RESEARCH ARTICLE

# INFLUENCE OF *GLOMUS FASCICULATUM* AND BIO FORMULATIONS ON GROWTH OF JAMUN (*SYZYGIUM CUMINII* SKEELS)

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**Abstract**: An experiment was conducted at Horticulture Research Station, Bijapur (Tidagundi) to know the influence of *Glomus fasciculatum* and bioformulations on growth of jamun stocks. Rootstocks treated with *Glomus fasciculatum* had registered highest stock height (23.85cm and 30.70cm in both *in-situ* and *ex-situ* respectively), stock diameter (6.31mm and 7.56mm in both *in-situ* and *ex-situ* respectively) and number of leaves (25.97 and 28.15 in both *in-situ* and *ex-situ* respectively) in *both in-situ* and *ex-situ*. Among sub-treatments, stocks treated with microbial consortia had recorded significantly highest stock height (23.45cm and 30.52cm in both *in-situ* and *ex-situ* respectively) stock diameter (6.19mm and 7.47mm in both *in-situ* and *ex-situ* respectively) and number of leaves (24.79 and 26.88 in both *in-situ* and *ex-situ* respectively) in organic conditions.

**Keywords**: *Syzygium cuminii*, *Glomus fasciculatum*, Bioformulations

## INTRODUCTION

Jamun is an indigenous, underexploited fruit crop of high commercial value belong to the family Myrtaceae. It has recently attained utmost importance as an arid zone crop because of its hardy nature, high yielding potential, quality fruits and also for its nutritive and medicinal properties especially in diabetes. Lack of recognised varieties, relatively long pre-bearing period and lack of standardised propagation techniques and non-availability of elite planting materials are major hurdles in the area expansion of this fruit crop. Maximum number of jamun trees are found scattered throughout the tropical and subtropical regions of the country. Information regarding the area under jamun is not available as it is seldom planted in the form of an orchard and generally scattered trees are found in fruit orchards. They are also seen growing in parks, on roadsides, avenues and as windbreaks. However, in recent years organised orchards are being established.

Chemical free traditional farming technology (organic, biodynamics, homa, panchagavya, agnihotra, rishi krishi, *etc*) are gaining a new momentum not only in India but also all over the world. These systems of organic cultivation offer a means to address self-reliance, rural upliftment and conservation of natural resources. Keeping this in view the study was undertaken to know the influence of these organics and *Glomus fasciculatum* on growth of jamun stocks under *in-situ* and *ex-situ* cultivation.

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## MATERIAL AND METHOD

An investigation was carried out at Horticulture Research and Extension Centre, Bijapur (Tidagundi) to know the combined influence of *Glomus fasciculatum* and bioformulations on growth of jamun stocks in both *in-situ* and *ex-situ*. The experiment consists of 10 treatment combinations consisting of two main plots ($M_1$- with *Glomus fasciculatum*, $M_2$- Un inoculated-control) and five sub plots ($S_1$- Amrit pani, $S_2$- Microbial consortia, $S_3$- Panchagavya, $S_4$- Inorganic fertilizer (60:30:90 g NPK per plant per year), $S_5$- Control) and was laid out in split plot design with three replications. Seeds were sown by placing five gram inoculum. Arboscular Mycorhizal (AM) fungi inoculation was done by spreading five gram inoculum uniformly at five centimeter depth after putting a thin layer of soil on the inoculum. The bioformulations were applied as soil application at three per cent at monthly interval.

Bioformulations were prepared and applied as soil drenching. Amrit pani was prepared by thorough mixing of 10 kg of cow dung and 250 g cow ghee. To this mixture, 500 g of honey was added and mixed thoroughly. This mixture was kept for incubation for 24 hours (Pathak and Ram, 2004) before use. Microbial consortium consisted of 15 local isolates of bacteria, fungi and actinomycetes comprising of bioinoculants, PGPRs and biocontrol agents in cow dung slurry. Where as panchagavya can be prepared with Seven kilograms of fresh cow dung and one kilogram of fresh cow ghee were mixed thoroughly and incubated for two days. On the third day, three litres of cow urine and 10 litres of

water were added to the above mixture and kept for incubation. After 15 days of incubation, three litres of sugarcane juice, two litres of cow milk, two litres of cow curd, three litres of tender coconut water and 12 ripe bananas were added and mixed thoroughly. This mixture was again kept for 15 days for incubation and then used (Pathak and Ram, 2004).

