



Influence of *Vrkshayurvedic* Practices on Growth and Yield of Maize (*Zea mays* L.)

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A field experiment was conducted to study the effect of *Vrkshayurvedic* farming on yield attributes of maize at central farm of Agricultural College and Research Institute, TNAU, Madurai from September 2009 to January 2010. The experiment consisted of 20 treatments: five different green leaf manures (*Albizia lebbek*, *Gliricidia sepium*, *Leucaena leucocephala*, *Delonix regia*, *Peltophorum ferrugineum*) @ 5 t ha⁻¹ as basal nutrition in main plot and four different tree leaf extracts (*Alangium salvifolium*, *Aegle marmelos*, *Morinda tinctoria*, *Annona squamosa*) @ 5 % in the form of five foliar sprays at 25, 39, 53, 67 and 82 DAS in sub plot. The results indicated that there were significant differences in yield attributes of maize due to the incorporation of green leaf manures and foliar spraying of tree leaf extracts. All the yield parameters were found to be high in the plot that received *Albizia lebbek* as green leaf manure with foliar spraying of *Annona squamosa*. The highest yield of 1820 kg ha⁻¹ was recorded in the plot that received *Albizia lebbek* as green leaf manure and foliar sprays of *Annona squamosa*, which was six times higher than the zero input management and almost 50 per cent of the yield realized from high input management (CPG management). The economic analysis showed that higher net return of Rs. 20367 ha⁻¹ and benefit cost ratio 1:2.26 were recorded by the treatment combination of *Albizia lebbek* and *Annona squamosa*.

Key words: *Vrkshayurveda*, green leaf manure, basal nutrition, foliar spraying, growth, yield, maize.

Maize (*Zea mays* L.), also known as corn, is the world's third most important cereal crop after wheat and rice. In India, it occupies third place among the cereals after rice and wheat, grown in an area of 7.59 m ha with the production of 14.71 mt and the average productivity is 1938 kg ha⁻¹ (www.agricoop.nic.in). In Tamil Nadu, maize is cultivated in an area of 2.02 lakh hectares with a production of 2.41 lakh tonnes with an average productivity of 1189 kg ha⁻¹ (DES, 2006). Maize is grown primarily for grain and secondarily for fodder and raw material for industrial purpose. The outstanding features of maize have been well documented all over the world. This crop is being considered as a "miracle crop" and also called as "queen of cereals" because of its carbon pathway (C₄), wider adaptability, higher multiplication ratio, desirable architecture, superior transpiration efficiency and high versatile uses. The incorporation of green leaf manure and foliar spraying of green leaf extracts are found to have favorable effect on growth and yield of many crops (Swaminathan, 2004).

Vrkshayurvedic farming is a traditional method of discovering and developing tree based on bio-formulation with indigenous knowledge and easier, less expansive. The recent awareness on harmful

and everlasting ill effects on human beings due to indiscriminate usage of chemical fertilizers in crop production among food producers and consumers have paved way for going back to human friendly, eco-friendly and traditional agriculture. Hence, an attempt was made to study the performance of green leaf manure and green leaf extracts on growth and yield of maize.

Materials and Methods

The experiment was conducted at Central farm, Agricultural College and Research Institute, Madurai. The farm is geographically located at 9°54' N latitude and 78°54' E longitude at an elevation of 147 m above mean sea level. Treatments consisted of incorporation of five green leaf manures (*Albizia lebbek*, *Gliricidia sepium*, *Leucaena leucocephala*, *Delonix regia*, *Peltophorum ferrugineum*) 5 t ha⁻¹ in main plot and foliar spraying of four green leaf extracts (*Alangium salvifolium*, *Aegle marmelos*, *Morinda tinctoria*, *Annona squamosa*) at 5 % in subplot. The experiment was carried out in split plot design with two replications. The maize crop was raised with a spacing 60 x 20 cm. The soil of the experiment field was sandy clay loam in texture. The green leaf manures were collected and incorporated

