



Impact of Integrated Plant Nutrient System on Cotton Seed Production in the Coastal Region of Karaikal, Puducherry

Bagavathi Ammal U¹, Kowsalya G¹, R Sankar¹ and Pradip Dey²

¹Department of Soil Science and Agricultural Chemistry, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal-609603, India

²ICAR-Indian Institute of Soil Science, Bhopal-462038, Madhya Pradesh, India

*Corresponding author's E-mail: pancham112@gmail.com

Abstract

To assess the effect of Integrated Plant Nutrient System (IPNS) on cotton seed production, an experiment was conducted with ten treatments, blanket fertilizer recommendation, FYM alone, Soil test crop response (STCR) NPK applications aimed at yield targets of 3.1, 3.3, and 3.5 Mg ha⁻¹, corresponding STCR-IPNS treatments for the same targets, one following the farmers' practice, and an absolute control in RBD with three replications at farmers holding at Varichikudy, Karaikal. The soil in the study area was clay in texture, classified as *Typic Haplusterts*. The results of field experiment have shown that application of STCR+IPNS-3.5 Mg ha⁻¹ recorded higher plant height, LAI, monopodia plant⁻¹, sympodia plant⁻¹ at all the crop growth stages, which was comparable with other STCR + IPNS treatments. Higher number of fruiting points plant⁻¹ (73.47) was recorded in the STCR+IPNS-3.3 Mg ha⁻¹ which was on par with other STCR+IPNS treatments. Higher bolls plant⁻¹ (64.32), boll setting percentage (87.66 %), boll weight (4.76 g) and Bartlett's Earliness Index (BEI) (0.59) were recorded in STCR+IPNS-3.5 Mg ha⁻¹. The highest seed cotton yield (3.6 Mg ha⁻¹), stover yield (5930 kg ha⁻¹), ginning per cent (42.52 %), seed index (9.19) and lint index (6.82) were recorded in STCR+IPNS-3.5 Mg ha⁻¹ treatment. The highest seed cotton yield in STCR-IPNS 3.5 Mg ha⁻¹ was 40.35 % and 34.63 % higher than the seed cotton yield recorded by farmers' practice (2.65 Mg ha⁻¹) and blanket recommendation (2.67 Mg ha⁻¹), respectively and 114.9 % higher than control (1.67 Mg ha⁻¹). and response ratio (7.10).

Keywords: Cotton, Integrated plant nutrient system, Fertilizer prescription equation, Soil test crop response

Introduction

In India, the area under cotton cultivation is between 12 to 13.5 million hectares against the world area under cultivation (32.91 million hectares) and contributes nearly 24 per cent of the global cotton production. India uses about 6.34 million MT of cotton against the world usage of about 26.09 million MT (The Cotton Corporation of India Ltd., 2022). To address the ongoing yearly depletion of soil nutrients in India, it is essential to increase the use of organic amendments alongside chemical fertilizers. Therefore, a sustainable approach to prevent further nutrient loss and maintain long-term crop productivity, soil health, and crop quality is achievable only through the Integrated Plant Nutrient System (IPNS). Despite being a longstanding concept, IPNS was not widely adopted earlier due to the relatively slow nutrient cycling in the soil-plant system.

Currently, IPNS has gained significant importance because of the existing nutrient shortfall and the fact that sustainable soil productivity cannot be achieved by using only chemical fertilizers or solely organic inputs. Among the different approaches to fertilizer recommendations, the yield-targeting approach is unique, as it accounts for both the soil test-based fertilizer doses and the expected crop yield achievable through proper agronomic practices. This targeted yield approach is also scientifically sound as the balanced fertilization is ensured not only among the fertilizer nutrients but also the soil available nutrients (Veeranna and Srijaya, 2017). Fertilizer Prescription Equations (FPEs) under IPNS was developed for cotton in Thirunallar Soil series (*Typic Haplusterts*) (Sakthi Priyanka, 2021). These equations are to be validated at farmer's holding before adoption. Therefore, the present research

work has been contemplated with the objectives of validate the Fertilizer Prescription Equation for cotton in Thirunallar Soil series and also to investigate the impact of varying fertilizer doses of NPK and IPNS on growth, yield attributes and yield of cotton crop.

