Journal of Agricultural Technology 2011 Vol. 7(3): 599-604
Available online http://www.ijat-aatsea.com
ISSN 1686-9141

# Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on growth and yield of greengram in rice based cropping sequence

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Anu Lavanya, G. and Ganapathy, M. (2011). Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on growth and yield of greengram in rice based cropping sequence. Journal of Agricultural Technology 7(3): 599-604.

The present investigation was made to study the effect of DAP and NAA spray along with bio-fertilizers for black gram, rice fallow crop in the deltaic region. The results revealed that applications 2 per cent DAP + Rhizobium + Phosphobacteria + residual effect of inorganic fertilizers and organic manures ($M_2S_2$) recorded the highest value of growth and yield attributes and yield of greengram. The maximum yields were recorded as 1082 kg $ha^{-1}$ and 1119 kg $ha^{-1}$ respectively in two seasons ($M_2S_2$) when compared to other treatments.

**Key words:** Bio-fertilizers, rice fallow greengram

## Introduction

Pulses are the main source of protein in Indian diet, where majority of the population comes under vegetarian category. On an average, pulses contain 20 – 25 per cent protein which is almost 2.5 – 3.0 times of the value normally found in cereals. Pulses are cheaper than meat; they are often referred to as "poor man's meat" in developing countries like India. The pulse crop residues are nutritious feed for livestock. Contribution of pulses to Indian agriculture and daily life has been tremendous besides being one of the important constitutes of our diet. The per capita consumption of pulses in India is decreasing from 69 g in the year 1960-61 to 40 g in 1997-98 as against 80 g recommended by WHO and FAO. In recent years, there has been understandable concern about decline in the per capita availability of pulses. A possible breakthrough in the production of pulses in India could be achieved in two ways (i) increasing area under pulses, (ii) raising the productivity of pulses per unit area of land.

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## Meterials and methods

Field experiment was conducted during January 2009 and January 2010 at the Experimental Farm, Department of Agronomy, Annamalai University to study the effect of DAP and NAA spray along with residual effect of inorganic fertilizers and organic manures of greengram in rice – greengram cropping sequence in the Cauvery deltaic region. The experiment was conducted in split plot design replicated thrice with treatments as main plots viz., control ($M_1$), 2 per cent DAP ($M_2$), 40 ppm NAA ($M_3$) and bio-fertilizer treatment as sub plot viz., $S_1$– Rhizobium + Phosphobacteria, $S_2$– Rhizobium + Phosphobacteria, $S_3$– Rhizobium + Phosphobacteria, $S_4$– Rhizobium + Phosphobacteria, $S_5$– Rhizobium + Phosphobacteria, $S_6$– Rhizobium + Phosphobacteria. The experimental soil was clayey loam in texture with low, medium and high in available nitrogen, available phosphorus and available potassium respectively. ADT-3 was chosen for the respective season's viz., January 2009 and January 2010. The greengram seeds were dibbled in rice stubbles at 15 kg $ha^{-1}$ immediately after the harvest of rice when the soil was in waxy soil condition. A spacing of 30cm x 10cm was adopted. It was raised with residual soil moisture. Standard cultivation practices were adopted.

## Results and discussion

Foliar fertilization had a significant effect on the growth and yield attributes of greengram. Applications of 2 percent DAP along with bio-fertilizers (Rhizobium + Phosphobacteria) + residual effect of inorganic fertilizers and organic manures was observed significantly increased the growth and yield attributes (Table 1, 2, 3 and 4). This might be attributed to the fact that foliar application twice met out N and P deficiencies at the critical time of flowering. Further, nutrients applied foliage would be easily available and translocated in the plants without any loss (Srinivasan and Ramasamy 1992). In addition to this, spraying of DAP and NAA increased the yield components due to the supply of foliage applied phosphorus and nitrogen at critical stages of the crop, leading to better photosynthetic activity resulting in better development of yield components. Combined inoculation of bio-fertilizers and DAP increased the growth and yield attributes due to increased availability of N and P in the root zone by fixing more atmospheric nitrogen by Rhizobium and solubilization of unavailable phosphates in the soil (Ghosh and Joseph 2008). The present results are in accordance with the findings of Parasuraman (2001) and (Satyajit *et al.,* 2003).