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in the field @ 5 t/ha and allowed for 45 days for decomposition. The leaf extract of tree species were prepared by grinding the leaf with distilled water at 1:1 proportion on maize and the foliar spraying of leaf extracts on maize were done on 25, 39, 53, 67 and 87 DAS. Two separate plots outside the experimental plot were maintained for comparison. They were zero input and recommended dose of fertilizer (RDF) management. (130: 62.5: 60 NPK kg ha⁻¹)

Results and Discussion

The growth characteristics like plant height, LAI, dry matter production showed significant response to green leaf manures and foliar spraying of leaf extracts (Table 1). The incorporation of green leaf manures had significant effect on growth of maize.

The plants were taller (191.9 cm) under M₁ (*Albizia lebbek*), followed by M₄ (*Delonix regia*) (185.2 cm) and the lowest plant height (169.2 cm) was recorded in M₂ (*Gliricidia sepium*).

The foliar spraying of leaf extract had a significant effect on maize. Among the treatments S₄ (*Annona squamosa*) had the tallest plants (187.6 cm) which was followed by S₃ (*Morinda tinctoria*) (182.0) and the shortest plants (175.6 cm) were recorded in S₂ (*Aegle marmelos*) at harvest stage. This might be due to consistent supply of nutrient to the maize plants by the decomposed green leaf manures of *Albizia lebbek*, which might have released the nutrient present in the leaves resulting in increased cell division and cell elongation, thereby increased

Table 1. Effect of Vrکشayurvedic practices on plant height, LAI, DMP and yield of maize

Treatment	Plant height (cm)	LAI	DMP (kg/ha)	Yield (kg / ha)
GLM -Incorporation (M)				
M ₁ - <i>Albizia lebbek</i>	191.9	5.19	7251	1751
M ₂ - <i>Gliricidia sepium</i>	169.2	4.56	6227	1502
M ₃ - <i>Leucaena leucocephala</i>	180.8	4.21	5582	1357
M ₄ - <i>Delonix regia</i>	185.2	4.69	6347	1588
M ₅ - <i>Peltophorum ferrugineum</i>	179.0	4.90	6533	1607
SEd	4.7	0.30	127	153
CD (p=0.05)	9.5	0.70	353	322
GLE Foliar Spraying (S)				
S ₁ - <i>Alangium salvifolium</i>	179.7	4.62	6173	1533
S ₂ - <i>Aegle marmellos</i>	175.6	4.30	5924	1516
S ₃ - <i>Morinda tinctoria</i>	182.0	4.77	6600	1563
S ₄ - <i>Annona squamosa</i>	187.6	5.15	6855	1633
SEd	3.2	0.20	72	83
CD (p=0.05)	6.4	0.50	153	165
Interaction M X S				
SEd	7.9	0.61	188	232
CD (p=0.05)	15.7	1.2	458	454
C ₁ - Zero input	109.7	4.56	835	305
C ₂ CPG	211.9	5.51	11532	3900

the plant height (Tripathi *et al.* 2000). The same reason may also be attributed to higher plant height under recommended dose of fertilizers. This might be also due to the inorganic fertilizers, which were readily available for growth of the plant through better fertilizer use efficiency (Thilakavathy, 1998). The zero input control recorded the least plant height (109.7 cm) since there was no external application of organic or inorganic source of nutrients.

The leaf area index (LAI) which determines the total assimilating area available for translocation to the sink showed differential response. With respect to LAI, among the treatments significantly higher LAI of 5.19 was recorded under M₁ (*Albizia lebbek*) registered which was followed by M₅ *Peltophorum ferrugineum* which recorded an LAI of 4.90. The

minimum LAI was recorded in M₃ *Leucaena leucocephala* at harvest stage.