Materials and Methods

The field experiment was conducted with cotton hybrid (RCH 659) with ten treatments, blanket fertilizer recommendation, FYM alone, STCR-based NPK applications aimed at yield targets of 3.1, 3.3, and 3.5 Mg ha⁻¹, corresponding STCR-IPNS treatments for the same yield targets, one following the farmers' practice, and an absolute control in RBD with three replications at farmers' holding at Varichikudy, Karaikal. The study area comes under coastal alluvial plain (PC1) classified as fine, smectitic isohyperthermic, *Typic Haplusterts* with an area of 26.14 per cent. The soil was found to be non-saline (0.48dS m⁻¹) and neutral (pH-7.20). The CEC of soil was 21.9 cmol (p⁺) kg⁻¹. Soil analysis indicated low fertility for KMnO₄-N (200.48 kg ha⁻¹), moderate levels of organic carbon (0.58 per cent), and high concentrations of Olsen-P (69.4 kg ha⁻¹) and NH₄OAc-K (348 kg ha⁻¹). Fertilizer applications in the STCR treatments followed the prescription equations established for NPK alone and IPNS. For STCR-IPNS treatments, FYM was applied basally at 12.5 Mg ha⁻¹. The applied FYM had 30% moisture, 0.53%, 0.27% and 0.51% NPK, respectively. The N, P and K contributed by FYM were subtracted from the inorganic fertilizer doses applied for STCR-IPNS

treatments (Table 1). STCR-based fertilizer doses determined using initial soil test values of available N, P and K kg ha⁻¹. The application of nitrogen as urea was taken up in three splits *i.e.*, Half of the nitrogen was applied basally, and the rest was administered at 45 and 65 days after sowing. The nutrient P and K were applied as basal in the form of single super phosphate and muriate of potash, respectively as per the treatments.

Fertilizer Prescription Equations for Cotton

STCR-IPNS

$$FN = 7.29 T - 0.23 SN - 0.80 ON$$

$$FP_2O_5 = 3.47 T - 0.47 SP - 0.71 OP$$

$$FK_2O = 4.30 T - 0.13 SK - 0.32 OK$$

Where, FN, FP₂O₅ and FK₂O are fertilizer N, P₂O₅ and K₂O in kg ha⁻¹, respectively; T is the yield target in q (100 q= 1Mg) ha⁻¹; SN, SP and SK are soil available N, P and K in kg ha⁻¹, respectively and ON, OP and OK are the quantities of N, P and K in kg ha⁻¹ supplied through FYM, respectively.

The yield and growth parameters were measured on three randomly chosen plants from each replication at four critical stages of cotton *viz.*, seedling stage at 30 DAS, flowering stage at 60 DAS, boll opening stage at 120 DAS and maturity stage at 150 DAS. The quality parameters *viz.*, ginning per cent (Santhanam, 1976), seed index and lint index (Khan *et al.*, 2010) were carried out at Central Institute for Cotton

Table 1. Fertilizer rate for cotton under various treatments

S.No.	Treatment details	N (kg)	P ₂ O ₅ (kg)	K ₂ O (kg)	FYM (Mg ha ⁻¹)
1	T ₁ - Control	0	0	0	0
2	T ₂ - FYM (12.5 Mg ha ⁻¹) alone	-	-	-	12.5
3	T ₃ - Farmers' practice	100	50	50	0
4	T ₄ - Blanket Recommendation	120	60	60	0
5	T ₅ - STCR-NPK alone – 3.1 Mg ha ⁻¹	181	80	83	0
6	T ₆ - STCR-NPK alone – 3.3 Mg ha ⁻¹	196	88	92	0
7	T ₇ - STCR-NPK alone – 3.5 Mg ha ⁻¹	210	95	100	0
8	T ₈ - STCR+IPNS – 3.1 Mg ha ⁻¹	133	56	38	12.5
9	T ₉ - STCR+IPNS – 3.3 Mg ha ⁻¹	148	63	46	12.5
10	T ₁₀ - STCR+IPNS – 3.5 Mg ha ⁻¹	163	71	54	12.5