**Table 1.** Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on DMP at harvest (Kg $ha^{-1}$) of green gram.

| | **January 2009** | | | | **January 2010** | | | |
|---|---|---|---|---|---|---|---|---|
| Sub treatment | **Main Treatment** | | | | **Main Treatment** | | | |
| | $M_1$ | $M_2$ | $M_3$ | Mean | $M_1$ | $M_2$ | $M_3$ | Mean |
| $S_1$ | 2019 | 3452 | 3307 | 2926.00 | 2280 | 3785 | 3633 | 3232.67 |
| $S_2$ | 2306 | 4024 | 3882 | 3404.00 | 2582 | 4407 | 4250 | 3746.33 |
| $S_3$ | 2164 | 3737 | 3595 | 3165.33 | 2429 | 4092 | 3938 | 3486.33 |
| $S_4$ | 1731 | 2879 | 2734 | 2448.00 | 1979 | 3189 | 3041 | 2736.33 |
| $S_5$ | 1873 | 3165 | 3023 | 2687.00 | 2128 | 3486 | 3338 | 2984.00 |
| $S_6$ | 1592 | 2591 | 2449 | 2210.67 | 1831 | 2892 | 2736 | 2486.33 |
| Mean | 1947.50 | 3308.00 | 3165.00 | | 2204.83 | 3641.83 | 3489.33 | |
| | **MAIN** | **SUB** | **MxS** | **SxM** | **MAIN** | **SUB** | **MxS** | **SxM** |
| SED | 22.59 | 33.51 | 58.60 | 57.04 | 27.46 | 38.01 | 66.08 | 65.84 |
| CD(p=0.05) | 62.73 | 68.44 | 124.15 | 118.54 | 76.24 | 77.64 | 143.34 | 134.47 |

$M_1$=Control, $M_2$= 2% DAP spray, $M_3$=40 ppm NAA, $S_1$ to $S_6$ =Residual organic manure + Rhizobium + Phosphobacteria.

**Table 2.** Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on number of pods $plant^{-1}$ of green gram.

| | **January 2009** | | | | **January 2010** | | | |
|---|---|---|---|---|---|---|---|---|
| Sub treatment | **Main Treatment** | | | | **Main Treatment** | | | |
| | $M_1$ | $M_2$ | $M_3$ | Mean | $M_1$ | $M_2$ | $M_3$ | Mean |
| $S_1$ | 13.67 | 18.69 | 18.21 | 16.86 | 14.62 | 20.90 | 20.28 | 18.60 |
| $S_2$ | 14.67 | 20.63 | 20.14 | 18.48 | 15.88 | 23.40 | 22.76 | 20.68 |
| $S_3$ | 14.18 | 19.66 | 19.18 | 17.67 | 15.24 | 22.13 | 21.51 | 19.63 |
| $S_4$ | 12.69 | 16.65 | 16.16 | 15.17 | 13.40 | 18.39 | 17.75 | 16.51 |
| $S_5$ | 13.18 | 17.72 | 17.18 | 16.03 | 14.03 | 19.64 | 19.02 | 17.56 |
| $S_6$ | 12.18 | 15.67 | 15.15 | 14.33 | 12.78 | 17.12 | 16.50 | 15.47 |
| Mean | 13.43 | 18.17 | 17.67 | | 14.33 | 20.26 | 19.64 | |
| | **MAIN** | **SUB** | **MxS** | **SxM** | **MAIN** | **SUB** | **MxS** | **SxM** |
| SED | 0.08 | 0.11 | 0.20 | 0.19 | 0.11 | 0.14 | 0.26 | 0.25 |
| CD(p=0.05) | 0.21 | 0.22 | 0.42 | 0.39 | 0.30 | 0.29 | 0.55 | 0.51 |

$M_1$ = Control, $M_2$ = 2% DAP spray, $M_3$= 40 ppm NAA, $S_1$ to $S_6$ = Residual organic manure + Rhizobium + Phosphobacteria.

**Table 3.** Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on number of seeds pod$^{-1}$ of green gram.

| Sub treatment | January 2009 | | | | January 2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | Main Treatment | | | | Main Treatment | | | |
| | $M_1$ | $M_2$ | $M_3$ | Mean | $M_1$ | $M_2$ | $M_3$ | Mean |
| $S_1$ | 5.51 | 6.19 | 6.13 | 5.94 | 6.28 | 7.40 | 7.29 | 6.99 |
| $S_2$ | 5.62 | 6.47 | 6.38 | 6.15 | 6.53 | 7.91 | 7.79 | 7.41 |
| $S_3$ | 5.56 | 6.30 | 6.24 | 6.03 | 6.41 | 7.67 | 7.53 | 7.20 |
| $S_4$ | 5.38 | 5.92 | 5.84 | 5.71 | 6.04 | 7.00 | 6.91 | 6.65 |
| $S_5$ | 5.45 | 6.07 | 6.01 | 5.84 | 6.16 | 7.20 | 7.09 | 6.82 |
| $S_6$ | 5.32 | 5.77 | 5.69 | 5.59 | 5.95 | 6.78 | 6.66 | 6.46 |
| Mean | 5.47 | 6.12 | 5.55 | | 6.23 | 7.33 | 7.21 | |
| | **MAIN** | **SUB** | **MxS** | **SxM** | **MAIN** | **SUB** | **MxS** | **SxM** |
| SED | 0.02 | 0.01 | 0.03 | 0.02 | 0.02 | 0.01 | 0.04 | 0.03 |
| CD(p=0.05) | 0.03 | 0.02 | 0.05 | 0.04 | 0.05 | 0.04 | 0.09 | 0.08 |

$M_1$=Control, $M_2$= 2% DAP spray, $M_3$=40 ppm NAA, $S_1$ to $S_6$ =Residual organic manure + Rhizobium + Phosphobacteria.

