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, in fact, 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 + sesame 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
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 daichana. Selvi\(^{[4]}\) reported positive impact on rice yield due to intercropping of daichana. 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\(^{[5]}\) 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 intersowing 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.
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 green manures also, row ratio and time of incorporation. Higher returns due to intercropping of cowpea as green manure in cotton were earlier reported by Rao$^{[6]}$. Similarly Ramesh$^{[7]}$ 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.

**REFERENCES**