## RESULT AND DISCUSSION

Stocks that are inoculated with AM fungus *Glomus fasciculatum* recorded significantly highest growth parameters when compared to uninoculated stocks at all the stages of growth period (both 90 and 180 Days after sowing (DAS)). Stocks that are inoculated with *Glomus fasciculatum* recorded significantly highest stock height (23.85cm and 30.70cm in *in-situ* and *ex-situ* respectively), stock diameter (6.31mm and 7.56mm in *in-situ* and *ex-situ* respectively) and number of leaves (25.97 and 28.15 in *in-situ* and *ex-situ* respectively) compared to uninoculated stocks.

Influence of sub-treatments on growth parameters was found to be significant during all the stages of stock growth compare to untreated stocks. At 180 DAS, the stocks treated with microbial consortia recorded significantly highest stock height (23.45cm and 30.52cm in *in-situ* and *ex-situ* respectively), stock diameter (6.19mm and 7.47mm in *in-situ* and *ex-situ* respectively) and number of leaves (24.79 and 26.88 in *in-situ* and *ex-situ* respectively) in both *in-situ* and *ex-situ* followed by panchagavya treatment compared to control. Interaction effects were found non significant for stock height, stock diameter and number of leaves at all stages of crop growth in both *in-situ* and *ex-situ.*

Increase in the growth of the rootstocks observed in the present investigation (Tables 1 and 2) may be attributed to the beneficial synthesis of the hormones and growth factors by AM fungi leading to increased cell multiplication and cell division with overall increase in the vegetative parameters. PGPR might had effected on plant growth directly by providing metabolites which promote plant growth without any interactions with native soil microflora (Kloepper *et al.,* 1981). Indirectly, they inhibit deleterious rhizobacteria and phytopathogens through different mechanisms. Hooker *et al*. (1992) demonstrated both direct nutrient uptake and indirect growth effects of fungus inoculation on plants which are in agreement with the results of present work of AM fungus and its beneficial effects on jamun seedlings. These effects were evident from the increased vegetative parameters, *viz*., rootstock height, stem diameter, number of leaves, when compared to uninoculated control. Undoubtedly, more nutrients and growth regulators available to stocks grown in both *in-situ* and *ex-situ.* The vegetative growth depends on the availability of nutrients, as stated by Nemec and Vu (1990).

Increase in growth parameters observed in the present investigation may be attributed to the activity of microorganisms. The availability of nutrients due to microbial transformations be an account of their direct role in nitrogen fixation by N fixers like Azospirillum sp. (Jeeva *et al.,* 1988) and Azotobacter sp. (Alvarez *et al.,* 1996), P solubilisation by P solubilisers like *Pseudomonas striata* and plant growth promoting substances produced by these organisms in bioformulations which fix nitrogen, solubilises P and make K available contributing higher values of growth parameters.

Stocks inoculated with *Glomus fasciculatum* recorded significantly highest fresh weight (32.94g and 36.92g in both *in-situ* and *ex-situ* respectively) and dry weight (9.98g and 11.16g in both *in-situ* and *ex-situ* respectively) compared to uninoculated stocks. Among different sub-treatments, stocks inoculated with panchagavya recorded significantly highest fresh weight (32.80g and 36.71 in both *in-situ* and *ex-situ* respectively) and dry weight (9.83g and 10.68g in both *in-situ* and *ex-situ* respectively) compared to uninoculated stocks. Where as *Glomus fasciculatum* and bioformulations did not interact significantly for both fresh weight and dry weight under *in-situ* and *ex-situ*.

Increased fresh and dry weight observed in the present investigation might be due to higher carbohydrate production (Tables 3 and 4). Auxins, gibberellins and cytokinins like substances produced by Rhizosphere bacteria might had helped plants to produce more of biomass as reported by Barea *et al*. (1976). Our findings also corroborate with the findings of Nemac and Vu (1990) for increase of biomass in AM inoculated plants. Further, it is well documented that infection of plant roots by AM fungi has beneficial effects on vegetative parameters and biomass production (fresh and dry weight) of host plants compared to untreated stocks. (Waterer and Coltman, 1998; Adivappar *et al*., 2004).

**Table 1.** Influence of *Glomus fasciculatum* and bioformulations on the growth parameter of Jamun in in-situ grown stocks.