Research on Cotton Technology, ICAR, Coimbatore.

The yield parameters were calculated by using the following formula

$$\text{Boll setting percent} = \frac{\text{Number of bolls harvested plant}^{-1}}{\text{Number of fruiting points plant}^{-1}} \times 100$$

Ginning per cent (Santhanam, 1976)

$$\text{Ginning (\%)} = \frac{\text{Weight of the lint (g)}}{\text{Weight of the seed cotton (g)}} \times 100$$

Lint index (Khan *et al.*, 2010)

$$\text{Lint index} = \frac{\text{Seed index} \times \text{Ginning \%}}{100 - \text{Ginning \%}}$$

Earliness in seed cotton harvested under various treatments was calculated by means of assessing the Bartlett's Earliness Index (Bartlett, 1947).

$$\text{BEI} = \frac{P_1 + P_1 + P_2 + \dots + (P_1 + P_2 + \dots + P_n)}{P_1 + P_2 + \dots + P_n \times n}$$

Where, $P_1, P_2 \dots P_n$ represents the seed cotton yield (kg) for each picking, and n denotes the total number of pickings.

Response Ratio (RR- kg kg⁻¹)

Response (kg ha⁻¹) / Quantities of N, P₂O₅ and K₂O applied (kg ha⁻¹).

Per cent achievement (%)

Per cent achievement =

$$\frac{\text{Yield obtained in STCR treatment (q ha}^{-1}\text{)}}{\text{Yield target (q ha}^{-1}\text{)}} \times 100$$

Results and Discussion

Growth parameters of cotton

The results of field experiment shown that application of STCR+IPNS-3.5 Mg ha⁻¹ recorded higher plant height at 30 DAS (46.44cm), 60 DAS (62.52cm), 120 DAS (89.07cm) and 150 DAS (99.45cm) (Table 2). Application of STCR+IPNS-3.5 Mg ha⁻¹ registered the highest LAI of 0.56 and was comparable with STCR+IPNS- 3.3 Mg ha⁻¹ which in turn comparable with STCR+IPNS- 3.1 t ha⁻¹. The number of monopodia branches per plant (2.89) and sympodia branches per plant (14.00), was the highest in the STCR+IPNS treatments performed on par to that of all treatments except control and FYM alone (Table 3). It could also be due to influence of organic manure/FYM combined with soil test-based fertilizer recommendation, which stimulated better plant and root growth by providing hormones, vitamins and other organic acids produced during decomposition of FYM and balanced fertilizer application. The organic acids could have solubilized the native and applied nutrients present within the soil which increased the growth and yield parameters of cotton. Rajakumar (2014), Sreenadha Reddy (2014) and Mageshen (2019) have also reported similar trend of results in Bhendi.

Yield components of cotton

The treatment which receiving both fertilizer and FYM at 12.5 Mg ha⁻¹ with a target yield of 3.3 Mg ha⁻¹ recorded higher number of fruiting points

Table 2. Impact of different fertilizer doses of STCR-NPK alone and STCR - IPNS on plant height (cm)