**Table 4.** Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on hundred Seed weight (gm) of greengram.

| | January 2009 | | | | January 2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | Main Treatment | | | | Main Treatment | | | |
| **Sub treatment** | **$M_1$** | **$M_2$** | **$M_3$** | **Mean** | **$M_1$** | **$M_2$** | **$M_3$** | **Mean** |
| $S_1$ | 3.22 | 3.52 | 3.49 | 3.41 | 3.28 | 3.64 | 3.61 | 3.51 |
| $S_2$ | 3.29 | 3.67 | 3.63 | 3.53 | 3.33 | 3.83 | 3.78 | 3.65 |
| $S_3$ | 3.25 | 3.59 | 3.56 | 3.47 | 3.31 | 3.73 | 3.68 | 3.57 |
| $S_4$ | 3.19 | 3.40 | 3.39 | 3.33 | 3.25 | 3.49 | 3.45 | 3.40 |
| $S_5$ | 3.21 | 3.46 | 3.43 | 3.37 | 3.26 | 3.58 | 3.53 | 3.46 |
| $S_6$ | 3.18 | 3.36 | 3.32 | 3.29 | 3.21 | 3.42 | 3.37 | 3.33 |
| Mean | 3.22 | 3.50 | 3.47 | | 3.27 | 3.62 | 3.57 | |
| | **MAIN** | **SUB** | **MxS** | **SxM** | **MAIN** | **SUB** | **MxS** | **SxM** |
| SED | NS | NS | NS | NS | NS | NS | NS | NS |
| CD(p=0.05) | NS | NS | NS | NS | NS | NS | NS | NS |

$M_1$=Control, $M_2$= 2% DAP spray, $M_3$=40 ppm NAA, $S_1$ to $S_6$ =Residual organic manure + Rhizobium + Phosphobacteria.

The maximum seed yield was recorded with 2 per cent DAP + Bio-fertilizers + residual effect of inorganic fertilizers and organic manures. It showed that N and P through foliar application at critical stages of crop growth are effectively absorbed by black gram and translocated more efficiently to the developing pods for proper filling of grains. The Rhizobium inoculation formed good nodulation

and increased black gram showing effective symbiosis which might have left appreciable amount of N to increased more yield. The highest grain yield (Table 5) was recorded in foliar application of DAP, enhanced the yield components by ensuring prompt delivery of mineral nutrients to the site of photosynthesis. Phosphobacteria application made the insoluble phosphates present in the soil into soluble forms by secreting organic acids resulting in effective solubilization and utilization of phosphorus. These findings are in agreement with Subramani and Solaimalai (2000), (Ramanathan *et al.,* 2004) and Sirinivasa Perumal and Sundari (2004).

**Table 5.** Effect of DAP, NAA and residual effect of inorganic fertilizers and organic manures on seed yield (Kg $ha^{-1}$) of greengram.

| | **January 2009** | | | | **January 2010** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Main Treatment** | | | | **Main Treatment** | | | |
| **Sub treatment** | **$M_1$** | **$M_2$** | **$M_3$** | **Mean** | **$M_1$** | **$M_2$** | **$M_3$** | **Mean** |
| $S_1$ | 547 | 947 | 915 | 803.00 | 606 | 971 | 935 | 837.33 |
| $S_2$ | 621 | 1082 | 1050 | 917.67 | 682 | 1119 | 1080 | 960.33 |
| $S_3$ | 582 | 1015 | 979 | 858.67 | 644 | 1044 | 1006 | 898.00 |
| $S_4$ | 480 | 787 | 745 | 670.67 | 533 | 826 | 791 | 716.67 |
| $S_5$ | 514 | 872 | 830 | 738.67 | 569 | 900 | 864 | 777.67 |
| $S_6$ | 446 | 702 | 663 | 603.67 | 497 | 753 | 717 | 655.67 |
| Mean | 531.67 | 900.83 | 863.67 | | 588.50 | 935.50 | 898.83 | |
| | MAIN | SUB | MxS | SxM | MAIN | SUB | MxS | SxM |
| SED | 6.48 | 7.81 | 13.96 | 13.54 | 6.23 | 8.76 | 15.18 | 15.17 |
| CD(p=0.05) | 18.01 | 15.96 | 30.72 | 27.65 | 17.29 | 17.89 | 32.89 | 30.99 |

$M_1$=Control, $M_2$= 2% DAP spray, $M_3$=40 ppm NAA, $S_1$ to $S_6$ =Residual organic manure + Rhizobium + Phosphobacteria.

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(Recieved 29 October 2010; accepted 26 March 2011)