| Treatments | 90 DAS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | plant height | | | | | | stock diameter | | | | | | Number of leaves | | | | | |
| | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 12.83 | 13.55 | 13.23 | 12.28 | 10.46 | 12.47 | 3.25 | 3.60 | 3.45 | 2.79 | 2.39 | 3.10 | 13.50 | 13.92 | 13.67 | 13.17 | 12.09 | 13.27 |
| $M_2$ | 10.94 | 11.83 | 11.50 | 10.43 | 8.39 | 10.62 | 2.23 | 2.86 | 2.55 | 2.07 | 1.96 | 2.33 | 11.58 | 12.00 | 11.75 | 11.25 | 10.17 | 11.35 |
| Mean | 11.89 | 12.69 | 12.36 | 11.36 | 9.42 | | 2.74 | 3.23 | 3.00 | 2.43 | 2.18 | | 12.54 | 12.96 | 12.71 | 12.21 | 11.13 | |
| For comparing the means of | S. Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | |
| M | 0.18 | | 1.08 | | 2.50 | | 0.15 | | 0.92 | | 2.12 | | 0.07 | | 0.44 | | 1.01 | |
| S | 0.25 | | 0.76 | | 1.05 | | 0.14 | | 0.41 | | 0.56 | | 0.15 | | 0.46 | | 0.63 | |
| S at same M | 0.36 | | NS | | NS | | 0.19 | | NS | | NS | | 0.22 | | NS | | NS | |
| M at same S | 0.37 | | NS | | NS | | 0.23 | | NS | | NS | | 0.21 | | NS | | NS | |
| 180 DAS | | | | | | | | | | | | | | | | | | |
| Treatments | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 24.52 | 25.62 | 25.06 | 23.62 | 20.45 | 23.85 | 6.35 | 7.07 | 6.62 | 6.05 | 5.47 | 6.31 | 26.25 | 26.75 | 26.58 | 26.08 | 24.17 | 25.97 |
| $M_2$ | 20.23 | 21.28 | 20.77 | 19.48 | 16.33 | 19.62 | 4.55 | 5.31 | 4.92 | 4.23 | 3.64 | 4.53 | 22.33 | 22.83 | 22.58 | 21.83 | 19.58 | 21.83 |
| Mean | 22.37 | 23.45 | 22.92 | 21.55 | 18.39 | | 5.45 | 6.19 | 5.77 | 5.14 | 4.55 | | 24.29 | 24.79 | 24.58 | 23.96 | 21.88 | |
| For comparing the means of | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | |
| M | 0.05 | | 0.32 | | 0.74 | | 0.25 | | 1.50 | | 3.46 | | 0.07 | | 0.44 | | 1.01 | |
| S | 0.09 | | 0.28 | | 0.39 | | 0.2 | | 0.59 | | 0.82 | | 0.15 | | 0.45 | | 0.62 | |
| S at same M | 0.13 | | NS | | NS | | 0.28 | | NS | | NS | | 0.21 | | NS | | NS | |
| M at same S | | | | | | | | | NS | | NS | | | | NS | | NS | |

$M_1$- *Glomus fasciculatum* $M_2$- Un inoculated $S_1$- Amrit pani $S_2$- Microbial Consortia $S_3$- Panchagavya $S_4$- RDF $S_5$- Control
DAS- Days after sowing NS- Non-significant

**Table 2.** Influence of *Glomus fasciculatum* and bioformulations on the growth parameter of Jamun in *ex-situ* grown stocks.

| Treatments | 90 DAS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | plant height | | | | | | stock diameter | | | | | | Plant leaves | | | | | |
| | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 19.05 | 20.18 | 19.37 | 18.55 | 18.31 | 19.09 | 4.49 | 4.90 | 4.69 | 3.91 | 3.68 | 4.33 | 16.92 | 17.25 | 17.08 | 16.75 | 16.08 | 16.82 |
| $M_2$ | 17.13 | 18.11 | 17.81 | 16.73 | 16.37 | 17.23 | 3.30 | 3.53 | 3.38 | 2.97 | 2.80 | 3.19 | 15.17 | 15.58 | 15.42 | 15.00 | 14.33 | 15.10 |
| Mean | 18.09 | 19.15 | 18.59 | 17.64 | 17.34 | | 3.89 | 4.22 | 4.03 | 3.44 | 3.24 | | 16.04 | 16.42 | 16.25 | 15.88 | 15.21 | |
| For comparing the means of | S. Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | |
| M | 0.30 | | 1.80 | | 4.16 | | 0.15 | | 0.89 | | 2.05 | | 0.23 | | 1.43 | | 3.30 | |
| S | 0.24 | | 0.73 | | 1.00 | | 0.21 | | 0.63 | | NS | | 0.13 | | 0.40 | | 0.55 | |
| S at same M | 0.34 | | NS | | NS | | 0.30 | | NS | | NS | | 0.19 | | NS | | NS | |
| M at same S | 0.43 | | NS | | NS | | 0.30 | | NS | | NS | | 0.29 | | NS | | NS | |
| 180 DAS | | | | | | | | | | | | | | | | | | |
| Treatments | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 31.03 | 32.46 | 31.52 | 30.24 | 28.22 | 30.70 | 7.68 | 8.37 | 7.97 | 7.25 | 6.51 | 7.56 | 28.42 | 29.17 | 28.92 | 28.17 | 26.08 | 28.15 |
| $M_2$ | 27.50 | 28.57 | 27.95 | 26.52 | 24.65 | 27.04 | 5.89 | 6.57 | 6.22 | 5.52 | 4.86 | 5.81 | 24.17 | 24.58 | 24.42 | 24.08 | 21.58 | 23.77 |
| Mean | 29.26 | 30.52 | 29.74 | 28.38 | 26.44 | | 6.79 | 7.47 | 7.10 | 6.39 | 5.68 | | 26.29 | 26.88 | 26.67 | 26.13 | 23.83 | |
| For comparing the means of | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | | S Em± | | CD at 5% | | CD at 1% | |
| M | 0.08 | | 0.51 | | 1.19 | | 0.15 | | 0.91 | | 2.11 | | 0.04 | | 0.26 | | 0.60 | |
| S | 0.39 | | 1.17 | | 1.62 | | 0.20 | | 0.60 | | 0.83 | | 0.13 | | 0.40 | | 0.55 | |
| S at same M | 0.55 | | NS | | NS | | 0.28 | | NS | | NS | | 0.19 | | NS | | NS | |
| M at same S | 0.50 | | NS | | NS | | 0.29 | | NS | | NS | | 0.17 | | NS | | NS | |