Treatments	30 DAS	60 DAS	120 DAS	150 DAS
T ₁ -Control	22.33	39.52	64.19	72.23
T ₂ -FYM (12.5 Mg ha ⁻¹) alone	24.83	44.84	68.33	76.75
T ₃ -Farmer's Practice	27.40	46.17	70.40	80.50
T ₄ -Blanket Recommendation	33.13	53.56	76.33	81.22
T ₅ -STCR-NPK alone-3.1 Mg ha ⁻¹	35.70	55.16	78.23	85.56
T ₆ -STCR-NPK alone-3.3 Mg ha ⁻¹	37.82	57.36	80.20	88.14
T ₇ -STCR-NPK alone-3.5 Mg ha ⁻¹	39.93	59.93	82.93	90.62
T ₈ -STCR+IPNS-3.1 Mg ha ⁻¹	40.39	60.00	83.33	93.70
T ₉ -STCR+IPNS-3.3 Mg ha ⁻¹	42.03	61.50	85.12	96.30
T ₁₀ -STCR+IPNS-3.5 Mg ha ⁻¹	46.44	62.52	89.07	99.45
S.Ed±	1.42	2.17	3.10	3.44
LSD (p=0.05)	2.98	4.56	6.50	7.21

Table 3. Impact of different fertilizer doses of STCR-NPK alone and STCR – IPNS on Leaf Area Index, Monopodia plant⁻¹ and Sympodia plant⁻¹

Treatments	LAI			Monopodia plant ⁻¹		Sympodia plant ⁻¹	
	30 DAS	60 DAS	120 DAS	120 DAS	150 DAS	120 DAS	150 DAS
T ₁ -Control	0.26	0.42	0.64	1.33	2.44	9.33	11.89
T ₂ -FYM (12.5 Mg ha ⁻¹) alone	0.32	0.50	0.74	1.56	2.56	11.44	12.11
T ₃ -Farmers' Practice	0.33	0.60	0.78	1.56	2.67	11.56	12.11
T ₄ -Blanket Recommendation	0.35	0.63	0.79	1.56	2.67	11.56	13.00
T ₅ -STCR-NPK alone-3.1Mg ha ⁻¹	0.40	0.68	0.88	1.67	2.78	12.33	13.11
T ₆ -STCR-NPK alone-3.3 Mg ha ⁻¹	0.42	0.69	0.90	1.67	2.78	12.44	13.56
T ₇ -STCR-NPK alone-3.5 Mg ha ⁻¹	0.45	0.70	0.91	1.89	2.78	13.44	13.89
T ₈ -STCR+IPNS-3.1 Mg ha ⁻¹	0.52	0.92	1.00	2.00	2.89	13.89	14.11
T ₉ -STCR+IPNS-3.3 Mg ha ⁻¹	0.54	0.95	1.07	2.11	2.89	13.89	14.67
T ₁₀ -STCR+IPNS-3.5 Mg ha ⁻¹	0.56	0.99	1.10	2.22	2.89	14.00	14.89
S.Ed ±	0.01	0.03	0.04	0.07	0.11	0.49	0.53
LSD (p-0.05)	0.03	0.06	0.07	0.14	0.22	1.03	1.11

Table 4. Impact of different fertilizer doses of STCR-NPK alone and STCR - IPNS on yield components

Treatments	Fruiting Points plant ⁻¹	Bolls plant ⁻¹	Boll Setting (%)	Boll weight (g)	BEI
T ₁ -Control	44.86	23.31	52.06	3.89	0.51
T ₂ -FYM (12.5 Mg ha ⁻¹) alone	50.23	30.26	60.21	3.98	0.53
T ₃ -Farmers' Practice	62.26	44.87	72.18	3.99	0.54
T ₄ -Blanket Recommendation	65.69	47.40	72.23	4.14	0.54
T ₅ -STCR-NPK alone-3.1Mg ha ⁻¹	66.68	56.52	84.84	4.53	0.55
T ₆ -STCR-NPK alone-3.3 Mg ha ⁻¹	69.01	58.48	85.03	4.56	0.56
T ₇ -STCR-NPK alone-3.5 Mg ha ⁻¹	70.45	60.29	85.73	4.58	0.56
T ₈ -STCR+IPNS-3.1 Mg ha ⁻¹	70.43	60.33	85.78	4.70	0.57
T ₉ -STCR+IPNS-3.3 Mg ha ⁻¹	73.59	63.21	85.94	4.71	0.58
T ₁₀ -STCR+IPNS-3.5 Mg ha ⁻¹	73.47	64.32	87.66	4.76	0.59
S.Ed ±	1.59	1.40	3.60	0.21	0.01
LSD (p-0.05)	3.33	2.94	7.54	0.43	0.02

