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# STUDIES ON ORGANIC AND INORGANIC SOURCES OF NUTRIENT APPLICATION IN COTTON-CHICKPEA CROPPING SEQUENCE

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## ABSTRACT

*The field experiment was conducted during 2006-07 and 2007-08 at the research farm of Department of Agronomy, MPKV, Rahuri, Dist. Ahmednagar (MS) to find the effect of different organic and inorganic sources alone or in combination with each other on growth attributes, yield attributes, yield, economics and nutrient uptake of hybrid cotton-chickpea cropping sequence under Western Maharashtra condition. The experiment was laid out in split plot design with three replications. The main plot comprised of 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 were applied to hybrid cotton cv. Phule-492 during summer season and the sub plot treatments comprising of $S_1$: Control, $S_2$: 50 % RDF, $S_3$: 75% RDF and $S_4$: 100% RDF. Chickpea cv. Digvijay was used to the experiment in rabi season. The application of fertilizer dose according to soil test crop response (STCR) equation to cotton recorded significantly higher values for different growth attributes, yield attributes, seed cotton yield, stalk yield, monetary returns and nutrient uptake. The residual effect of GRDF (10 t FYM ha$^{-1}$ + RDF) applied to summer cotton was found at par with 100 % RDN application through vermicompost and 25 % RDF + 75 % RDN through vermicompost and recorded significantly higher values of chickpea in respect of different growth attributes, yield attributes, grain yield and straw yield. Residual effect of GRDF (10 t FYM ha$^{-1}$ + RDF) on chickpea recorded significantly higher economic returns and nutrient uptake followed by 100 % RDN through vermicompost. Chickpea with the application of 100 % RDF was found at par with 75 % RDF and produced significantly higher values for growth attributes, yield attributes, grain yield, straw yield, economic returns and NPK uptake.*

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

## INTRODUCTION

Cotton-chickpea cropping sequence is widely grown under diverse agro-climatic conditions. In India, the 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$^{-1}$ (Anonymous 2008a). Chickpea is the premier pulse crop of India containing 22 % protein. It is the 19$^{th}$ most important crop grown in the world. About 70 per cent of world production of chickpea is from Asia. Among pulses, chickpea occupy 33 % of area and 46 % of production in India. Presently, India is having 9.4 mt of *rabi* pulses production. The area in Maharashtra is 13080 ha with the production of 924000 tonnes (Anonymous 2008b).

Sustainability in crop yield and soil health could be achieved by the application of mineral fertilizer along with organic manures. Nutrient management

has been key input in intensive cropping. Inadequate and imbalanced use of plant nutrients is one of the major constraints for low productivity of crops. The beneficial effect of farmyard manure, vermicompost, in improving the soil fertility and productivity is well documented (Baran *et al*. 1998). Hence, an experiment was conducted to assess the effect of different organic and inorganic sources of nutrient application alone or in combination with each other on growth attributes, yield attributes, yield, economics and nutrient uptake of cotton-chickpea cropping sequence under irrigated condition in Western Maharashtra condition.

## MATERIALS AND METHODS

The field experiment was conducted during 2006-07 and 2007-08 at the research farm of Department of Agronomy, MPKV, Rahuri, Dist. Ahmednagar (MS) to find the effect of different organic and inorganic sources alone or in combination with each other on growth attributes, yield attributes, yield, economics and nutrient uptake of hybrid cotton-chickpea cropping sequence under Western Maharashtra condition. 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 (8.01 pH).

The experiment was laid out in split plot design with three replications. The main plot comprised of 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 were applied to hybrid cotton *cv*. Phule-492 during summer season and the sub plot treatments comprising of $S_1$: Control, $S_2$: 50 % RDF, $S_3$: 75% RDF and $S_4$: 100% RDF. Chickpea *cv*. Digvijay was used in the experiment in *rabi* season. The * indicate that from $T_2$ to $T_6$ all the fertilizers 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 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 spacing for cotton was 90 cm x 90 cm and that of chickpea crop was 45 cm x 10 cm. The total inorganic fertilizer application to chickpea was done at the time of sowing. 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$^{-1}$ as compared with rest of the treatments of INM treatments to summer cotton. Nehra *et al.* (2004) reported the similar findings such that nitrogen is well recognized as a promoter of vegetative growth. 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.

