

EFFECT OF ORGANIC FOLIAR NUTRITION ON GROWTH AND YIELD OF MAIZE (*Zea mays L.*)

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ABSTRACT

A field experiment was conducted during July to October 2016 under deep clay soil at the Experimental farm, Faculty of Agriculture, Annamalai University to study the effect of organic foliar nutrition on growth and yield of maize (*Zea mays L.*). The experiment was conducted in randomized block design and replicated thrice. The experiment comprised of ten treatments viz., control (water spray), liquid organic supplements jeevamrutha, beejamrutha, vermiwash at 3 and 5% concentration applied 3 times on 20, 40 and 60 DAS. The results of the experiment showed that foliar spray of 5% jeevamrutha on 20, 40 and 60 DAS significantly recorded higher growth, yield attributes and yields of maize viz., plant height, leaf area index (LAI), dry matter production (DMP), cob length and cob diameter, number of grains cob⁻¹, test weight, grain and stover yield. Significantly lowest values for growth attributes, yield attributes, grain and stover yields of maize were recorded under control. Based on the above, it could be concluded that, foliar spray of 5% jeevamrutha on 20, 40 and 60 DAS would help to increase productivity and profitability of maize under Cauvery delta region of Tamil Nadu.

Keywords: Jeevamrutha, Beejamrutha, Vermiwash, Foliar spray, Maize, Grain and Stover yield.

INTRODUCTION

Maize (*Zea mays L.*) is an important and versatile cereal grown over diverse environment and geographical ranges for human food, feed and fodder for livestock. It also serves as a basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries etc. (Arvaidya *et al.*, 2012). In terms of global production, Maize (*Zea mays L.*) is largest grown cereal in the world and comes third in terms of consumption after rice and wheat. Maize, popularly known as “Queen of Cereals” is a miracle crop grown in more than 130 countries of different continents (Preetha and Stalin. 2014). Worldwide maize is grown over an area of 168 million hectares with a production of 945.8 million tonnes and with the productivity of 5.7 t ha⁻¹. In India, maize occupies an area of 9.43 million hectares with a production of 24.35 million tonnes and the productivity of 2.54 t ha⁻¹. In Tamil Nadu, it is cultivated in an area of 0.22 million hectares with production of 0.81 million tonnes and a productivity of 3.7 t ha⁻¹. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. The use of liquid organic manures such as beejamrutha, jeevamrutha and vermiwash results in higher growth, yield and quality of crops. Beejamrutha and jeevamrutha contains macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms (Table A and B) (Gadewar *et al.*, 2013). Vermiwash is a liquid fertilizer collected after the passage of water through a column of worm activation. It is a collection of excretory and secretory products of earthworms, along with major micronutrients of the soil and soil organic molecules that are useful for plants (Kaur *et al.*, 2015). Several strategies were initiated to boost the productivity of maize. One among them being the efficient way is foliar application of liquid organic manures for exploiting the maximum genetic potential of the crop. Recently, many studies have reported that beejamrutha, jeevamrutha and vermiwash as foliar spray is effective. But research studies on different doses of aforesaid liquid manures on maize crop were meagre. Therefore, the present study was undertaken to find out the response of different concentration of beejamrutha, jeevamrutha and vermiwash on growth and grain yield of maize in Cauvery delta region of Tamil Nadu.

MATERIALS AND METHODS

Field experiment was conducted at the experimental farm, department of Agronomy, Annamalai University, Annamalai nagar and Tamil nadu to study the effect of organic foliar nutrition on growth and yield of maize (*Zea mays L.*). The experimental farm is geographically located at 11°24'N latitude, 79° 44'E longitude and +5.79 m above mean sea level. The experimental soil was clay loam in texture with pH 7.8, EC 0.45 dsm⁻¹, organic carbon 0.55 and low N (227.0 Kg ha⁻¹), medium in P (23 Kg ha⁻¹) and high in K (254 Kg

