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RESEARCH ARTICLE

EVALUATION OF DIFFERENT ORGANIC SUPPLEMENTS ON GROWTH AND YIELD ENHANCEMENT IN ZEA MAYS

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ABSTRACT

Field experiments were conducted at experimental farm, Faculty of Agriculture, Annamalai University, Chidambaram in two seasons to study the effect of foliar spray of Panchagavya, humic acid and Kunapanjola on the growth and yield of maize. The experiments were laid out in Randomized Block Design with eleven treatments and replicated thrice. The treatments include foliar spraying of three different organic products viz., Panchagavya, humic acid and kunapanjola with three levels of spray along with inorganic nutrient application on maize. The results revealed that application of 100% recommended dose of fertilizers (RDF) and 3 sprays (20,40 and 60 DAS) of 3 % Panchagavya recorded the highest growth and yield attributes and yield of maize and this was followed by application of recommended dose of fertilizers (100 %) along with 3 sprays (20,40 and 60 DAS) of 3 % humic acid during both the seasons. The least growth and yield parameters were recorded in absolute control without use of organic products and inorganic fertilizers. The increase in growth and yield of maize was mainly attributed by greater availability of nutrients through soil application (100 % RDF) and foliar spray of panchagavya at various stages of crop growth.

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INTRODUCTION

Maize, a crop of worldwide economic importance, provides approximately 30% of the food calories to more than 4.5 billion people in 94 developing countries. The demand for maize is expected to double worldwide by 2050. Maize is considered as the third most important food crop among the cereals in India and contributes to nearly 9% of the national food basket. Grown in an area of 8.55 mha with an average productivity of 2.5 t ha⁻¹, maize contributes to more than half of the coarse cereal production of the country (Jat et al. 2007). The annual maize production in India is about 21.7 mt with an annual growth rate of 3 to 4 % (ASG, 2009). Maize yields in India need to be increased significantly to sustain this growth rate to meet India's growing food, feed and industrial needs. Strong market demand and resilience of maize to abiotic and biotic stresses have increased the area and production of maize in the country over the past decade. Productivity of maize, however, has not increased proportionately and significant yield gaps are evident across maize growing areas in the country. Maize is an exhaustive crop and removes large amounts of plant nutrients from the soil to support high biomass production. With increased awareness on organic farming among the farming community their use of many organic formulations in crop production is increasing.

During the last few years there has been increasing interest in the use of panchagavya, beejamrutha, kunapanjola, jeevamrutha and other liquid organic formulations. Panchagavya and kunapanjola are two organic products which have received wide spread attention and acceptability among organic farming community. They proved to be efficient plant growth stimulants which enhances the biological efficiency of crops and the nutritional quality of the fruits and vegetables. Swaminathan (2007) and Devakumar et al., (2008) reported the presence of naturally occurring beneficial microorganism's predominantly lactic acid bacteria, yeast, actinomycets, photosynthetic bacteria, nitrogen fixers, phosphorus solublisers and fungi in panchagavya. Similarly, Humic acid is another organic component obtained from humic substances, which is an intimate part of the soil organic structure which is highly effective in improving soil condition and plant growth (Pettit, 2004). Humic matter is formed through the biological and chemical humification of dead animal and plant parts and through the biological actions of microorganisms, having high molecular weight, resistance to decay and ranging in color from yellow to black. Humic acid, which is used as a commercial product normally contains, 6-8% H, 44-58% C, 0.5-4% N, 42-46% O and many other components (Larcher, 2003). Humic acid may be utilized in agriculture as a fertilizer, plant growth promoter, nutrient carrier and soil conditioner (Bidegain et al., 2000). The aim and objective of our present study were to investigate the integrated effect of foliar spraying of organic inputs viz., panchagavya, kunapanjola and

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humic acid along with inorganics on growth and yield attributes and yield of maize.

MATERIALS AND METHOD

To investigate the integrated effect of foliar spraying of panchagavya, kunapajala and humic acid along with inorganics, two field experiments were conducted at experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil nadu, India for two seasons. The experimental fields were clay loam and the pre sowing soil fertility status recorded were low in available N, medium in available P and high in available K and with a pH of 7.8.