Residual effect of GRDF (10 t FYM ha$^{-1}$ + RDF) applied to summer cotton was found at par with 100 % RDN application through vermicompost and 25 % RDF + 75 % RDN through vermicompost and recorded significantly higher values in respect of plant height, plant spread, total dry matter plant$^{-1}$ of chickpea. This might be due to residual effect of organic manures applied to preceding crop as it provided major as well as micronutrient for longer period. These results are in conformity with those reported by Channabasavanna *et al.* (2008). Chickpea with the application of 100 % RDF was found at par with 75 % RDF. It produced significantly higher values for growth attributes as compared to its lower level and control. The results are in conformity with those reported by Patel *et al*. (2007).

**Yield attributes:** The residual effect of application of GRDF (10 t FYM ha$^{-1}$ + RDF) to cotton in summer season was found to be at par with 100 % RDN through vermicompost and recorded significantly higher values for the yield attributes *viz*. number of pods, pod weight, number of grains, seed yield plant$^{-1}$ and 100 seed weight. The addition of organic manures to preceding crop showed the positive impact on all the yield contributing characters of chickpea. This delayed impact can be attributed to the built up of residual soil fertility after addition of organic manures for continuous two seasons. The results are in agreement with those reported by Gawai and Pawar (2005). Application of 100 per cent RDF was at par with 75 per cent RDF and recorded significantly higher values for the yield attributes as compared to rest of the inorganic treatments and control.

**Yield:** Cotton crop produced maximum seed cotton yield and stalk yield with the application of fertilizer dose according to STCR equation followed by application of gross recommended dose of fertilizer (GRDF). Kaur *et al*. (2007) also opined the similar results for increased seed cotton yield under INMS.

Application of GRDF showed superiority in grain and bhusa yield of chickpea followed by 100 per cent RDN through vermicompost. The increased grain and bhusa yield might be attributed due to application of INMS to preceding crop summer cotton, resulted in better root nodulation and nitrogen fixation. Utilization of inexhaustible atmospheric nitrogen through biological nitrogen fixation might have helped in maintaining soil productivity. These results are in conformation with those reported by Gawai and Pawar (2005). Application of 100 per cent RDF to chickpea recorded significantly higher grain and bhusa yield as compared with its lower levels and control. However, the yield obtained with that of 75 per cent RDF was at par with 100 per cent RDF.

**Economics:** The economic analysis of cotton under INMS 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. The benefit: cost ratio was found maximum with the application of fertilizer dose according to STCR equation followed by 75 % RDF + 25 % RDN through vermicompost and GRDF. 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. Khandare et al. (2002) reported similar results.

Residual effect of GRDF (10 t FYM ha$^{-1}$ + RDF) on chickpea applied to summer cotton was at par with the application 100 % RDN through vermicompost and showed the highest gross and net monetary returns after built up of residual fertility compared to rest of the INMS treatments and control. This has clearly brought out that application of organic manures along with sub optimal levels of recommended dose to preceding crop summer cotton has an added advantage to enhance the returns of chickpea. Similar results were reported by Gupta (2004). Numerically higher B:C ratio of chickpea was recorded due to

residual effect of application of GRDF (10 t FYM $ha^{-1}$ + RDF) to summer cotton.

Application of 100 % RDF to chickpea recorded the highest gross monetary returns and net monetary returns and numerically higher B:C ratio. This was due to the increased grain and straw yield of chickpea with increased levels of fertilizer application. The statistical parity of net monetary returns among 100 per cent RDF and 75 per cent RDF again confirmed the saving of fertilizers to the extent of 25 per cent. The results are in conformity to those reported by Gawai and Pawar (2005).