per plant (73.59) (Table 4). The soil which received STCR+IPNS- 3.5 Mg ha⁻¹ recorded higher number of bolls (64.32) which was on par with STCR+IPNS-3.3 Mg ha⁻¹ which in turn was comparable with STCR+IPNS at 3.1 Mg ha⁻¹ and STCR with NPK alone at 3.5 Mg ha⁻¹ treatments. The STCR+IPNS at 3.5 Mg ha⁻¹ treatment was found to record higher (87.66 per cent) boll setting percentage which was comparable with other STCR+IPNS and all STCR-NPK alone treatments. The plot which received STCR+IPNS-3.5 Mg ha⁻¹ treatment recorded higher boll weight (4.76 g) and was on par with other STCR+IPNS and all STCR-NPK alone treatments. The BEI (Bartlett's Earliness Index) was found to range from 0.51 in control to 0.59 in STCR+IPNS- 3.5

Mg ha⁻¹ treatment. Addition of organic manure along with balanced nutrient addition to soil increased the microbial activity which might have produced growth regulators leading to activation of cell division, cell elongation and formation of more tissues resulting in good vegetative growth and other yield parameters.

Yield of cotton

The higher cotton yield was recorded in STCR+IPNS- 3.5 Mg ha⁻¹ (3.6 Mg ha⁻¹) which was comparable with STCR+IPNS- 3.3 Mg ha⁻¹ treatment and significantly different from other treatments. The higher stover yield of 5930 kg ha⁻¹ was found with STCR+IPNS-3.5 Mg ha⁻¹ which did not differ significantly with other STCR-

Table 5. Impact of different fertilizer doses of STCR-NPK alone and STCR - IPNS on yield and Quality of cotton

Treatments	Seed cotton yield (Mg ha ⁻¹)	Stover yield (Mg ha ⁻¹)	Ginning per cent	Seed Index	Lint Index
Treatments	1.68	4.27	31.79	7.79	3.64
T ₂ -FYM (12.5 t ha ⁻¹) alone	2.23	4.59	36.39	8.38	4.80
T ₁ -Control	2.57	5.04	34.78	7.76	4.15
T ₂ -FYM (12.5 Mg ha ⁻¹) alone	2.67	5.17	35.75	7.55	4.22
T ₃ -Farmers' Practice	3.11	5.25	35.90	8.05	4.52
T ₄ -Blanket Recommendation	3.21	5.36	35.97	8.20	4.64
T ₅ -STCR-NPK alone-3.1Mg ha ⁻¹	3.24	5.31	36.93	8.35	4.91
T ₆ -STCR-NPK alone-3.3 Mg ha ⁻¹	3.29	5.75	38.50	8.69	5.46
T ₇ -STCR-NPK alone-3.5 Mg ha ⁻¹	3.46	5.85	41.54	8.99	6.42
T ₈ -STCR+IPNS-3.1 Mg ha ⁻¹	3.60	5.93	42.52	9.19	6.82
T ₉ -STCR+IPNS-3.3 Mg ha ⁻¹	0.12	2.93	1.46	0.33	0.50
T ₁₀ -STCR+IPNS-3.5 Mg ha ⁻¹	0.25	6.18	3.07	0.68	1.05