ha⁻¹). The experiment comprising of ten treatments viz., T₁ - control (water spray), T₂ - foliar spray of 3 % jeevamrutha on 20, 40 and 60 DAS, T₃ - foliar spray of 3 % beejamrutha on 20, 40 and 60 DAS, T₄ - foliar spray of 3 % vermiwash on 20, 40 and 60 DAS, T₅ - foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS, T₆ - foliar spray of 5 % Beejamrutha on 20, 40 and 60 DAS, T₇ - foliar spray of 5 % vermiwash on 20, 40 and 60 DAS, T₈ - foliar spray of 8 % jeevamrutha on 20, 40 and 60 DAS, T₉ - foliar spray of 8 % beejamrutha on 20, 40 and 60 DAS and T₁₀ - foliar spray of 8 % vermiwash on 20, 40 and 60 DAS. The experiment was laid out in a randomized block design with three replications. The maize hybrid Pioneer 30B07 was chosen for the study. The recommended seed rate of 20 kg ha⁻¹ was used for the experiment. The seeds were sown by dibbling with a spacing of 60 X 20 cm. The fertilizers were applied to the experimental field as per the recommended manurial schedule of 135:62.5:50 kgs of N, P₂O₅ and K₂O ha⁻¹. The entire dose of phosphorus, potassium and half dose of nitrogen was applied as basal. The remaining half dose of nitrogen was top dressed in two equal splits at 25 and 45 days after sowing. As per treatment schedule liquid organic manures were applied. All necessary management practices were carried out as per standard recommendation for maize crop. The growth and yield attributing characters such as plant height, LAI, DMP, number of grains cob⁻¹, cob length, cob girth and test weight of maize were recorded from 5 randomly selected plants. Grain and stover yields were also recorded from each plot. The crop was harvested manually at full maturity. The harvested crop of the plot was bundled separately, tagged properly and bring to the clean threshing floor. The data on various studies recorded during the investigation were subjected to statistical scrutiny suggested by Gomez and Gomez (1984).

Chemical composition of the liquid organic manures

The chemical composition of the liquid organic manures chosen in the study was analyzed using standard methodologies (Cappuccino, 2014). The parameters tested includes, pH, conductivity (EC), Total N, P, K, Ca, Mg, Fe, Zn, Indole acetic acid (IAA) and gibberellic acid (GA). All three liquid manures were also tested for specific group microbes that includes bacteria, fungi, actinomycetes, phosphate solubilizers and free living nitrogen fixers using standard microbiological enumeration techniques (Cappuccino, 2014).

Table A. Chemical composition of Jeevamrutha, Beejamurtha and Vermiwash

Parameters	Beejamurtha	Jeevamrutha	Vermiwash
pH	8.2	7.07	7.11
Soluble salt (EC) dSm-1	5.5	3.40	2.11
Total Nitrogen (PPM)	40	770	6.3
Total Phosphorus (ppm)	155.4	166	48.86
Total Potassium (ppm)	252.0	126	245.67
Total Zinc (ppm)	2.96	4.29	0.03
Total Copper (ppm)	0.52	1.58	0.35
Total Iron (ppm)	15.35	282	2.21
Total Manganese (ppm)	3.32	10.7	0.04
IAA (ppm)	7.1	7.9	5.43
GA ₃ (ppm)	3.9	4.5	3.5

Table B. Microbial population in Jeevamrutha, Beejamurtha and Vermiwash

Organisms	Beejamurtha	Jeevamrutha	Vermiwash
	(cfu /ml)	(cfu /ml)	(cfu /ml)
Bacteria	15.40×10 ⁵	19.70×10 ⁵	2.40 x10 ⁶
Fungai	10.50×10 ³	13.40×10 ³	9.46 x10 ⁴
Actinomycetes	6.80×10 ³	3.50×10 ³	2.0×10 ³
Free living nitrogen fixers	3.10×10 ²	4.60×10 ²	3.0×10 ³
Phosphate solubilising organisms	2.70×10 ²	4.20×10 ²	7.3×10 ⁴

RESULTS AND DISCUSSION

Effect of organic supplements on growth attributes

All the treatments significantly influenced the growth attributes of maize. Among the treatments, foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS (T₅) recorded significantly higher plant height (202.57 cm) and LAI (8.09). This could be attributed to greater potential of growth promoting substances in jeevamrutha which helps to enhance carbohydrate synthesis and effective translocation of photosynthates which would contribute to improvement in growth attributes. Similar findings have also been reported by

Suresh Dhapke *et al.* (2013). The same treatment also registered significantly higher dry matter production of 13485 kg ha⁻¹. This might be due to availability of significant quantity of vitamins and natural phytohormones in jeevamrutha in a balanced form resulting in increased DMP. The results were in accordance with the report of Amareswari Uma and Sujathamma (2014). The least values of growth attributes was registered under control (T₁).

Effect organic supplements on yield and yield attributes

The yield potential of maize is determined by yield attributes and the values of yield attributes were in accordance with that of growth parameters. Among the various treatments, foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS (T₅) registered significantly higher cob length (22.38 cm) and cob girth (14.07 cm) and hundred grains weight (28.93 g). Higher availability of growth promoting substances such as IAA, GA, cytokinin, kinetin, essential plant nutrients, effective microorganisms were present in jeevamrutha that directly influenced LAI, increased photosynthetic activity and assimilate partitioning from source to sink might be attributed to increased yield attributes in this treatments. These results were in agreement with the findings of Sreenivasa *et al.* (2010). The control plot (T₁) recorded the least values of yield attributes.

