



AGRICULTURE

# THE EFFECT OF NPK FERTILIZER AND AM FUNGI ON THE GROWTH AND YIELD OF COTTON (*GOSSYPIMUM HIRSUTUM* L.) VAR. LRA 5166

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## Abstract

An experiment was conducted to find out the effect of NPK fertilizer and AM fungi on cotton (*Gossypium hirsutum* L.) var LRA 5166. The recommended fertilizer schedule of 80:40:40 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was followed for the varieties cotton crop. The growth attributes like plant height, plant fresh and dry weights and yield attributes, like number of sympodial branches, bolls etc., were noticed maximum under increased 100 per cent NPK with AM fungi inoculated plants. The plant height, plant fresh and dry weight and yield of inoculated plants that received 50 per cent NPK/ha was on par with the uninoculated plants supplied with 100 per cent NPK/ha.

**Keywords:** AM fungi, Cotton, NPK

## Introduction

*Gossypium hirsutum* L. (cotton-white gold) is the king of fibres which provides the basic material for the clothing of man. Cotton plays a dominant role in India's agrarian and industrial economy. But this crop grow in fields with marginal and submarginal fertility levels under dry land farming system in our country. Usually little or no chemical fertilizer is added to this crop and hence characterized by low yield (Koranne, 1996). Hence, there is a need to study the possible ways of improving the yields of this crop. AM fungi (Arbuscular mycorrhizae) is the most important supplement for the increasing high cost of NPK fertilizer input, into cropping system without substantial loss in yield (Vijayakumar *et al.*, 2000; Tripathi *et al.*, 2005). Because AM fungi reported to be involved in improvement of plant growth and enhancing accumulation of plant nutrients (mainly phosphorus, zinc, copper and sulphur) through greater soil exploration by mycorrhizal hyphae (Kumar *et al.*, 2001). Based on the importance of cotton, different levels of NPK fertilizers along with AM fungi were applied to determine the optimum level of nutrient requirements.

## Materials and Methods

The field experiment was conducted to find out the effect of AM fungi (*Glomus mosseae*) on the growth and yield of cotton as influenced by NPK. The field was prepared as per the recommended agronomic practices. LRA 5166 variety was utilized for this study. The recommended fertilizer schedule of 80:40:40 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was followed for the varieties cotton crop. The nitrogen was top dressed to cotton in three

splits on 30, 50 and 90 days after sowing. The entire dose of phosphorus and potassium was applied along with the first dose of nitrogen by pocket application method near each plant hill of cotton. The fertilizers, urea, superphosphate and muriate potash were used for the above manurial schedule. *Glomus mosseae* (AM fungi) inoculum were used in this experiment. The inoculum contains about 150 infective propagules per gram was placed 5 cm below the soil surface before sowing the seeds.

## Treatments and fertilizer levels

Absolute control – T<sub>1</sub>, AM alone – T<sub>2</sub>, 20:10:10 NPK kg/ha, (25% of recommended dose) – T<sub>3</sub>, 40:20:20 NPK kg/ha, (50% of recommended dose) – T<sub>4</sub>, 60:30:30 NPK kg/ha, (75% of recommended dose) – T<sub>5</sub>, 80:40:40 NPK kg/ha (100% of recommended dose of NPK – T<sub>6</sub>, AM + 25% of recommended dose of NPK – T<sub>7</sub>, AM + 50% of recommended dose of NPK – T<sub>8</sub>, AM + 75% of recommended dose of NPK – T<sub>9</sub>, AM + 100% of recommended dose of NPK – T<sub>10</sub>.

## Results and Discussion

The results on the growth attributes are presented in Table 1. The plant height increased with the advancement of age of plants. The highest plant height, fresh and dry weight (120.66 cm/plant; 127.10 g/plant; 32.20 g/plant) were recorded in inoculated plants at 100 per cent NPK/ha. Lowest plant height, fresh and dry weight (65.12 cm/plant, 73.30 g/plant, 12.50 g/plant) was recorded in control. The AM inoculated plants showed higher plant height, fresh and dry weight at all the graded levels when compared to the uninoculated plants at the corresponding levels of NPK. Under unfertilized condition, a significant

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increase in the plant height, fresh and dry weight of AM inoculated plants was observed throughout the growth period when compared to uninoculated plants. The plant height of 113.00 cm/plant, under AM inoculated

cotton plant at 50 per cent NPK/ha was found to be on par with 112.62 cm/plant recorded at 100 per cent NPK/ha fertilized uninoculated treatment.

Table 1. Effect of inoculation of *Glomus mosseae* on the growth attributes of cotton at graded level of NPK

