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EFFECT OF DIFFERENT INMS TREATMENTS ON GROWTH, YIELD, QUALITY, ECONOMICS AND NUTRIENT UPTAKE OF HYBRID COTTON PHULE-492 (*Gossypium hirsutum* L.)

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ABSTRACT

The field experiment was conducted during summer season of 2006-07 and 2007-08 at the research farm of Department of Agronomy, MPKV, Rahuri, Dist. Ahmednagar (MS) to find the effect of different integrated nutrient management treatments on growth, yield, quality, economics and nutrient uptake of hybrid cotton cv. Phule-492. The experiment with seven treatments viz. T_1: Gross recommended dose of fertilizer (GRDF) i.e.10 t farm yard manure (FYM) ha^{-1} + recommended dose of fertilizer (RDF) as 100:50:50 kg NPK ha^{-1}, T_2: 75 % RDF + 25 % recommended dose of nitrogen (RDN) through vermicompost, T_3: 50 % RDF + 50% RDN through vermicompost, T_4: 25 % RDF + 75 % RDN through vermicompost, T_5: 100 % RDN through vermicompost, T_6: fertilizer dose according to soil test crop response (STCR) equation and T_7: Control was laid out in randomized block design with three replications. The application of fertilizer dose according to soil test crop response (STCR) equation recorded significantly higher values for different growth attributes viz. plant height, monopodial branches, sympodial branches and dry matter $plant^{-1}$, seed cotton yield, stalk yield, monetary returns and nutrient uptake during both the years of experimentation. Application of different INM treatments did not show significant influence on quality parameters viz. ginning percentage, uniformity ratio, bundle strength, 2.5 per cent span length, maturity coefficient and fibre fineness. Significantly lowest values for growth attributes, seed cotton yield, stalk yield, monetary returns and nutrient uptake were recorded by the control.

Key words: hybrid cotton, growth attributes, nutrient uptake, quality, seed cotton yield.

INTRODUCTION

Organic materials were practically the only external source of nutrients to crops before introduction of inorganic fertilizers. The various implications of commercial fertilizer particularly in decreasing the soil fertility and productivity and the ever increasing cost of chemical fertilizers compels one to think of the use of organic manures (Bhardwaj and Gaur 1985 and Modgal and Singh 1990). The application mineral fertilizer along with organic manures could achieve sustainability in crop yield and soil health.

Cotton is widely grown in different cropping systems under diverse agro-climatic conditions. With the advent of hybrids, the cotton yields have been boosted up and consequently increased the nutrient requirement of the system. In India, largest area under cotton crop is in Maharashtra. The area and production of cotton crop in Maharashtra during 2006-07 is 31.07 lakh ha and 3250 thousand bales, but has the lowest productivity of 187 kg ha^{-1} with hardly three per cent of the area under irrigation (Anonymous 2008). The present investigation was therefore, undertaken to find the effect of different integrated nutrient management treatments on growth, yield, quality and economics of hybrid cotton.

MATERIALS AND METHODS

The experiment was conducted during summer season of 2006-07 and 2007-08 at the Post

Graduate Institute research farm, Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The soil of the experimental field was medium black and fairly drained. The textural class was clayey. A dominant type of clay mineral was montmorillonite and grouped under order vertisol. The chemical composition indicated that the soil was low in available nitrogen (168.33 kg ha^{-1}), medium in organic carbon (0.52 %), low in available phosphorus (13.46 kg ha^{-1}) and very high in available potassium (467.33 kg ha^{-1}). The soil was alkaline in reaction (pH 8.01).

The experiment with seven treatments *viz*. T_1: Gross recommended dose of fertilizer (GRDF) ***i.e.*** 10 t farm yard manure (FYM) ha^{-1} + recommended dose of fertilizer (RDF) as 100:50:50 kg NPK ha^{-1}, T_2: 75 % RDF + 25 % recommended dose of nitrogen (RDN) through vermicompost*, T_3: 50 % RDF + 50% RDN through vermicompost* T_4: 25 % RDF + 75 % RDN through vermicompost*, T_5: 100 % RDN through vermicompost*, T_6: fertilizer dose according to soil test crop response (STCR) equation* , T_7: Control was laid out in randomized block design with three replications. The * indicate that from T_2 to T_6 all the fertilizer doses were given according to soil test values. The fertilizers were applied to the treatment T_6 as per the targeted yield equations developed by Soil Test Crop Response (STCR) Project, MPKV, Rahuri-413722, Dist. Ahmednagar for summer cotton. Before planting of summer cotton, the soil was analyzed for available NPK (kg ha^{-1}) and analyzed values were put in following targeted yield equation of summer cotton. The targeted yield for summer cotton was 25 q ha^{-1} for both the seasons.