$M_1$- *Glomus fasciculatum* $M_2$- Un inoculated $S_1$- Amrit pani $S_2$- Microbial Consortia $S_3$- Panchagavya $S_4$- RDF $S_5$- Control
DAS- Days after sowing NS- Non-significant

**Table 3.** Influence of *Glomus fasciculatum* and bioformulations on fresh and dry weight (g) of Jamun in *in-situ* grown stocks.

| Treatments | Fresh weight (180 DAS) | | | | | | Dry weight (180 DAS) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 33.59 | 34.46 | 35.37 | 32.47 | 28.81 | 32.94 | 10.17 | 10.23 | 10.35 | 9.82 | 9.32 | 9.98 |
| $M_2$ | 28.48 | 29.63 | 30.23 | 27.63 | 23.52 | 27.90 | 9.13 | 9.27 | 9.32 | 8.87 | 8.37 | 8.99 |
| mean | 31.03 | 32.05 | 32.80 | 30.05 | 26.17 | | 9.65 | 9.75 | 9.83 | 9.34 | 8.85 | |
| For comparing the means of | S. Em± | | CD at 5% | | CD at 1% | | S. Em± | | CD at 5% | | CD at 1% | |
| M<br>S<br>S at same M<br>M at same S | 0.08<br>0.20<br>0.28<br>0.26 | | 0.48<br>0.60<br>NS<br>NS | | 1.10<br>0.82<br>NS<br>NS | | 0.12<br>0.16<br>0.22<br>0.23 | | 0.72<br>0.47<br>NS<br>NS | | 1.65<br>0.65<br>NS<br>NS | |

$M_1$- *Glomus fasciculatum*, $M_2$- Un inoculated, $S_1$- Amrit pani, $S_2$- Microbial Consortia, $S_3$- Panchagavya, $S_4$- RDF, $S_5$- Control
NS- Non-significant DAS- Days after sowing

**Table 4.** Influence of *Glomus fasciculatum* and bioformulations on fresh weight (g) and dry weight (g) of Jamun in *ex-situ* grown stocks.

| Treatments | Fresh weight (180 DAS) | | | | | | Dry weight (180 DAS) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | mean |
| $M_1$ | 37.82 | 38.58 | 39.54 | 35.86 | 32.79 | 36.92 | 11.23 | 11.34 | 11.53 | 11.08 | 10.62 | 11.16 |
| $M_2$ | 31.51 | 33.32 | 33.87 | 29.56 | 26.69 | 30.99 | 9.56 | 9.71 | 9.83 | 9.29 | 8.79 | 9.43 |
| mean | 34.67 | 35.95 | 36.71 | 32.71 | 29.74 | | 10.39 | 10.52 | 10.68 | 10.18 | 9.70 | |
| For comparing the means of | S. Em± | | CD at 5% | | CD at 1% | | S. Em± | | CD at 5% | | CD at 1% | |
| M | 0.09 | | 0.53 | | 1.23 | | 0.10 | | 0.58 | | 1.33 | |
| S | 0.21 | | 0.63 | | 0.87 | | 0.13 | | 0.39 | | 0.53 | |
| S at same M | 0.30 | | NS | | NS | | 0.18 | | NS | | NS | |
| M at same S | 0.28 | | NS | | NS | | 0.19 | | NS | | NS | |

$M_1$- *Glomus fasciculatum*, M2- Un inoculated, S1- Amrit pani, S2- Microbial Consortia, S3- Panchagavya, S4- RDF, S5- Control
NS- Non-significant DAS- Days after sowing

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