# EFFECT OF MICRONUTRIENTS ON THE GROWTH AND LEAF YIELD OF TERMINALIA ARJUNA

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***Abstract – Six micronutrients namely Manganese, Zinc, Copper, Boron, Molybdenum and Iron in three doses each were foliarly applied to study the effect of micronutrients in different concentrations on the growth and leaf yield of Terminalia arjuna with 4' x 4' spacing. The usual package of practices i.e. N (150 kg/ha/hr),***

***P (50 kg/ha/yr), K (50 kg/ha/yr) and FYM (1 kg / plant/yr) was also followed. All the micronutrients showed promontory effects over control in respect of growth and leaf yield of T. arjuna. Among all the nineteen treatments of micronutrients under study, Manganese @ 2.00 kg / ha / crop was found to be the beset in respect of growth and leaf yield of T. arjuna. This treatment gave 31.33% increase in leaf yield over control.***

***Keywords : Terminalia arjuna, micronutrients, growth, leaf yield.***

## INTRODUCTION

Terminalia arjuna is one of the primary food plant of tropical tasar silkworm Antheraea mylitta Drury (Jolly et al, 1968). Extensive economic plantation of T. arjuna has been raised under Inter State Tasar Project for controlled rearing of A. mylitta, Hence, it required specific attention for improvement in its growth and leaf yield through effective crop management. Loknath and Shivashankar (1986) reported that deficiencies of micronutrients limit the maximum potential yield of mulberry. It has also been reported by Sinha et al., (1992) that soils of all states of India have become deficient in micronutrients. The effect of micronutrients on growth and leaf yield of mulberry has been studied by Singhvi et al., (1996). However, no work has so far been reported on the effect of micronutrients on the growth and leaf yield of tassar food plant Terminalia arjuna. Hence, the present paper deals with the effect of foliar application of micronutrients on the growth and leaf yield of T. arjuna.

## MATERIALS AND METHODS

The experiment was conducted in the experimental field of Central Tasar Research & Training Institute, Nagri, Ranchi. Six micronutrients, Manganese, Zinc, Copper, Boron, Molybdenum and Iron in three doses were foliarly applied on Terminalia arjuna plants with 4' x 4' spacing. The usual package of Practices of major nutrients i.e. Nitrogen (150 kg/ha/yr), Phosphorus (50 kg/ha/yr), Potassium (50 kg/ha/yr) and Farm Yard Manure (1 kg/plant/yr) was also followed. The soil was sandy loam laterite having pH 5.3, organic carbon 0.23%, available phosphors 6.11 kg/ha and available potash 300 kg/ha. Micronutrients status of the soil is given below :

| Name of micronutrients | Status in soil (ppm.) |
|---|---|
| Available Manganese | 135.70 |
| Available Copper | 39.90 |
| Available Boron : | 0.37 |
| Available Zinc : | 39.60 |
| Available Molybdenum : | 252.70 |
| Available Iron : | 37.80 |

Randomised block design with three replications was followed for each treatment. A sample size of 30 plant per replication was considered suitable for the experiment.
Ninteen treatments including control are as follows :

T1 = 2.5 kg Zn/ha/crop T2 = 5.0 kg Zn/ha/crop T3 = 7.5 kg Zn/ha/crop

T4 = 0.5 kg B/ha/crop T5 = 1.0 kg B/ha/crop T6 = 1.5 kg B/ha/crop

T7 = 0.05 kg T8 = 0.10 kg T9 = 0.15 kg

| | | |
|---|---|---|
| Mo/ha/crop | Mo/ha/crop | Mo/ha/crop |
| T10 = 0.50 kg Fe/ha/crop | T11 = 0.75 kg Fe/ha/crop | T12 = 1.00 kg Fe/ha/crop |
| T13 = 2.00 kg Mn/ha/crop | T14 = 4.00 kg Mn/ha/crop | T15 = 6.00 kg Mn/ha/crop |

T19 = Control i.e. without micronutrients.