**Nutrient uptake:** The total NPK uptake by cotton was highest due to application of fertilizer dose according to STCR equation followed by GRDF. 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 NPK uptake compared to rest of the INMS treatments. Beneficial effects of combined application of organic manures with inorganic fertilizers to cotton in respect of nutrient uptake are supported by observations of Badole and More (2001) and Dhawan *et al*. (2005).

The nutrient of chickpea was significantly higher due to residual effect of application of GRDF followed by 100 % RDN through vermicompost and 25 % RDF + 75 % RDN through vermicompost compared to rest of the INMS treatments and control. This might be due to the application of slow nutrient releasing organic manures with lapse of time in mineralization process, restrict the losses of nutrients either through leaching or volatilization might have resulted in higher nutrient uptake. The NPK uptake due to only inorganic fertilizers *i.e.* RDF according to STCR equation recorded lower values of nutrient uptake in chickpea, proved the superiority of application of inorganic fertilizers in conjunction with organic manures like vermicompost. Similar results were reported by Karande *et al*. (2007). The graded levels of fertilizer application to chickpea increased the NPK uptake significantly with the application of increased levels of fertilizers. This was higher than those of 75 %, 50 % levels of inorganic fertilizer and control. The adequate supply of major plant nutrients under 100 % RDF might have supplemented by the beneficial residual effects of INMS treatments resulting in higher uptake of nutrients due to increased nutrient use efficiency of fertilizers applied to summer cotton. The results are in agreement with those reported Patel *et al*. (2007).

It is concluded from the data interpreted herein that GRDF (10 t FYM $ha^{-1}$ + RDF) treatment applied to summer cotton followed by 100 % RDN through and 75 % RDF application to chickpea is better preposition for achieving higher productivity and profitability of cotton-chickpea cropping sequence under irrigated condition in inceptisols of Western Maharashtra.

**Table 1.** Growth attributes and yield of cotton as influenced by different treatments

| Treatments | Growth attributes | | | Yield attributes | | | | Yield | |
|---|---|---|---|---|---|---|---|---|---|
| | Plant height at harvest (cm) | Monopodial branches at harvest | Sympodial branches at harvest | Dry matter at harvest $plant^{-1}$ (g) | Total picked bolls $plant^{-1}$ | Hundred seed weight (g) | Total seed cotton weight $plant^{-1}$ (g) | Seed cotton yield (kg $ha^{-1}$) | Stalk yield (kg $ha^{-1}$) |
| **$T_1$:** GRDF (10 t FYM $ha^{-1}$ + RDF) | 129.33 | 3.13 | 32.91 | 334.22 | 47.26 | 8.28 | 176.31 | 2140 | 5341 |
| **$T_2$:** 75 % RDF + 25 % RDN through VC | 114.50 | 3.06 | 32.55 | 307.03 | 41.35 | 8.19 | 152.60 | 1835 | 4518 |
| **$T_3$:** 50 % RDF + 50 % RDN through VC | 105.34 | 2.80 | 32.07 | 289.61 | 37.55 | 8.02 | 136.53 | 1649 | 4159 |
| **$T_4$:** 25 % RDF + 75 % RDN through VC | 102.00 | 2.74 | 31.57 | 241.83 | 33.21 | 7.53 | 118.69 | 1422 | 3560 |

| Treatments | Growth attributes | | | Yield attributes | | | | Yield | |
|---|---|---|---|---|---|---|---|---|---|
| | Plant height at harvest (cm) | Monopodial branches at harvest | Sympodial branches at harvest | Dry matter at harvest plant$^{-1}$ (g) | Total picked bolls plant$^{-1}$ | Hundred seed weight (g) | Total seed cotton weight plant$^{-1}$ (g) | Seed cotton yield (kg ha$^{-1}$) | Stalk yield (kg ha$^{-1}$) |
| **$T_5$:** 100 % RDN through VC | 95.83 | 2.61 | 31.45 | 212.02 | 30.32 | 7.43 | 104.69 | 1293 | 3227 |
| **$T_6$:** Fertilizer dose according to STCR equation | 137.83 | 3.37 | 33.36 | 395.86 | 49.82 | 8.42 | 195.23 | 2381 | 5960 |
| **$T_7$:** Control | 89.17 | 2.51 | 30.97 | 185.26 | 21.77 | 7.49 | 87.65 | 1027 | 2496 |
| **SE(m)±** | **2.99** | **0.07** | **0.15** | **19.69** | **1.28** | **0.06** | **5.41** | **98** | **244** |
| **CD at 5 %** | **8.81** | **0.19** | **0.42** | **58.22** | **3.72** | **0.17** | **15.93** | **301** | **752** |
| **General Mean** | **110.57** | **2.89** | **32.13** | **280.83** | **37.32** | **7.91** | **138.81** | **1678** | **4180** |

