	-	0.51	1.90	-	0.44	0.69	-	0.06	0.18	-
C.D.(P=0.05)	NS	1.92	-	NS	NS	-	NS	NS	-	NS	NS	-

Table 3. Effect of manures and bio pesticides on nutrient uptake by *hirsutum* cotton.

Treatments	N uptake (Kgha ⁻¹)			P uptake(Kgha ⁻¹)			K uptake(Kgha ⁻¹)			Ginning out turn (%)			Seed oil percentage%		
	2007	2008	mean	2007	2008	mean	2007	2008	mean	2007	2008	mean	2007	2008	mean
Plant protection															
Chemical plant protection	38.10	51.68	44.89	5.23	10.69	7.96	15.03	28.63	21.83	30.72	33.54	32.13	19.36	18.64	19.00
Protection with biopesticides	36.79	57.27	47.03	4.84	9.55	7.19	13.89	28.69	21.29	30.39	33.15	31.77	19.38	18.72	19.05
S.Em±	1.52	3.60	-	0.35	0.25	-	0.32	0.77	-	0.75	0.1	-	0.11	0.04	-
C.D.(P=0.05)	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-
Nutrient sources															
FYM @ 10 t ha ⁻¹	35.00	44.20	39.60	3.62	10.53	7.07	11.18	28.97	20.07	29.47	32.90	31.18	19.55	18.62	19.08
Vermicompost @ 2.5tha ⁻¹	32.00	43.85	32.92	5.77	7.80	6.78	15.69	27.85	21.77	33.83	33.20	33.51	19.36	18.60	18.98
Green manure @15 kgha ⁻¹	34.17	48.55	36.36	5.17	15.55	10.36	14.54	38.99	26.76	30.55	33.02	31.78	19.52	18.84	19.18
FYM@ 5t + vermicompost 1.25 t ha ⁻¹	27.70	41.93	34.81	5.18	9.49	7.33	12.52	27.94	20.23	30.25	34.44	32.34	19.72	18.30	19.01
FYM 5t ha ⁻¹ + green manure	34.42	47.20	35.81	4.57	8.66	6.61	13.94	30.51	22.22	30.29	32.91	31.60	19.23	18.60	18.91
Vermicompost @ 1.25tha ⁻¹	42.69	43.25	32.97	5.41	8.94	7.17	14.62	23.16	18.89	30.27	33.64	31.95	19.01	19.20	19.10
+green manure															
FYM @ 3.3tha ⁻¹ + vermicompost @0.8tha ⁻¹ + green manure	44.01	57.20	50.60	5.85	11.67	8.76	17.96	31.94	24.95	27.89	34.25	31.07	19.10	18.75	18.92
RDF (40-20-20 kg NPK ha-1)	50.22	54.03	56.62	6.09	11.71	8.90	19.87	30.38	25.12	30.37	32.82	31.59	19.01	18.72	18.86
Control	27.71	30.07	28.89	3.58	6.70	5.14	9.81	18.23	19.02	32.10	33.90	33.00	18.85	18.52	19.18
S.Em±	3.39	8.82	-	0.47	0.57	-	0.81	1.62	-	1.56	0.54	-	0.21	0.13	-
C.D.(P=0.05)	9.78	21.19	-	1.36	1.64	-	2.34	4.69	-	NS	NS	-	0.61	0.38	-

level. But under severe infestation, chemical pesticides may be advocated for quick control of pest and to get some yield. Regarding nutrient sources, FYM, vermicompost and green manure are as good as chemical fertilizer in improving the yield.

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