The experiment was conducted for two years to study the growth and leaf yield of T. arjuna. Leaf samples were collected after 45 days of the application of micronutrients in the field excluding too tender and over matured leaves from each treated plot in three replications. All the biochemical constituents of leaves except moisture were determined on oven dry basis. Moisture, total minerals, total carbohydrate and crude fibre were estimted by the method of AOAC (1955). Kjeldahl's mthod as described by Vogel (1978) was followed for the determination of total nitrogen. Crude protein was calculated by multiplying the estimated value of the nitrogen content by 6.25. Method as suggested by Arunachalam and Bandopadhyay (1984) was followed to decide the ranking of different treatments of micronutrients under study for different growth and leaf yield parameters.

**RESULTS AND DISCUSSION**

Foliar application of micronutrients significantly improved all the attributes of T. arjuna i.e., number of branches/plant, lngth of the branch, number of leaves/branch, length and breadth of the leaf (Table I). Results of the present study support the findings of Singhvi et al., (1996) who also observed that micronutrients when applied on mulberry resulted in increase in height of the plant, number of leaves per plant, number of shoot per plant and number of nodes per plant. The increase in plant growth may be due to the role of micronutrients in various physiological processes and favourable effects on nutrient interaction. It is also evident from Table I that there has been significant increase in leaf yield over control in case of all the micronutrients, the highest being 31.33% over control for Manganese (2.0kg/ha/crop). It was followed by Zinc (26.37% over control) and Copper (21.41% over control) when they were applied @5.0 kg/ha/crop & 0.5 kg/ha/crop respectively.

Similar trend of increased leaf yield by the application of micronutrients has been reported by Day and Gupta (1974), Loknath & Shivashankar (1986) and Bose et. al, (1994). This is due to the beneficial effect of micronutrients on the vegetative growth of plants.

Significant increase in chemical constitutents i.e., moisture, crude protin, total carbohydrate and total mineralss was also recorded due to micronutrints application (Table II). However, the increase was non-significant in case of crude fibre content. Finding of the present study corroborate the results of Loknath et al., (1986).

Data in Table III indicate the scores allotted to nineteen different treatments of micronutrients under study for growth parameters and chemical constituents by the method of Arunachalam and Bandopadhyaya (1984) where lower values signify higher ranking. It is evident from this table that among different treatments of micronutrients, treatment T13 i.e. application of Manganese @ 2.0 kg/ha/crop is the best followed by T2 (Zinc @ 5.0kg/ha/crop) & T16 (Copper @ 0.5kg/ha/crop).

From the present study it is, therefore, concluded that among all the treatments of micronutrients under study, treatment T13 i.e. application of Managanese @ 2.0kg/ha/crop is the best for the growth and leaf yield of T. arjuna.