**Table 2.** Monetary returns and Uptake of nitrogen, phosphorus and potassium of cotton as influenced by different treatments

| **Treatments** | Monetary returns (Rs ha$^{-1}$) | | | | Uptake of nutrients (kg ha$^{-1}$) | | |
|---|---|---|---|---|---|---|---|
| | Cost of cultivation | Gross monetary returns | Net monetary returns | Benefit: Cost ratio | N | P | K |
| **$T_1$:** GRDF (10 t FYM ha$^{-1}$ + RDF) | 26524 | 51485 | 24961 | 1.95 | 137.85 | 27.11 | 138.03 |
| **$T_2$:** 75 % RDF + 25 % RDN through VC | 22156 | 44103 | 21948 | 1.99 | 115.17 | 20.04 | 106.33 |
| **$T_3$:** 50 % RDF + 50 % RDN through VC | 27194 | 39695 | 12501 | 1.46 | 106.15 | 21.91 | 110.76 |
| **$T_4$:** 25 % RDF + 75 % RDN through VC | 32294 | 34227 | 1933 | 1.06 | 98.88 | 21.76 | 120.69 |
| **$T_5$:** 100 % RDN through VC | 37242 | 31104 | -6139 | 0.84 | 96.36 | 18.61 | 124.75 |
| **$T_6$:** Fertilizer dose according to STCR equation | 19320 | 57289 | 37970 | 2.97 | 157.53 | 31.63 | 151.10 |
| **$T_7$:** Control | 14034 | 24662 | 10628 | 1.76 | 82.21 | 8.05 | 88.29 |
| **SE(m)±** | **--** | **2358** | **2358** | **--** | **5.47** | **1.26** | **5.07** |
| **CD at 5 %** | **--** | **7256** | **7256** | **--** | **15.87** | **3.69** | **14.70** |
| **General Mean** | **25538** | **38939** | **13401** | **1.71** | **113.45** | **21.30** | **119.99** |