Targeted yield equation (STCR)

$F\ N = (13.1 \times T) - (0.75 \times SN)$
$F\ P_2O_5 = (6.83 \times T) - (2.84 \times SP)$
$F\ K_2O = (8.75 \times T) - (0.18 \times SK)$

Where,

FN = Nitrogen (kg ha^{-1}) to be applied from fertilizer
FP_2O_5 = Phosphorus (kg ha^{-1}) to be applied from fertilizer
FK_2O = Potash (kg ha^{-1}) to be applied from fertilizer
T = Targeted yield (q ha^{-1})
SN = Available nitrogen (kg ha^{-1}) from the soil
SP = Available phosphorus (kg ha^{-1}) from the soil
SK = Available potassium (kg ha^{-1}) from the soil

In T_2 to T_5 remaining dose of P and K supplied through chemical fertilizers. Seed treatment of *Azotobacter* and PSB given to all treatments. ½ dose of N and entire P_2O_5 and K_2O was applied at the time of sowing, ¼ N at 30 days after sowing and ¼ N at 60 days after sowing was applied by ring placement method. The observations recorded are tabulated, analyzed and interpreted herein.

RESULTS AND DISCUSSION

Growth attributes: The application of fertilizer dose according to soil test crop response (STCR) equation recorded significantly higher values for different growth attributes *viz*. plant height, monopodial branches, sympodial branches and dry matter $plant^{-1}$. Nehra *et al.* (2004) reported the similar findings such that nitrogen is well recognized as a promoter of vegetative growth. The increased availability of nitrogen through different N management practices in general resulted in higher values of growth attributes. He further stated that organic manures are slow releasing N source found beneficial during subsequent stages of crop, which might have resulted in increasing the total dry matter at harvest. Control treatment and 100 per cent RDN through vermicompost exhibited lower values of these growth parameters of cotton during both the years of experimentation.

Yield: The integrated nutrient management showed great impact on seed cotton and stalk yield during both the years of experimentation. Cotton crop produced maximum seed cotton yield, stalk yield and biological yield with the application of fertilizer dose according to STCR equation followed by application of gross recommended dose of fertilizer (GRDF) during 2006-07 and 2007-08. The increased seed cotton yield of cotton by integration of organic and inorganic fertilizer might be attributed due to FYM or vermicompost which are considered to be good source of all plant nutrients and also the mineralization of organic

nitrogen in FYM and vermicompost, which is a slow process, might have provided nitrogen during the crop requirement. Kaur *et al*. (2007) also opined the similar results for increased seed cotton yield under INMS. The harvest index value was highest with control (29.23 %) during first year and during second year it was found highest with the application of 75 % RDF + 25 % RDN through vermicompost (29.20 %) followed by control.

Quality: Application of different nutrient levels of sources of organic, inorganic sources and their combinations had no significant influence on ginning percentage, uniformity ratio, bundle strength, 2.5 per cent span length, maturity coefficient and fibre fineness. However, numerically higher values of all quality parameters were recorded due to application of RDF according to STCR equation over GRDF and other vermicompost levels. All quality parameters were genetic character of a variety which were not influenced by fertilizer levels. Dhillon *et al*. (2006) and Srinivasulu and Hema (2007) concluded that fertilizer at any level did not show any positive effect on quality of fibre.

Economics: The economic analysis of cotton under integrated nutrient management brought out the higher gross and net monetary returns with the application of fertilizer dose according to STCR equation followed by GRDF compared to rest of the INMS treatments and control during both the years of experimentation. The benefit: cost ratio was found maximum with the application of fertilizer dose according to STCR equation (2.93 and 3.00) followed by 75 % RDF + 25 % RDN through vermicompost (1.96 and 2.02) and GRDF (1.95 and 1.94) during both the years of experimentation. This was mainly due to lower cost of cultivation in fertilizer dose application according to STCR equation to cotton over vermicompost levels having higher cost of cultivation. Similar results were reported by Katkar *et al*. (2002).

Nutrient uptake: The total nitrogen uptake by cotton was highest with the application of fertilizer dose according to STCR equation followed by GRDF during both the years of experimentation. Among the vermicompost levels, application of 75 % RDF + 25 % RDN through vermicompost was found at par with application of 50 % RDF + 50 % RDN through vermicompost and recorded significantly higher nitrogen uptake compared to rest of the INMS treatments. Beneficial effects of combined application of FYM and vermicompost with inorganic fertilizers to cotton in respect of nitrogen uptake are supported by the observations of Dhawan *et al*. (2005). This might be due to mineralization and slow release of nutrients to cotton crop resulting in to higher uptake of nutrients with the increased seed cotton yield under INMS treatments.

Total phosphorus and potassium uptake showed the similar trend to that of nitrogen during both the years of experimentation. The additional phosphorus supplied through organic manure and its influence on solubilizing native phosphorus might have resulted into increased phosphorus uptake by GRDF, which was found at par with the application of fertilizer dose according to STCR equation. These results are in agreement with the results of Dhawan *et al*. (2005).