In respect of grain and stover yield, foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS (T₅) significantly registered higher grain yield (5863 kg ha⁻¹) and stover yield (8119 kg ha⁻¹). However it was on par with foliar spray of 5 % beejamrutha on 20, 40 and 60 DAS. Foliar spraying with jeevamrutha could have created stimuli in the plant system which in turn increased the production of growth regulator in cell system and the action of growth regulators in plant system stimulated the necessary growth and development, leading to better yield. Besides the easy transfer of nutrients and growth stimulants to plants through foliar spray of optimum dose of jeevamrutha might be the reason for enhancement in grain yield. The results confirms the findings of Sridar *et al.* (2011). Harvest index parameter was also registered higher value under this treatment. However it was not significantly superior over other treatments. The least grain yield (3637 kg ha⁻¹) and stover yield (5245 kg ha⁻¹) was registered under T₁ (control).

CONCLUSION

Thus, on the basis of the experimental findings, it can be concluded that foliar spraying of 5 % jeevamrutha on 20, 40 and 60 DAS may be taken up to get higher grain yield of maize. If the availability of jeevamrutha is limited, foliar spraying with 5 % beejamrutha can also be recommended for getting higher yield in maize under Cauvery delta region of Tamil Nadu.

Table 1. Effect of liquid organic supplements on growth and yield attributes of maize

Treatments	Plant height (cm)	Leaf Area index	DMP (kg ha ⁻¹)	Cob length (cm)	Cob girth (cm)	Number of grains cob ⁻¹	100 grains weight (g)
T ₁	125.48	5.02	8365	13.82	8.73	272.78	25.49
T ₂	161.60	6.46	10773	17.80	11.24	351.30	26.93
T ₃	159.22	6.37	10615	17.54	11.08	346.13	26.75
T ₄	150.21	6.01	10014	16.55	10.45	327.55	26.42
T ₅	202.57	8.09	13485	22.38	14.07	438.73	28.93
T ₆	197.65	7.91	13177	21.77	13.75	429.68	28.62
T ₇	187.58	7.50	12505	20.66	13.05	407.78	28.09
T ₈	176.81	7.07	11788	19.48	12.30	384.38	27.68
T ₉	174.40	6.94	11560	19.10	12.06	377.15	27.44
T ₁₀	163.94	6.56	10930	18.06	11.40	356.40	27.11
SEd	3.65	0.12	257	0.41	0.24	8.63	0.18
CD (P=0.05)	7.42	0.26	526	0.83	0.52	17.54	0.39

T₁ – control (water spray), T₂ - foliar spray of 3 % jeevamrutha on 20, 40 and 60 DAS, T₃ - foliar spray of 3 % beejamrutha on 20, 40 and 60 DAS, T₄ - foliar spray of 3 % vermiwash on 20, 40 and 60 DAS, T₅ - foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS, T₆- foliar spray of 5% beejamrutha on 20, 40 and 60 DAS, T₇- foliar spray of 5 % vermiwash on 20, 40 and 60 DAS, T₈ – foliar spray of 8 % jeevamrutha on 20, 40 and 60 DAS, T₉ – foliar spray of 8 % beejamrutha on 20, 40 and 60 DAS, T₁₀ – foliar spray of 8 % vermiwash on 20, 40 and 60 DAS

Table 2. Effect of liquid organic supplements on grain and stock yields of maize

Treatments	Grain yield (Kg ha ⁻¹)	Stover yield (Kg ha ⁻¹)	Harvest index
T ₁ - control (water spray),	3637	5245	40.95
T ₂ - foliar spray of 3 % jeevamrutha on 20, 40 and 60 DAS	4684	6629	41.40
T ₃ - foliar spray of 3 % beejamrutha on 20, 40 and 60 DAS	4615	6547	41.35
T ₄ - foliar spray of 3 % vermiwash on 20, 40 and 60 DA	4354	6196	41.27
T ₅ - foliar spray of 5 % jeevamrutha on 20, 40 and 60 DAS	5863	8119	41.93
T ₆ - foliar spray of 5% beejamrutha on 20, 40 and 60 DAS	5729	7954	41.87
T ₇ - foliar spray of 5 % vermiwash on 20, 40 and 60 DAS	5437	7587	41.75
T ₈ - foliar spray of 8 % jeevamrutha on 20, 40 and 60 DAS	5125	7197	41.59
T ₉ - foliar spray of 8 % beejamrutha on 20, 40 and 60 DAS	5026	7074	41.54
T ₁₀ - foliar spray of 8 % vermiwash on 20, 40 and 60 DAS	4752	6717	41.43
SEd	122	144	1.25
CD (P=0.05)	246	296	NS

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