**Table I. Influence of micronutrients on the growth and yield of Terminalia arjuna.**

| *Treatment* | *No. of brances/ plant* | *Length of the branch (cm)* | *No. of leaves / branch* | *Length of leaf (cm)* | *Breadth of leaf (cm)* | *Leaf yield (kg/plant)* | *Increase over control (%)* |
|---|---|---|---|---|---|---|---|
| T1 | 7.39 bcde | 170.39 bedef | 230.69de | 18.17 bcde | 5.85 bc | 4.42 cde | 15.40 |
| T2 | 7.55b | 173.65b | 248.62b | 18.40ab | 5.88ab | 4.84b | 26.37 |
| T3 | 7.34bcdef | 171.95bc | 222.86efgh | 18.28ab | 5.81bcd | 4.42cde | 15.40 |
| T4 | 7.4bc | 172.50b | 236.20de | 18.38ab | 5.86ab | 4.62bcd | 20.63 |
| T5 | 7.21cdefg | 171.80bc | 223.25efg | 18.20bcde | 5.80bcd | 4.35cde | 13.32 |
| T6 | 7.20efg | 171.50bcd | 220.97efgh | 18.23abcd | 5.79bcde | 4.29def | 12.01 |
| T7 | 7.17efg | 168.05ef | 215.56fgh | 17.91cdef | 5.65cdef | 4.32cde | 12.79 |
| T8 | 7.31bcdef | 171.00bcde | 236.94cd | 18.51bcdef | 5.81bcd | 4.52bcd | 18.02 |
| T9 | 7.20efg | 171.54bcd | 221.41efgh | 18.13bcdef | 5.78bcde | 4.28def | 11.75 |
| T10 | 7.03ghi | 168.64cdef | 211.58h | 17.89def | 5.54fg | 4.17efg | 8.88 |
| T11 | 7.28cdef | 168.31def | 225.76ef | 18.33ab | 5.79bcde | 4.36cde | 13.84 |
| T12 | 6.83hi | 162.50g | 194.15i | 17.90cdef | 5.50fg | 3.95fg | 3.13 |
| T13 | 7.85a | 177.55a | 267.19a | 18.58a | 6.06a | 5.03a | 31.33 |
| T14 | 7.09fgh | 167.26f | 214.15gh | 17.85fg | 5.63def | 4.25ef | 10.97 |
| T15 | 6.86hi | 163.58g | 194.90i | 17.80fg | 5.59ef | 3.97fg | 3.66 |
| T16 | 7.44bcd | 173.04b | 244.80bc | 18.25abc | 5.87ab | 4.65bc | 21.41 |
| T17 | 7.45bcd | 171.67bcd | 241.47bcd | 18.40ab | 5.81bcd | 4.52bcd | 18.02 |
| T18 | 7.42bcde | 171.42bcde | 223.96efg | 18.20bcde | 5.75bcde | 4.28def | 11.75 |
| T19 (control / Temoin) | 6.78i | 159.00h | 188.50i | 17.55g | 5.38g | 3.83g | |
| LSD at 5% | 0.26 | 3.38 | 11.51 | 0.35 | 0.20 | 0.34 | |

Figures with different alphabets differ significantly. Average values are based on two years data.

**Table II. Chemical composition of Terminalia arjuna leaf as influenced by different treatments.**

| *Treatment* | *Moisture (%)* | *Crude protein (%)* | *Total carbohydrates (%)* | *Crude fibre (%)* | *Total minerals (%)* |
|---|---|---|---|---|---|
| T1 | 70.83 bcdef | 12.25gh | 15.00g | 8.80a | 7.37cd |
| T2 | 71.33ab | 14.50bc | 17.00b | 8.60a | 8.00a |
| T3 | 70.30efg | 13.50d | 16.20cd | 8.70a | 7.67b |
| T4 | 70.43defg | 12.75fg | 16.00de | 8.70a | 7.67b |
| T5 | 70.17g | 13.5cd | 16.50c | 8.70a | 7.67b |
| T6 | 70.17g | 13.00e | 16.00de | 8.75a | 7.67b |
| T7 | 70.67cdefg | 12.50fgh | 15.00g | 8.80a | 7.27de |
| T8 | 70.50cdefg | 14.00c | 16.00de | 8.75a | 7.90a |
| T9 | 70.30efg | 13.00e | 15.60f | 8.80a | 7.57bc |
| T10 | 70.17g | 12.25gh | 15.00g | 8.80a | 7.10ef |
| T11 | 70.40efg | 12.50fgh | 15.70ef | 8.70a | 7.93a |
| T12 | 71.00bcd | 12.00hi | 14.80gh | 8.75a | 7.90a |
| T13 | 71.83a | 15.63a | 17.50 | 8.90a | 8.00a |
| T14 | 70.30efg | 15.00b | 16.02de | 8.60a | 7.67b |
| T15 | 70.20fg | 13.00e | 14.90g | 8.80a | 7.33d |
| T16 | 71.10bc | 14.00cd | 16.50c | 8.60a | 8.00a |
| T17 | 70.90bcde | 13.50de | 15.80ef | 8.70a | 7.33d |
| T18 | 70.20fg | 13.00ef | 15.05g | 8.70a | 7.33d |
| T19 (control / Temoin) | 70.03g | 11.50i | 14.50h | 8.50a | 7.00f |
| LSD at 5% | 0.65 | 0.60 | 0.32 | NS | 0.21 |

**NS :** denotes not significant.

Figures with different alphabets differ significantly. Average values are based on two years data.