Thus, growing of summer hybrid cotton with the application of fertilizer dose according to STCR equation followed by GRDF (FYM 10 t ha^{-1} + RDF) is better preposition for achieving higher productivity and profitability under irrigated condition in inceptisols of Western Maharashtra.

Table 1: Growth attributes of cotton as influenced by different treatments

Treatments	2006-07 Summer				2007-08 Summer			
	Plant height at harvest (cm)	Monopodial branches at harvest	Sympodial branches at harvest	Dry matter at harvest plant^{-1} (g)	Plant height at harvest (cm)	Monopodial branches at harvest	Sympodial branches at harvest	Dry matter at harvest plant^{-1} (g)
T_1: GRDF (10 t FYM ha^{-1} + RDF)	126.33	2.94	31.84	326.34	132.33	3.32	33.98	342.10
T_2: 75 % RDF + 25 % RDN through VC	111.67	2.84	31.39	297.24	117.33	3.28	33.70	316.81
T_3: 50 % RDF + 50 % RDN through VC	103.67	2.71	31.11	282.02	107.00	2.89	33.02	297.20
T_4: 25 % RDF + 75 % RDN through VC	99.67	2.66	30.20	233.92	104.33	2.81	32.93	249.73
T_5: 100 % RDN through VC	93.33	2.61	30.03	206.01	98.33	2.61	32.86	218.03
T_6: Fertilizer dose according to STCR equation	134.33	3.06	32.40	382.72	141.33	3.68	34.32	409.00
T_7: Control	87.33	2.47	29.67	178.00	91.00	2.54	32.26	192.51
SE(m)±	**2.82**	**0.04**	**0.15**	**17.80**	**3.16**	**0.09**	**0.14**	**21.58**
CD (at 5 %)	**8.32**	**0.11**	**0.45**	**52.31**	**9.30**	**0.26**	**0.39**	**64.12**
General Mean	**108.05**	**2.76**	**30.95**	**272.32**	**113.09**	**3.02**	**33.30**	**289.34**

Table 2. Seed cotton yield, stalk yield, biological yield (kg ha^{-1}) and harvest index as influenced by different treatments

Treatments	Seed cotton yield (kg ha^{-1})		Stalk yield (kg ha^{-1})		Biological yield (kg ha^{-1})		Harvest index (%)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
T_1: GRDF (10 t FYM ha^{-1} + RDF)	2012	2267	5014	5667	7026	7934	28.64	28.57
T_2: 75 % RDF + 25 % RDN through VC	1757	1912	4401	4635	6158	6547	28.53	29.20
T_3: 50 % RDF + 50 % RDN through VC	1572	1725	3995	4323	5567	6048	28.24	28.52
T_4: 25 % RDF + 75 % RDN through VC	1307	1537	3266	3853	4573	5390	28.58	28.52
T_5: 100 % RDN through VC	1202	1383	3009	3445	4211	4828	28.54	28.65
T_6: Fertilizer dose according to STCR equation	2329	2432	5841	6078	8170	8510	28.51	28.58
T_7: Control	930	1123	2252	2739	3182	3861	29.23	29.09
SE(m)±	**102**	**93**	**256**	**231**	**359**	**325**	**-**	**-**
CD (at 5 %)	**315**	**287**	**790**	**713**	**1120**	**1013**	**-**	**-**
General mean	**1587**	**1768**	**3968**	**4391**	**5555**	**6159**	**28.61**	**28.73**

Table 3. Uniformity ratio, bundle strength, 2.5 % span length, maturity coefficient and fibre fineness of cotton as influenced by different treatments

Treatments	Uniformity ratio		Bundle strength (g tex^{-1})		2.5 % Span length (mm)		Maturity coefficient (%)		Fibre fineness (Militex)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
T_1: GRDF (10 t FYM ha^{-1} + RDF)	51.33	51.50	20.03	20.53	26.77	25.83	0.73	0.79	4.63	4.37
T_2: 75 % RDF + 25 % RDN through VC	50.67	51.00	20.80	21.27	26.77	26.37	0.71	0.79	4.43	4.17
T_3: 50 % RDF + 50 % RDN through VC	50.67	51.50	19.53	20.73	26.40	26.00	0.71	0.78	4.67	4.40
T_4: 25 % RDF + 75 % RDN through VC	51.67	49.23	20.07	21.40	26.27	26.60	0.80	0.78	4.53	4.07
T_5: 100 % RDN through VC	51.67	51.48	20.47	21.63	26.00	26.40	0.79	0.79	4.60	4.17
T_6: Fertilizer dose according to STCR equation	52.00	51.00	19.60	20.43	26.83	26.00	0.77	0.78	4.70	4.00
T_7: Control	51.67	49.00	19.33	21.33	26.20	26.60	0.77	0.77	4.70	4.30
SE(m)±	**0.46**	**0.88**	**0.40**	**0.42**	**0.27**	**0.29**	**0.04**	**0.02**	**0.11**	**0.13**
CD at 5 %	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
General mean	**51.38**	**50.67**	**19.98**	**21.05**	**26.46**	**26.26**	**0.75**	**0.78**	**4.63**	**4.37**