| Treatments             | At 60 and 120 days after sowing |        |                              |        |                            |       |
|------------------------|---------------------------------|--------|------------------------------|--------|----------------------------|-------|
|                        | Plant height (cm/plant)         |        | Plant fresh weight (g/plant) |        | Plant dry weight (g/plant) |       |
|                        | 60                              | 120    | 60                           | 120    | 60                         | 120   |
| Control                | 51.28                           | 65.12  | 14.00                        | 73.30  | 4.10                       | 12.50 |
| AM alone               | 68.42                           | 99.10  | 28.12                        | 102.60 | 8.20                       | 22.80 |
| 25% NPK (20:10:10)/ha  | 72.62                           | 100.20 | 30.00                        | 104.20 | 8.30                       | 22.82 |
| 50% NPK (40:20:20)/ha  | 75.38                           | 100.62 | 34.30                        | 109.20 | 8.50                       | 23.00 |
| 75% NPK (60:30:30)/ha  | 80.60                           | 108.38 | 35.70                        | 111.28 | 9.00                       | 23.60 |
| 100% NPK (80:40:40)/ha | 83.98                           | 112.62 | 37.70                        | 114.60 | 10.60                      | 24.20 |
| AM + 25% NPK/ha        | 81.86                           | 108.42 | 36.00                        | 112.12 | 9.10                       | 23.50 |
| AM + 50% NPK/ha        | 84.10                           | 113.00 | 39.00                        | 117.10 | 10.50                      | 24.60 |
| AM + 75% NPK/ha        | 90.62                           | 118.60 | 42.20                        | 122.60 | 12.60                      | 27.60 |
| AM + 100% NPK/ha       | 92.98                           | 120.66 | 45.30                        | 127.10 | 14.10                      | 32.20 |

F<sub>1</sub> – 11.62\*\*, F<sub>1</sub> – F value for the variance between the treatments

F<sub>2</sub> – 348.85\*\*, F<sub>2</sub> – F value for the variance between the age of the plant

\*\* – significant at 1 per cent level

Table 2. Effect of inoculation of *Glomus mosseae* on the yield attributes of cotton at graded level of NPK

| Treatments             | At 60 and 120 days after sowing        |       |                           |       | Boll weight (g/plant) |
|------------------------|--|-------|---------------------------|-------|-----------------------|
|                        | Number of sympodial branches per plant |       | Number of bolls per plant |       |                       |
|                        | 60                                     | 120   | 60                        | 120   |                       |
| Control                | 5.00                                   | 12.40 | 4.20                      | 9.20  | 2.50                  |
| AM alone               | 8.00                                   | 15.20 | 6.80                      | 16.00 | 4.10                  |
| 25% NPK (20:10:10)/ha  | 10.00                                  | 18.00 | 7.20                      | 16.40 | 4.00                  |
| 50% NPK (40:20:20)/ha  | 11.40                                  | 19.60 | 9.60                      | 18.80 | 4.20                  |
| 75% NPK (60:30:30)/ha  | 13.20                                  | 22.20 | 12.20                     | 20.60 | 4.60                  |
| 100% NPK (80:40:40)/ha | 14.80                                  | 24.10 | 14.80                     | 22.80 | 5.60                  |
| AM + 25% NPK/ha        | 13.80                                  | 22.00 | 13.50                     | 20.80 | 5.00                  |
| AM + 50% NPK/ha        | 15.20                                  | 24.40 | 15.00                     | 22.20 | 5.72                  |
| AM + 75% NPK/ha        | 18.00                                  | 26.40 | 17.20                     | 26.60 | 6.00                  |
| AM + 100% NPK/ha       | 19.00                                  | 26.80 | 19.20                     | 27.20 | 6.40                  |

F<sub>1</sub> – 225.84\*\*, F<sub>2</sub> – F value for the variance between the treatments

F<sub>2</sub> – 448.51\*\*, F<sub>2</sub> – F value for the variance between the age of the plant

\*\* – significant at 1 per cent level

The results on the number of sympodial branches, number of bolls and boll weight are presented in Table 2. The sympodial branches increased with the advancement of age of plants. The highest sympodial branches of 26.80 per plant were recorded in inoculated plants at 100 per cent NPK/ha. Lowest sympodial branches of 12.40 per plant, was recorded in control. The AM inoculated plants showed higher sympodial branches at all the graded levels when compared to the uninoculated plants at the corresponding levels of NPK. Under unfertilized condition, a significant increase in the sympodial branches of AM inoculated plants was observed throughout the growth period when compared to uninoculated plants. The sympodial branches of 24.40 per plant under AM inoculated plant at 50 per cent NPK/ha was found to be on par with 24.10 per plant recorded at 100 per cent NPK/ha fertilized uninoculated treatment.

NPK fertilization increased the number of bolls per plant significantly at 25, 50, 75 and 100% NPK/ha levels under both inoculated and uninoculated conditions. Inoculation of AM enhanced the number of bolls over the uninoculated treatments. A highest of 27.20 bolls per plant was recorded in AM inoculated treatment fertilized with 100 per cent NPK/ha. The highest boll weight of 6.40 g per plant was recorded in inoculated plants at 100 per cent recommended dose of fertilizers. Control recorded the lowest results.

In the present study, AM inoculation significantly increased the plant growth and yield of cotton at all the levels of NPK. They increased upto 120 days after sowing. The inoculated plants showed higher number than the uninoculated plants. The plant height, plant fresh and dry weight, sympodial branches, bolls and boll weight of inoculated plants that received 50 per cent NPK/ha was on par with the uninoculated plants supplied with 100 per cent NPK/ha. In general,

biofertilizer (AM fungi) along with N and P enhanced the yield of African marigold (Rajadurai and Beaulah, 2000), growth in barley (Saif and Khan, 1999) and tuber yield in cassava (Sivaprasad *et al.*, 1989) etc. It can be concluded that the application of 50 per cent of recommended dose of NPK fertilizer with AM fungi inoculation will result in improved growth and yield in cotton.

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