IPNS treatments and STCR-NPK alone-3.3 Mg ha⁻¹ which in turn recorded comparable stover yield of 5.30 Mg ha⁻¹ and 5.25 Mg ha⁻¹ with STCR-NPK alone-3.5 Mg ha⁻¹ and STCR-NPK alone-3.1 Mg ha⁻¹, respectively (Table 5). Enhanced yield might be linked to the rise in LAI leading to higher photosynthesis and accumulation of high number of metabolites in the plant system. The increase in yield due to integration of organic and inorganic is quite expected. The positive and favourable influence of organic manure application on the physical, chemical, physico-chemical and biological properties need no further emphasis as it is well established. The effectiveness of inorganic fertilizers was significantly enhanced when applied together with organic manure (Fritz and Wonneberger, 1973). The better physical environment provided by organics favours good root growth which facilitate efficient utilization of applied nutrients thus ultimately increased yield. Similar observations were also reported by Lalithakumari *et al.* (2010) in cotton.

The results indicated that as the yield targets increased, the yield levels also rose proportionally. The highest seed cotton yield of 3.6 Mg ha⁻¹ was recorded in STCR+IPNS 3.5 Mg ha⁻¹, which was 40.35 per cent and 34.63 per cent higher than the seed cotton yield recorded by farmers' practice (2.56 Mg ha⁻¹) and blanket recommendation (2.67 Mg ha⁻¹), respectively and 114.9 per cent higher than control (1.68 Mg ha⁻¹). Reduced seed cotton and stover yields in farmer-managed and blanket fertilizer treatments relative to STCR+IPNS could

result from nutrient applications not aligned with crop requirements and ignoring the initial soil nutrient level

The findings of this study also indicated that under STCR-NPK alone and IPNS treatments, seed cotton and stover yields increased correspondingly with higher yield targets, likely due to the application of greater nutrient doses to achieve higher yield targets. Among the same yield targets, the STCR+IPNS treatments recorded relatively higher seed cotton and stover yields than those under STCR-NPK alone treatments due to cumulative impact of FYM and inorganic fertilizers on enhanced growth and yield parameters, nutrient availability and uptake, which have resulted in higher yield. Under IPNS, FYM helps sustain plant nutrients in available forms for a longer duration by enhancing soil organic matter (SOM) and soil physico-chemical and biological characteristics. Inorganic fertilizers on the other hand, supply nutrients which are readily soluble in soil solution and thereby make nutrients instantly available to plants was also reported by Aziz *et al.* (2010), Bodruzzaman *et al.* (2010) and Tilahun Tadesse *et al.* (2013). Maragatham *et al.* (2012) and Velayutham and Santhi (2013) have also reported the results of a long term STCR-IPNS demonstration in increasing the yield as compared to blanket recommendation.

Quality characters of cotton

The ginning per cent recorded the highest in plot which received STCR+IPNS-3.5 Mg ha⁻¹

Table 6. Yield, Percent achievement and response ratio in cotton

S. No.	Treatments	Fertilizer Dose (kg/ha)			Seed cotton yield (Mg ha ⁻¹)	Total N/P ₂ O ₅ /K ₂ O applied	Percent achievement	Response ratio (kg/kg)
		N	P ₂ O ₅	K ₂ O				
1	T ₁ - Control	0	0	0	1.68	0	-	-
2	T ₂ - FYM (12.5 Mg ha ⁻¹) alone	-	-	-	2.23	-	-	-
3	T ₃ - Farmer's practice	100	50	50	2.57	200	-	4.45
4	T ₄ - Blanket Recommendation	120	60	60	2.67	240	-	4.16
5	T ₅ - STCR-NPK alone - 3.1 Mg ha ⁻¹	181	80	83	3.11	344	100.4	4.18
6	T ₆ - STCR-NPK alone - 3.3 Mg ha ⁻¹	196	88	92	3.21	376	98.3	4.08
7	T ₇ - STCR-NPK alone - 3.5 Mg ha ⁻¹	210	95	100	3.24	405	92.7	3.87
8	T ₈ - STCR+IPNS - 3.1 Mg ha ⁻¹	133	56	38	3.29	227	106.1	7.11
9	T ₉ - STCR+IPNS - 3.3 t ha ⁻¹	148	63	46	3.46	257	104.8	6.93
10	T ₁₀ - STCR+IPNS - 3.5 Mg ha ⁻¹	163	71	54	3.60	288	102.9	6.68