**Table 1.** Growth attributes of chickpea as influenced by different treatments in cotton-chickpea sequence

| Treatments | Growth attributes | | | Yield attributes | | | | |
|---|---|---|---|---|---|---|---|---|
| | Plant height (cm) | Plant spread (cm) | Dry matter plant$^{-1}$ (g) | Number of pods plant$^{-1}$ | Pod weight (g) plant$^{-1}$ | Number of grains plant$^{-1}$ | Grain weight (g) plant$^{-1}$ | 100 grain weight (g) plant$^{-1}$ |
| **Main plot treatments** | | | | | | | | |
| $T_1$: GRDF (10 t FYM ha$^{-1}$ + RDF) | 49.96 | 43.03 | 60.51 | 67.42 | 18.32 | 59.30 | 13.69 | 22.19 |
| $T_2$: 75 % RDF + 25 % RDN through VC | 43.87 | 36.15 | 39.82 | 52.34 | 13.55 | 46.56 | 10.37 | 21.00 |
| $T_3$: 50 % RDF + 50 % RDN through VC | 46.87 | 40.17 | 48.17 | 58.62 | 15.54 | 52.83 | 12.00 | 21.63 |
| $T_4$: 25 % RDF + 75 % RDN through VC | 47.59 | 40.13 | 54.78 | 63.19 | 16.57 | 55.66 | 12.49 | 21.74 |
| $T_5$: 100 % RDN through VC | 48.29 | 41.88 | 60.46 | 64.63 | 17.11 | 58.68 | 13.43 | 21.87 |
| $T_6$: Fertilizer dose according to STCR equation | 45.17 | 36.45 | 40.95 | 59.29 | 15.10 | 53.06 | 11.99 | 21.50 |
| $T_7$: Control | 41.68 | 35.46 | 39.56 | 43.10 | 12.97 | 37.32 | 8.28 | 20.55 |
| SEm± | 0.68 | 0.50 | 0.61 | 1.64 | 0.38 | 1.21 | 0.14 | 0.15 |
| CD at 5 % | 1.93 | 1.48 | 1.81 | 4.77 | 1.13 | 3.52 | 0.39 | 0.43 |
| **Sub plot treatments** | | | | | | | | |
| $S_1$: Control | 41.41 | 35.12 | 44.13 | 45.74 | 12.42 | 39.55 | 10.77 | 21.03 |
| $S_2$: 50 % RDF | 46.20 | 39.04 | 49.23 | 58.06 | 15.17 | 51.37 | 11.07 | 21.29 |
| $S_3$: 75 % RDF | 48.26 | 40.68 | 51.26 | 63.80 | 16.83 | 57.46 | 12.31 | 21.72 |
| $S_4$: 100 % RDF | 48.95 | 41.30 | 52.10 | 65.90 | 17.97 | 59.26 | 12.83 | 21.94 |
| **SEm±** | **0.28** | **0.22** | **0.28** | **1.21** | **0.39** | **0.97** | **0.25** | **0.09** |
| **CD at 5 %** | **0.83** | **0.67** | **0.84** | **3.56** | **1.13** | **2.82** | **0.75** | **14.11** |
| **Interaction (M x S)** | | | | | | | | |
| **SEm±** | **0.83** | **0.67** | **0.81** | **2.61** | **0.64** | **2.47** | **0.30** | **0.85** |
| **CD at 5 %** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** |
| **General mean** | **46.20** | **39.04** | **49.18** | **58.37** | **15.60** | **51.91** | **11.75** | **21.50** |

**Table 2.** Yield, monetary returns and nutrient uptake of chickpea as influenced by different treatments in cotton-chickpea sequence