The foliar spraying of leaf extract had a significant effect on LAI in maize. Among the treatments, S₄ *Annona squamosa* recorded higher LAI of 5.15. It was followed by S₃ *Morinda tinctoria* with a value of 4.77 and the least LAI of 4.30 at harvest stage was observed with S₂ *Aegle marmellos*. This might be due to availability of nutrients to the crop during different growth phases and could have improved the LAI (Patel *et al.*, 2003). The recommended dose of inorganic fertilizers recorded the highest LAI. This might be due to the application of inorganic fertilizers, and uptake by plants and utilization of nutrients, which has become constituent of nucleic acid, which might have promoted cell division resulting in

increased vegetative growth (Musmade and Knode, 1986). Similar observations were recorded by Sirohi *et al.* (1998) in onion. The absolute control recorded the least LAI, which might be due to low level of nutrients in the soil as evidenced from the initial analysis of the soil hence the utilization would have been also in the lower side.

In respect of DMP, at harvest stage, the highest DMP (7251 kg ha⁻¹) was recorded in M₁ (*Albizia lebbek*), which was followed by M₅ *Peltophorum ferrugineum* with DMP of (6533 kg ha⁻¹) and the lowest DMP (5582 kg ha⁻¹) was recorded in M₃ (*Leucaena leucocephala*). Foliar spraying of S₄ *Annona squamosa* recorded the highest DMP of 6855 kg ha⁻¹. It was followed by S₃ (*Morinda tinctoria*) which recorded a DMP of 6600 kg ha⁻¹ and the lowest DMP of 5924 kg ha⁻¹ was recorded in S₂ (*Aegle marmelos*) at harvest stage. This might be due to faster decomposition of the green leaf manures and subsequent availability and better uptake of nutrients which increased plant height, LAI and dry matter production in the crop (Bheemaiah and Subra maniyan, 2004). The presence of secondary metabolites in the leaf extracts might have increased the dry matter production (Malik, 2000). Similar observations were recorded by Swaminathan and Gururajan (2005) in green gram. The recommended dose of inorganic fertilizers recorded the highest values in all growth parameters. This might be due to nutrient availability and better uptake of nutrients and increased LAI and plant height with better photosynthetic activity and accumulation (Rather *et al.*, 2003). As usual, the zero input recorded the lowest growth parameters. This might be due to the non-availability of the nutrients from the soil to the plant.

The incorporation of green leaf manures had significant effect on grain yield of maize (Table 1). Grain yield was higher (1751 kg ha⁻¹) in M₁ (*Albizia lebbek*), followed by M₅ *Peltophorum ferrugineum*: 1607kg ha⁻¹ and the lowest (1357 kg ha⁻¹) yield was recorded with M₃ (*Leucaena leucocephala*).

The foliar spraying of leaf extract had significant effect on grain yield of maize. S₄ (*Annona squamosa*) recorded higher grain yield of 1633 kg ha⁻¹. It was followed by S₃ (*Morinda tinctoria*) which recorded a grain yield of 1563 kg ha⁻¹ and the least grain yield was recorded under S₂ (*Aegle marmelos*) (1516 kg ha⁻¹), which was five times higher than the zero input management and almost 50 per cent of the yield realized from high input management (CPG management).

Higher positive influence of soil microbial population influenced by the application *Albizia lebbek* green leaf manures, higher concentration of micronutrients in *Annona squamosa* as foliar spray supported by low incidence of pest and weed infestation have attributed for the better performance of *Albizia lebbek* + *Annona squamosa* combination in terms of yield. Increasing soil microbes enhances

root-hair formation and thereby increases root uptake capacity by secreting growth hormones and there by yield can be increased. (Tien *et al.*, 1979). The foliar application of tree leaf extracts increased yield and nutrition of green gram, due to the presence of microelements and plant growth regulators (Zodape *et al.*, 2010). The recommended dose of inorganic fertilizers recorded the highest grain yield per hectare. This might be due to increased nutrient availability and better uptake and utilization of nutrient. The more number of leaves might have increased the photosynthates which could have lead to better source - sink relationship to accumulate more of the stored food (Chelladurai, 2006). Similar observation was recorded by Thilakavathy and Ramasamy (1998) in aggregatum onion and Devi *et al.* (2003) in multiple onions. The zero input recorded lower yield. This might be due to low level of nutrients in the soil.

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