

Yield Attributes, Yield and Economics of Cotton as Influenced by Intercropping Unconventional Greenmanures

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Abstract: Field experiments were conducted in summer 2003 and winter 2003-04 to find out the effect of unconventional greenmanures on growth, yield and economics of cotton. Three greenmanures viz., marigold, sesamum and sunnhemp were raised as intercrops in single and double rows in the interspace of hybrid cotton TCHB 213. They were incorporated *in situ* on 30 and 40 DAS. The results revealed that intercropping marigold in two rows in between cotton rows and incorporating it on 30 DAS had contributed ultimately more kapas and lint yield of cotton securing higher yield advantage in both summer and winter crops. Higher net return and BC ratio were obtained when intercropping with marigold in two rows in between cotton rows and incorporating it on 30 DAS.

Key words: Unconventional greenmanure, cotton, yield attributes, yield, economics

INTRODUCTION

Cotton (*Gossypium* spp.), considered as “King of Fibre” and “White Gold”, is one of the most important commercial crops grown in as much as 80 countries in the world occupying 33 m. ha. In 2000-01, Cotton has been cultivated in India over an area of 9 m. ha with a production of 145 lakh bales. The productivity has been arrived at 276 kg ha⁻¹ (4), which is very low as compared to the world average of 550 kg ha⁻¹(1). In view of low productivity, the yield enhancing practices in cotton have to be strengthened. Hybrid cotton in general has more potential than varieties. It is mostly grown under irrigation with high level of management to exploit the hybrid vigour. Green manuring is an age-old practice and even research on it has been for long. Maiden experiment on green manuring was first commenced as early as 1882 at Kanpur in India⁽²⁾. Though it continues to be researched, while the practice of greenmanuring is, infact, getting phased out as it is not appealing to the farmers who do not want to give a time slot in their cropping programme to raise a greenmanure. Further, fertilizers came handy to them.

Greenmanures are neither cash crops nor food crops and this is yet another reason for greenmanures not becoming popular in the present day agriculture. Unlike in the past, the 'bulkiness' of greenmanures or for that matter of any other organic manure is a constraint in the present day agriculture. The opportunity cost of raising greenmanures is also less.

Yet it has to be promoted due to several unfavourable effects caused by chemical agriculture widely prevalent now. With these ideas in view, an attempt was made to find out the effect of intercropping unconventional greenmanures on the yield and economics of cotton in comparison with sunnhemp as standard. To find out their optimal row ratio and ideal time of incorporation, they were raised in single and two rows allowing them for 30 and 40 DAS for incorporation.

MATERIAL AND METHODS

Field experiments were carried out at Agricultural Research Station, Bhavanisagar, Tamil Nadu, India in order to find out the effect of unconventional greenmanures as intercrops on the associate hybrid cotton yield and economics during the year 2003 to 2004. The soil of the experimental fields was well drained sandy clay loam. The fertility status of the soil in both the fields was low, medium and high in available N, P and K respectively. Four cropping systems viz, sole cotton, cotton + marigold, cotton + sesamum and cotton + sunnhemp were tested (Factor A) in single and double rows (Factor B) incorporating them on 30 and 40 DAS (Factor C). The treatments were laid out in a factorial randomized block design replicated thrice. Sesamum and sunnhemp were solid rows in the interspace i.e., 60 cm in between two cotton rows for single row spacing. For two rows, they were sown at 40cm interval in the interspace. In a similar way, marigold seedlings were

planted keeping 10 cm intra row spacing, cotton was earthed up simultaneously at the respective incorporation timings.

Fertilizers were applied at the rate of 120: 60: 60 kg N, P₂O₅ and K₂O ha⁻¹ respectively. Full dose of P & K and ½ N were applied as basal. Remaining N was applied in equal splits at the time of incorporation of greenmanure and at 60 DAS. Fertilizers were applied to cotton rows alone. The seed cotton was harvested in five pickings. Gross and net returns were computed considering the current market price of inputs and produces. Benefit cost ratio was worked out for different treatments by dividing the gross returns by cost of cultivation.

RESULTS AND DISCUSSIONS

Cotton Yield Attributes and Yield: Boll production, fruiting points, boll setting and boll weight: Greenmanures intersown and incorporated *in situ* in between cotton rows had more bolls (29.10 and 33.86 in summer and winter season respectively) than in sole crop (without intercropping greenmanures) (27.94 and 28.06 bolls respectively) (Table 1). On an average, the winter season crop produced 30.96 bolls plant⁻¹ as compared to 28.52 in summer crop. Marigold intercropping and incorporation *in situ* resulted in more boll production in both seasons counting on an average 30.41 and 36.98 bolls plant⁻¹ in summer and winter seasons respectively. It was followed by sunnhemp intercropping. Sesamum greenmanuring has not favoured the boll production.

As regards row ratio, raising two rows of greenmanures in between cotton rows and *in situ* incorporation resulted in more boll production to the tune of 22.5 and 24.8 per cent respectively in summer 2003 and winter 2003-04 crops as compared to single row raising of greenmanures. Boll production was more with early incorporation of intersown greenmanures.