Preparation of Kunapajala: Kunapajala was prepared by following the procedures outlined by Sarkar et al., (2014). It contained fish scale waste 10Kg, grind sesame oil cake 4 kg, rice husk 4kg, molasses 4kg and fresh cow urine 30L. These ingredients were taken in an 80L plastic pot, mixed well and allowed to ferment aerobically in shade for 60 days, the preparation was sieved well with the help of a fine cloth and stored for use. 3 liters of Panchagavya and Kunapajala filtrate was diluted in 100 liters of water and sprayed according to the treatment schedule at different growth stages of maize crop. Humic acid was obtained from Nachalur farmers producers company, Nachalur, Karur D.T. Tamil nadu. The experiments consists of 11 treatments comprising of three different organic compounds Viz Panchagavya , Kunapajala and humic acid

Table 1. Influence of foliar application of organic supplements on growth and yield attributes in hybrid Maize

Treatments	Plant height		DMP (kg/ha)		Test weight (g)	
	Season I	Season II	Season I	Season II	Season I	Season II
T1 - Absolute control	151.6	158.3	6160	6675	25.4	25.5
T2 - Recommended dose of Fertilizers alone	163.5	164.9	9100	9576	25.6	25.6
T3 - T2 + Foliar spray of panchagavya at 30 DAS	180.3	182.6	10894	11491	25.6	25.7
T4 - T2 + Foliar spray of panchagavya at 25 and 50 DAS	196.8	202.2	12076	12863	25.8	25.9
T5 - T2 + Foliar spray of panchagavya at 20, 40 and 60 DAS	205.6	211.4	13002	13850	25.9	26.1
T6 - T2 + Foliar spray of Kunapajala at 30 DAS	170.6	173.3	9981	10456	25.5	25.5
T7 - T2 + Foliar spray of Kunapajala at 25 and 50 DAS	187.3	191.8	11606	12296	25.7	25.8
T8 - T2 + Foliar spray of Kunapajala at 20, 40 and 60 DAS	198.3	203.7	12301	13157	25.8	25.9
T9 - T2 + Foliar spray of humic acid at 30 DAS	172.7	175.1	10055	10664	25.6	25.6
T10 - T2 + Foliar spray of humic acid at 25 and 50 DAS	190.6	194.2	11703	12518	25.8	25.8
T11 - T2 + Foliar spray of humic acid at 20, 40 and 60 DAS	200.1	205.2	12402	13272	25.9	26
SEd	2.2	2.3	265	282	0.8	0.9
CD	5.4	5.7	530	561	NS	NS

Table 2. Influence of foliar application of organic supplements on grain and stover in hybrid Maize

Treatments	Grain yield (kg/ha)		Stover yield (kg/ha)	
	Season I	Season II	Season I	Season II
T1 - Absolute control	2124	2286	4036	4389
T2 - Recommended dose of Fertilizers alone	3321	3482	5779	6094
T3 - T2 + Foliar spray of panchagavya at 30 DAS	4111	4320	6783	7171
T4 - T2 + Foliar spray of panchagavya at 25 and 50 DAS	4773	5064	7303	7799
T5 - T2 + Foliar spray of panchagavya at 20, 40 and 60 DAS	5180	5496	7822	8354
T6 - T2 + Foliar spray of Kunapajala at 30 DAS	3683	3844	6298	6612
T7 - T2 + Foliar spray of Kunapajala at 25 and 50 DAS	4464	4711	7142	7585
T8 - T2 + Foliar spray of Kunapajala at 20, 40 and 60 DAS	4862	5180	7439	7977
T9 - T2 + Foliar spray of humic acid at 30 DAS	3724	3935	6331	6729
T10 - T2 + Foliar spray of humic acid at 25 and 50 DAS	4501	4796	7202	7722
T11 - T2 + Foliar spray of humic acid at 20, 40 and 60 DAS	4902	5225	7500	8047
SEd	115	121	174	181
CD	230	241	347	363

Preparation of Panchagavya: Panchagavya solution was prepared adopting the methodology described previously with minor modification (Natarajan, 2007). Briefly, fresh cow dung (7 Kg), cow ghee (1 Kg), fresh cow urine (10 liter), cow milk (3 liter), cow milk curd (2 liter), jaggery (3 Kg) and ripened banana (2 Kg) were mixed in an open plastic container. On the first day, 7 Kg cow dung was mixed with 1 Kg cow ghee and kept for 72 hours followed by addition of 10 liter cow urine and 10 liter water. The mixture was stirred twice in a day and allowed to ferment for 15 days. On the 18th day, 3 Kg cow milk, 2 Kg cow curd, 3 Kg jaggery and 2 Kg banana were added in the mixture and allowed to ferment for further seven days while stirring twice a day. The Panchagavya was ready for use after a period of 25 days. When stirred twice daily, the Panchagavya solution can be kept for six months without any deterioration in its quality. Whenever the solution becomes thick due to evaporation of water over a long period, suitable quantity of water was added to keep it in a liquid state.