Table 4. Monetary returns of hybrid cotton as influenced by different treatments

Treatments	Cost of cultivation (Rs ha^{-1})		Gross monetary returns (Rs ha^{-1})		Net monetary returns (Rs ha^{-1})		Benefit: Cost ratio	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
T_1: GRDF (10 t FYM ha^{-1} + RDF)	24792	28256	48278	54691	23486	26435	1.95	1.94
T_2: 75 % RDF + 25 % RDN through VC	21473	22838	42173	46033	20700	23195	1.96	2.02
T_3: 50 % RDF + 50 % RDN through VC	26675	27713	37767	41622	11092	13909	1.42	1.50
T_4: 25 % RDF + 75 % RDN through VC	31842	32746	31367	37087	-475	4341	0.99	1.13
T_5: 100 % RDN through VC	37085	37399	28850	33357	-8235	-4042	0.78	0.89
T_6: Fertilizer dose according to STCR equation	19078	19561	55907	58671	36829	39110	2.93	3.00
T_7: Control	12977	15091	22276	27048	9299	11957	1.72	1.79
SE(m)±	**--**	**--**	**2464**	**2252**	**2464**	**2252**	**--**	**--**
CD at 5 %	**--**	**--**	**7582**	**6930**	**7582**	**6930**	**--**	**--**
General mean	**24846**	**26229**	**38088**	**39790**	**13242**	**13560**	**1.67**	**1.75**

Table 5. Uptake of nitrogen, phosphorus and potassium (kg ha^{-1}) as influenced by different treatments

Treatments	Uptake of nutrients (kg ha^{-1})					
	N		P		K	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
T_1: GRDF (10 t FYM ha^{-1} + RDF)	132.16	143.53	24.13	30.09	130.74	145.31
T_2: 75 % RDF + 25 % RDN through VC	108.80	121.53	14.98	25.09	106.39	106.27
T_3: 50 % RDF + 50 % RDN through VC	101.60	110.69	19.57	24.24	105.91	115.61
T_4: 25 % RDF + 75 % RDN through VC	94.53	103.23	21.37	22.14	111.70	129.68
T_5: 100 % RDN through VC	91.49	101.23	21.09	16.13	115.77	133.72
T_6: Fertilizer dose according to STCR equation	151.32	163.74	32.23	31.02	150.34	151.86
T_7: Control	80.20	84.21	6.00	10.09	87.29	89.28
SE(m)±	**4.93**	**6.01**	**1.43**	**1.09**	**5.77**	**4.36**
CD at 5 %	**14.32**	**17.41**	**4.17**	**3.21**	**16.74**	**12.66**
General mean	**108.59**	**118.31**	**19.91**	**22.68**	**115.45**	**124.53**

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Ảnh hưởng của quản lý dinh dưỡng tổng hợp lên sự tăng trưởng, năng suất, chất lượng, hiệu quả kinh tế và dinh dưỡng hấp thụ trên giống bông vải lai (*Gossypium hirsutum* L.)

Nghiên cứu "ảnh hưởng của quản lý dinh dưỡng tổng hợp lên sự phát triển, năng suất, chất lượng, hiệu quả kinh tế và dinh dưỡng hấp thụ trên giống bông vải lai Phule-492" tại trường Đại học nông nghiệp Mahatma Phule (MPKV), Rahuri, Ahmednagar, Maharashtra, Ấn Độ. Kết quả nghiên cứu trong suốt hai năm cho thấy nghiệm thức bón phân theo việc kiểm tra đất để đáp ứng dinh dưỡng cho cây bông vải đã ghi nhận về chiều cao cây, số nhánh chính, nhánh phụ, trọng lượng khô trên cây, năng suất hạt, năng suất bông, hiệu quả kinh tế và dinh dưỡng hấp thu đạt cao nhất và khác biệt có ý nghĩa thống kê so với các nghiệm thức khác. Áp dụng các mức độ phân khác nhau đã không có sự khác biệt về các chi tiêu theo dõi như sợi bộng, tỷ lệ đồng đều, chiều dài, độ dài của giãn ngang 2.5%, hệ số chín và độ đẹp của sợi bông. Các giá trị được ghi nhận khác biệt thấp nhất ở nghiệm thức đối chứng (T_7) về năng suất hạt, năng suất bông, hiệu quả kinh tế và dinh dưỡng hấp thu.