treatment (42.52 per cent) and was comparable with STCR+IPNS-3.3 Mg ha⁻¹ treatment which in turn was comparable with STCR+IPNS-3.1t ha⁻¹(Table 5). The treatment which received STCR+IPNS-3.5 Mg ha⁻¹ was the best among the different treatments tried which was comparable with other STCR+IPNS treatments. The lint index was found to range from 3.64 in control to 6.82 in STCR+IPNS-3.5 Mg ha⁻¹. The present investigation clearly revealed that all these quality parameters were significantly influenced by different fertilizer STCR+IPNS treatments. It is also true that there are the ample evidences to show that the addition of organic manures could improve the quality of cotton. From the results, it was observed that the application of organic sources like FYM resulted in the enhancement in seed cotton and lint yield of cotton which could be ascribed to sustainable availability of all the nutrients by FYM throughout the crop growing period. Similar results have been reported by Gwarazimba (2009) on lint and seed index, Tewolde *et al.* (2007) and Beedy *et al.* (2010) on lint yield and Abdel Aal *et al.* (2011) on seed index.

Validation of existing fertilizer prescription equations

Per cent achievement of yield targets

The per cent achievement of yield targets ranged from 92.68 under STCR-NPK alone -3.5 Mg ha⁻¹ to 106.1 under STCR+IPNS at 3.1 Mg ha⁻¹ (Table 6). As per the guidelines followed in AICRP-STCR, the per cent achievement of yield targets

should be within ± 10 per cent variation proving the validity of Fertilizer Prescription Equations.

In this regard, the data clearly revealed that the highest achievement of yield target was recorded with STCR+IPNS at 3.1 Mg ha⁻¹ (106.1 per cent) followed by STCR+IPNS-3.3 Mg ha⁻¹ (104.8 per cent) and STCR+IPNS-3.5 t ha⁻¹ (102.9 per cent). The results showed that the percentage achievement remained within $\pm 10\%$ variation across all yield target levels, confirming the validity of the Fertilizer Prescription Equations. Overall, yield targeting under IPNS generally achieved a higher percentage of the intended yield compared to the corresponding STCR-NPK alone treatments.

Response Ratio (RR)

The response ratio recorded for various treatments ranged from 3.87 kg kg⁻¹ in STCR-NPK alone - 3.5 Mg ha⁻¹ to 7.10 kg kg⁻¹ in STCR+IPNS- 3.1t ha⁻¹ (Table 6). Next to STCR+IPNS 3.1 Mg ha⁻¹, the highest RR was recorded under STCR+IPNS-3.3 Mg ha⁻¹ (6.94 kg kg⁻¹). Among the STCR treatments, STCR-IPNS recorded relatively higher RR than their corresponding NPK alone treatments. However, all the STCR+IPNS treatments recorded relatively higher RR as compared to farmer's practice (4.45 kg kg⁻¹).

Conclusion

From the results of present study, it is concluded that the highest cotton seed yield (3.6 Mg ha⁻¹), stover yield (5.93 Mg ha⁻¹) and ginning per cent

of 42.52 per cent, seed index of 9.19 and lint index of 6.82. were significantly influenced by STCR+IPNS-3.5 Mg ha⁻¹. The nutrients released from STCR-NPK alone, blanket recommendation and farmer's practice was lower compared to STCR+IPNS treatments

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Received: May 20, 2025; Accepted: August 18, 2025