| Treatments | Yield | | Monetary returns | | | | Nutrient uptake | | |
|---|---|---|---|---|---|---|---|---|---|
| | Seed yield (kg/ha) | Straw yield (kg/ha) | Cost of cultivation (Rs/ha) | Gross monetary returns (Rs/ha) | Net monetary returns (Rs/ha) | Benefit: Cost ratio | N (Kg/ha) | P (Kg/ha) | K (Kg/ha) |
| **Main plot treatments** | | | | | | | | | |
| $T_1$: GRDF (10 t FYM $ha^{-1}$ + RDF) | 2441 | 2888 | 12081 | 44990 | 32909 | 3.72 | 126.79 | 24.47 | 58.58 |
| $T_2$: 75 % RDF + 25 % RDN through VC | 1816 | 2157 | 12081 | 33511 | 21430 | 2.76 | 97.04 | 16.83 | 44.62 |
| $T_3$: 50 % RDF + 50 % RDN through VC | 2124 | 2459 | 12081 | 39013 | 26932 | 3.22 | 100.75 | 16.60 | 50.05 |
| $T_4$: 25 % RDF + 75 % RDN through VC | 2210 | 2482 | 12081 | 40687 | 28606 | 3.36 | 106.81 | 14.17 | 50.69 |
| $T_5$: 100 % RDN through VC | 2393 | 2629 | 12081 | 44108 | 32028 | 3.64 | 117.71 | 20.80 | 53.90 |
| $T_6$: Fertilizer dose according to STCR equation | 2121 | 2449 | 12081 | 39072 | 26991 | 3.23 | 84.33 | 17.68 | 38.28 |
| $T_7$: Control | 1423 | 1619 | 12081 | 26260 | 14179 | 2.16 | 61.92 | 12.34 | 37.88 |
| **SEm±** | **57** | **67** | **--** | **1058** | **1056** | **--** | **2.81** | **1.10** | **1.47** |
| **CD at 5 %** | **158** | **187** | **--** | **2924** | **2924** | **--** | **8.16** | **3.20** | **4.30** |
| **Sub plot treatments** | | | | | | | | | |
| $S_1$: Control | 1537 | 1813 | 11429 | 28323 | 16894 | 2.46 | 86.78 | 15.49 | 42.84 |
| $S_2$: 50 % RDF | 2029 | 2364 | 12010 | 37399 | 25390 | 3.11 | 99.26 | 17.56 | 47.77 |
| $S_3$: 75 % RDF | 2319 | 2667 | 12296 | 42711 | 30415 | 3.47 | 104.80 | 18.43 | 49.75 |
| $S_4$: 100 % RDF | 2416 | 2775 | 12589 | 44505 | 31916 | 3.53 | 106.51 | 18.75 | 50.49 |
| **SEm±** | **55** | **79** | **--** | **1095** | **1095** | **--** | **1.23** | **0.14** | **0.81** |
| **CD at 5 %** | **145** | **208** | **--** | **3031** | **3031** | **--** | **3.60** | **0.42** | **2.34** |
| **Interaction (M x S)** | | | | | | | | | |
| SEm± | 158 | 182 | -- | 2898 | 2898 | -- | 2.89 | 1.07 | 2.74 |
| CD at 5 % | NS | NS | -- | NS | NS | -- | NS | NS | NS |
| **General mean** | **2075** | **2404** | **12081** | **38234** | **26154** | **3.15** | **99.34** | **18.20** | **47.71** |

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**Nghiên cứu áp dụng dinh dưỡng từ nguồn vô cơ và hữu cơ trên hệ thống luân canh bông vải – đậu (chickpea)**

Thí nghiệm trên đồng ruộng trong suốt thời gian 2006-2007 và 2007-2008 ở nông trại của bộ môn Trồng trọt, MPKV, Rahuri, Amednagar, MS, Ấn Độ cho việc tìm ảnh hưởng khác nhau của phân hóa học, phân hữu cơ và sự kết hợp giữa phân hóa học và phân hữu cơ trên sự tăng trưởng, thành phần năng suất, năng suất, hiệu quả kinh tế và dinh dưỡng hấp thu của hệ thống luân canh bông vải – cây đậu chikpea dưới điều kiện của miền Tây của bang Maharashtra. 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 thấy chiều cao cây, số nhánh chính, nhánh phụ, trọng lượng khô/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. Ảnh hưởng của việc lưu tồn phân nghiệm thức áp dụng 10 t FYM $ha^{-1}$ + 100% theo khuyến cáo sử dụng cho bông vải trong vụ Hè đã tìm thấy tương đương với việc áp dụng 100 % N nhờ vào vermicompost ($T_5$) và 25 % NPK theo khuyến cáo + 75 % N nhờ vào vermicompost ($T_4$) và đã ghi nhận có sự khác biệt ý nghĩa cao hơn về các thành sinh trưởng, thành phần năng suất, năng suất hạt và năng suất cây của đậu (Chickpea). Kết quả cũng cho thấy có ảnh hưởng của sự lưu tồn của 10 t FYM $ha^{-1}$ + 100% NPK ($T_1$) trên đậu chickpea cho hiệu quả kinh tế và dinh dưỡng hấp thu cao, tiếp theo là nghiệm thức 100% N nhờ vào vermicompost. Trên đậu chickpea đã cho thấy khi áp dụng 100% NPK theo khuyến cáo ($S_4$) và 75% NPK ($S_3$) đã có sự khác biệt cao hơn về các thành phần tăng trưởng, các thành phần năng suất, năng suất hạt, năng suất cây, hiệu quả kinh tế và NPK hấp thu so với các nghiệm thức khác.