**Table III. Scoring of nineteen different treatments of micronutrient for growth parameters and chemical constituents.**

| *Treatment* | *Growth parameters* | | | | | | | *Chemical constituents* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *No. of branches / plant* | *Length of the branch* | *No. of leaves / branch* | *Length of leaf* | *Breadth of leaf* | *Leaf yield* | *Moisture* | *Crude protein* | *Total carbohydrate* | *Crude fibre* | *Total minerals* | *Total scores scores and ranks* |
| T13 | 0.11 | 0.13 | 0.11 | 0.14 | 0.14 | 0.14 | 0.14 | 0.11 | 0.13 | 1.00 | 0.17 | 2.32 (I) |
| T2 | 0.22 | 0.25 | 0.22 | 0.21 | 0.21 | 0.29 | 0.21 | 0.28 | 0.25 | 1.00 | 0.17 | 3.31 (II) |
| T16 | 0.33 | 0.25 | 0.28 | 0.33 | 0.21 | 0.36 | 0.36 | 0.39 | 0.38 | 1.00 | 0.17 | 4.06 (III) |
| T4 | 0.28 | 0.25 | 0.50 | 0.21 | 0.21 | 0.43 | 0.79 | 0.72 | 0.56 | 1.00 | 0.33 | 5.28 (IV) |
| T8 | 0.44 | 0.44 | 0.39 | 0.57 | 0.43 | 0.43 | 0.71 | 0.33 | 0.56 | 1.00 | 0.17 | 5.47 (V) |
| T17 | 0.33 | 0.38 | 0.33 | 0.21 | 0.43 | 0.43 | 0.50 | 0.50 | 0.69 | 1.00 | 0.67 | 5.47 (V) |
| T3 | 0.44 | 0.31 | 0.72 | 0.21 | 0.43 | 0.57 | 0.88 | 0.44 | 0.44 | 1.00 | 0.33 | 5.77 (VI) |
| T5 | 0.56 | 0.31 | 0.67 | 0.50 | 0.43 | 0.57 | 1.00 | 0.44 | 0.38 | 1.00 | 0.33 | 6.19 (VII) |
| T11 | 0.50 | 0.63 | 0.61 | 0.21 | 0.50 | 0.57 | 0.88 | 0.78 | 0.69 | 1.00 | 0.17 | 6.54 (VIII) |
| T1 | 0.39 | 0.50 | 0.50 | 0.50 | 0.36 | 0.57 | 0.57 | 0.83 | 0.88 | 1.00 | 0.58 | 6.68 (IX) |
| T6 | 0.56 | 0.38 | 0.72 | 0.36 | 0.50 | 0.71 | 1.00 | 0.56 | 0.56 | 1.00 | 0.33 | 6.68 (IX) |
| T9 | 0.56 | 0.38 | 0.72 | 0.57 | 0.50 | 0.71 | 0.88 | 0.56 | 0.75 | 1.00 | 0.42 | 7.05 (X) |
| T18 | 0.39 | 0.44 | 0.67 | 0.50 | 0.50 | 0.71 | 0.93 | 0.61 | 0.88 | 1.00 | 0.67 | 7.30 (XI) |
| T14 | 0.78 | 0.75 | 0.83 | 0.93 | 0.71 | 0.71 | 0.88 | 0.22 | 0.56 | 1.00 | 0.33 | 7.70 (XII) |
| T7 | 0.56 | 0.69 | 0.78 | 0.64 | 0.64 | 0.57 | 0.71 | 0.78 | 0.88 | 1.00 | 0.75 | 8.00 (XIII) |
| T12 | 0.94 | 0.88 | 1.00 | 0.64 | 0.93 | 0.93 | 0.43 | 0.94 | 0.94 | 1.00 | 0.17 | 8.80 (XIV) |
| T10 | 0.89 | 0.50 | 0.89 | 0.71 | 0.93 | 0.86 | 1.00 | 0.83 | 0.88 | 1.00 | 0.92 | 9.41 (XV) |
| T15 | 0.94 | 0.88 | 1.00 | 0.93 | 0.79 | 0.86 | 0.93 | 0.56 | 0.88 | 1.00 | 0.67 | 9.44 (XVI) |
| T19 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 11.00 (XVII) |

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