applied as foliar spraying at different stages of crop growth along with recommended dose of fertilizers. The experiment was laid out in Randomized Block design and replicated thrice. The recommended dose of fertilizers in Tamil Nadu is 135 :62.5:50 kg of N:P₂O₅:K₂O / ha. Maize hybrid NK 6240 was used as the test crop for both the seasons. Observations on plant height, dry matter production, test weight, grain and stover yields at harvest were recorded. Data were analyzed separately for both years. All the data on growth attributes and yield in the experiments were statistically analysed as suggested by Panse and Sukhatame (1978). The critical differences were worked out at 5 % probability level.

RESULTS AND DISCUSSION

Growth parameters: The plant height (table 1) was significantly increased with application of full dose of nutrients along with foliar spray of organic substances. Among

the treatments, application of 100 % recommended dose of fertilizer along with three sprays of three per cent panchagavya at 20, 40 and 60 DAS recorded the tallest plants of 204.9 and 213.5 cm during first and second seasons, respectively. This was followed by treatment T11, T8 and T4 and they were on par with each other. This might be due to assimilation of nutrients through applied nutrient at required time leads to tallest plants compared to all other treatments. In addition to this, application of RDF + panchagavya foliar spray increased the plant height due to increase in protein synthesis and cell regulators such as IAA, GA, etc. The highest dry matter production was observed under T5 (100 % RDF of NPK + Pancha-gavya spray 3 times @ 3 per cent concentration) at both the seasons of the study. This treatment was found to be significantly superior over the other treatments by recording the highest dry matter production of 7822 and 8354 Kg ha⁻¹ at harvest during two seasons respectively. These results were in accordance with findings of Sridhar (2003). The least dry matter production of 4036 and 4389 Kg ha⁻¹ at harvest was recorded under absolute control (T1).

Yield components and yield: The perusal of the data (Table 2) indicated that there was no significant difference noticed in respect of test weight of the grains in both the seasons as it is a genetic character. The organic liquid manures are eco-friendly organic preparations made from cow products and contain macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting substances like IAA, GA and beneficial microorganisms. In the present study, higher growth, and yield of crops are due to these factors which are in confirmation with findings of Natarajan (2007). In the present study grain and stover yields of maize varied significantly due to foliar application of organic fertilizers along with recommended dose of fertilizer to that of absolute control. The highest yield of maize is observed in the 100 % RDF + spraying of 3 % Panchagavya at 20, 40 and 60 DAS. This might be due to adequate supply of nutrients at different growth stages of the crop as well as presence of growth regulators in Panchagavya contributing to higher grain yield (Sridhar *et al.*, 2001 and Somasundaram *et al.*, 2003). The yield of any crop plants depends on the assimilatory surface of the plant system. A sound source in terms of plant height, LAI, Stem girth to support and hold the leaves are logically able to increase the dry matter and its distribution in different parts is important for determination of total yield of the a crop. Next in order of higher corn yield was recorded in treatment which receives foliar spraying of humic acid at three different DAS along with recommended dose of fertilizers. The least corn yield and stover yield was recorded under absolute control and this might be due to lack of adequate supply of nutrients (nitrogen, phosphorus and potassium) during the critical crop growth

stages which in turn affected the growth of the crop ultimately reflecting on grain and stover yield.

Conclusion

Based on the study, application of 135:62.5:50 kg of N: P₂O₅: K₂O along with three sprays of three per cent panchagavya at 20, 40 and 60 DAS recorded the highest growth and yield parameters, grain and stover yields in hybrid maize. It can be concluded that application of higher dose of inorganic nutrients (100 % RDF) along with 3 % Panchagavya improved the growth attributes which ultimately reflected on the yield of corn. Use of these formulations in organic farming would help framers to get higher yield and returns besides improvement in soil physical, chemical and biological properties. These formulations can be prepared locally by resource poor farmers and improve soil health, besides obtaining higher returns to the farmers in rural areas.

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