Fruiting points were higher with intercropping greenmanures and *in situ* incorporation as compared to sole cotton. Similarly marigold intercropping had more fruiting points followed by sunnhemp. Sesamum had no favourable influence. Double row greenmanure had higher fruiting points as compared to single row. Early incorporation (30 DAS) favoured more fruiting points. Boll setting (%) was not affected by the sources of greenmanure in both the seasons. Double row raising of greenmanures improved the boll setting as compared to single row greenmanures. Greenmanures incorporation timing had no influence on the boll setting.

As regards greenmanuring effect on boll production, all greenmanures raised in double row in the interspace of cotton and incorporated *in situ*

produced more bolls plant⁻¹, marigold excelling others. This effect was seen in both the seasons. Early incorporation of greenmanures had favourable effect on this yield attribute. Mahendran^[3] reported improvement in sugarcane yield attributes due to intercropping of daincha. Selvi^[8] reported positive impact on rice yield due to intercropping of daincha. The present study goes in line with their observations. Boll weight was, however, not influenced by the sources of greenmanures and so also by incorporation timing. Satheeshkumar^[7] reported higher values for many of the cotton yield attributes due to intercropping and *in situ* incorporation of sunnhemp. The present study also goes in line with his observations.

Kapas and Lint Yield: The positive effect of intercropping and *in situ* incorporation of greenmanures on growth parameters and yield attributes reflected on kapas yield in both the seasons (Table 1) having thus higher yield than sole cotton (without intercropping any greenmanure). The yield increase was by 28.2 and 25.0 per cent due to green manuring in summer and winter seasons, respectively as compared to sole cotton. Winter season crop yielded more kapas.

As regards sources of greenmanures, marigold out yielded other sources and the difference was clear in winter crop. It was followed by sunnhemp. Marigold as compared to sole cotton had nearly 35.0 per cent higher kapas yield in summer 2003 crop and 39.7 per cent in winter crop. The sunnhemp had 31.0 and 24.9 per cent higher yield, respectively. The increase in kapas yield due to sesamum green manuring was marginal as compared to sole cotton. In both the seasons, double row intersowing / interplanting of greenmanures produced more kapas yield than single row and similarly earlier incorporation on 30 DAS had favourable effect.

Economics: Cost of cultivation, returns and B: C ratio varied depending upon the treatments imposed. Sole cotton had lower cost of cultivation, returns and B: C ratio both in summer and winter crops. Cost of cultivation had increased by about Rs.1000 ha⁻¹ due to marigold intercropping but on an average, the gross and net returns have increased by Rs.10213 and Rs.9182 ha⁻¹, respectively in summer crop, 2003 and Rs.14, 696 and Rs.13, 664 ha⁻¹ in winter crop, 2003-04. The B: C ratio was also higher as compared to sole cotton. This was followed by sunnhemp. Sesamum intercropping secured relatively less returns and B: C ratio. Among different greenmanures, raising of sesamum is less costly as compared to marigold and sunnhemp intercropping. The trend was similar in both summer and winter crops.

Table 1: Effect of unconventional greenmanures intercropping on yield attributing characters and kapas yield of cotton

Treatment	No. of Bolls plant ⁻¹		Fruiting points (Nos. Plant ⁻¹)		Boll setting percentage (%)		Boll weight (gms Boll ⁻¹)		Kapas Yield (Kg ha ⁻¹)		Lint Yield (Kg ha ⁻¹)	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Inter crop												
I ₁ – Marigold	30.41	36.98	99.85	120.9	30.33	30.55	4.54	4.72	1515	1988	485.3	621.3
I ₂ – Sesamum	27.67	31.75	93.24	109.8	29.73	28.99	4.29	4.45	1334	1633	407.6	492.2
I ₃ – Sunnhemp	29.21	32.86	95.03	117.1	30.78	29.5	4.35	4.52	1470	1778	463.2	541.3
Sed	0.78	0.73	2.26	4.38	0.86	1.14	0.17	0.37	45.37	57.9	7.94	20.6
CD (P=0.05)	1.6	1.51	4.66	9.03	NS	NS	NS	NS	93.65	119.5	16.4	42.6
Row ratio												
R ₁ – Single row	26.15	29.07	93.69	109.1	27.94	26.64	4.05	4.24	1376	1713	422.9	515.8
R ₂ – Double row	32.04	38.65	98.39	119.2	32.62	32.72	4.73	4.88	1504	1887	481.1	587.4
SEd	0.68	0.6	1.85	3.57	0.7	0.93	0.14	0.3	37.05	47.3	6.5	16.9
CD (P=0.05)	1.31	1.23	3.81	7.37	1.44	1.91	0.25	0.62	76.46	97.6	13.4	34.8
Days of incorporation												
D ₁ – 30 DAS	30.01	35.21	98.81	117.3	30.29	29.84	4.44	4.72	1488	1855	475.3	573.1
D ₂ – 40 DAS	28.18	32.51	93.26	111	30.28	29.52	4.35	4.41	1393	1744	428.7	530.1
SEd	0.63	0.6	1.85	3.57	0.7	0.93	0.14	0.3	37.05	47.3	6.5	16.9
CD (P=0.05)	1.31	1.23	3.81	NS	NS	NS	NS	NS	76.46	97.6	13.4	34.8
Cropping system												
Without GM (S ₁)	27.94	28.06	84.26	113.7	33.16	24.99	4.07	4.09	1123	1423	331.3	406
Overall mean of GM (S ₂)	29.1	33.86	96.04	114.1	30.28	29.68	4.39	4.56	1440	1779	452	551.6
SEd	1.14	1.08	3.3	6.44	1.26	1.67	0.25	0.54	66.79	85.2	11.7	30.4
CD (P=0.05)	NS	2.22	6.87	NS	2.54	3.45	NS	NS	137.85	175.9	24.1	62.7

Table 2: Effect of unconventional greenmanures incorporation on economics of cotton

Treatment	Cost of cultivation (Rs. ha ⁻¹)		Gross Return (Rs. ha ⁻¹)		Net Return (Rs. ha ⁻¹)		B : C ratio	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Sole cotton	20105	20105	29198	36998	9094	16894	1.45	1.84
Marigold								
Single row, 30 DAS Incorp.	21137	21137	36218	46358	15082	25222	1.71	2.19
Single row, 40 DAS Incorp.	21137	21137	37388	48308	16252	27172	1.77	2.29
Double row, 30 DAS Incorp.	21137	21137	44971	60476	23835	39340	2.13	2.86
Double row, 40 DAS Incorp.	21137	21137	39069	51636	17933	30500	1.85	2.44
Sesamum								
Single row, 30 DAS Incorp.	20205	20205	31538	39338	11334	19134	1.56	1.95
Single row, 40 DAS Incorp.	20205	20205	33540	41340	13335	21135	1.66	2.05
Double row, 30 DAS Incorp.	20205	20205	40898	48438	20693	28233	2.02	2.4
Double row, 40 DAS Incorp.	20205	20205	32795	40768	12590	20563	1.62	2.02
Sunnhemp								
Single row, 30 DAS Incorp.	20605	20605	37449	45500	16844	24896	1.82	2.21
Single row, 40 DAS Incorp.	20605	20605	38558	46358	17953	25753	1.87	2.25
Double row, 30 DAS Incorp.	20605	20605	41019	49348	20414	28743	1.99	2.39
Double row, 40 DAS Incorp.	20605	20605	35915	43706	15310	23101	1.74	2.12

For any given source of manure double row intersowing / interplanting of greenmanures had yielded higher gross and net returns and so also B : C ratio in both summer and winter crops. Across different sources and incorporation timing, raising two rows of greenmanures secured on an average an additional net income of Rs.3329 ha⁻¹ and Rs.4528 ha⁻¹ in summer and winter crops, respectively as compared to single row sowing / planting.

As regards timing of incorporation of intersown greenmanures, the influence varied depending upon the greenmanure and row ratio combination. For any given greenmanure, single row sowing in combination with incorporation on 40 DAS gave higher returns. Double row intersowing / planting of greenmanures relatively fetched more return with early incorporation. The trend was seen in both seasons. The variables contributed for the returns were in the order of greenmanures > row

ratio > incorporation timings. Similarly double row sowing coupled with early incorporation fetched higher returns than other combinations. Double row of marigold interplanting and incorporating it *in situ* on 30 DAS was found more promising and fetched higher returns than any other combination of variables in both summer 2003 and winter 2003-04 crops. There was better growth of cotton due to intercropping and *in situ* incorporation of marigold which resulted in higher yield of kapas and lint in both seasons. Sesamum intercropping did not improve the cotton yield much in both summer and winter crops. The treatment combination (Table.2) could further spell out that interplanting of marigold in two rows in between cotton rows and incorporating it on 30 DAS had more yield advantage in both summer and winter crops securing 1730 and 2326 kg ha⁻¹, respectively. Further the advantage was quite surpassing as compared to sole cotton securing as low as 1123 and 1423 kg ha⁻¹ respectively. Net returns and B: C ratio was similarly higher in the combination of marigold two rows and 30 DAS incorporation. While the cultivation cost increase was marginal in this combination (Marigold ; double row; 30 days incorporation), the profit difference was substantial as compared to sole cotton and outscored other greenmanures also, row ratio and time of incorporation. Higher returns due to intercropping of cowpea as greenmanure in cotton were earlier reported by Rao^[6]. Similarly Ramesh^[5] reported in sugarcane due to intercropping of daincha. As regards row ratio and days of incorporation, they had significant, concurrent interaction in summer followed by winter crops.

Conclusion: The results revealed that intercropping marigold in two rows in between cotton rows and incorporating it on 30 DAS had contributed ultimately more kapas and lint yield of cotton securing higher yield advantage in both summer and winter crops. Higher net return and BC ratio were obtained when intercropping with marigold in two rows in between cotton rows and incorporating it on 30 DAS.

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