



EFFECT OF DIFFERENT SOURCES OF ORGANIC MANURE GRANULES ON THE GROWTH OF HYBRID MAIZE

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Abstract

The field experiment was conducted to study the effect of inorganic fertilizers and organic granules in growth parameters of hybrid maize at Annamalai University Experimental Farm, Annamalai Nagar, during February – May, 2016. The experiments comprised of (T₁) Recommended Dose of Fertilizer (RDF) (250:75:75) NPK kg ha⁻¹, (T₂) 75% RDF + Humic acid granules @ 12.5 kg ha⁻¹, (T₃) 75% RDF + Seaweed extract granules @ 20 kg ha⁻¹, (T₄) 75% RDF + Organic manure granules (Pressmud + ash) @ 100 kg ha⁻¹, (T₅) 75% RDF + Bone meal granules @ 12.5 kg ha⁻¹, (T₆) 50% RDF + Humic acid granules @ 12.5 kg ha⁻¹, (T₇) 50% RDF + Seaweed extract granules @ 20 kg ha⁻¹, (T₈) 50% RDF + Organic manure granules (pressmud+ash) @ 100 kg ha⁻¹, (T₉) 50% RDF + Bone meal granules @ 12.5 kg ha⁻¹. The application of 75 per cent RDF + humic acid granules @ 12.5 kg ha⁻¹ (T₂) significantly registered highest values. The least values were recorded with 75 per cent RDF + bone meal granules 12.5 kg ha⁻¹ (T₉).

Key Words: Bone meal granules, Hybrid maize, Inorganic fertilizers, Humic acid granules Organic manure granules, Sea weed granules.

Introduction

Maize (*Zea mays* L.) is the third important cereal crop next to rice and wheat in the world. Its potential could not be utilized fully due to lack of proper agronomic management practices like nutrient management, season and variety. The productivity of maize is largely dependent on its nutrient management. Maize, being an exhaustive crop depletes a major portion of plant nutrients from soil by crop harvesting. Unless the soils are supplied with nutrients removed by the crop, it will be great threat to sustain crop production.

The use of chemical fertilizers is the quickest and surest way of boosting crop production, but their continuous use alone is not able to sustain the maize yield. It is well known that maize is a heavy feeder of nutrient. The organic sources besides supplying N, P and K also make unavailable sources of elemental nitrogen, bound phosphates, micronutrients, and decomposed plant residues into an available form to facilitate to plant to absorb the nutrients.

Organic manure induced improvement in soil

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physical, chemical and biological properties. Building up of secondary and micro-nutrients, counteracting deleterious effects of soil acidity, salinity and alkalinity and substances of soil health are the key beneficial effects associated with organic manure granules application. Use efficiency of N fertilizers is improved in the presence of organic manures. The concept of integrated nutrient management (INM) gains momentum in recent years to improve and maintain the soil health. Besides this, with escalating cost of energy based fertilizer material, limited fossil fuels, INM approach combines the use of organic sources along with fertilizers, which would be remunerative for getting higher yields with considerable fertilizer economy

Humic acid is a principal component of humic substance, which is the major organic constituent of soil (humus), peat and coal. It is also major organic constituents of many upland streams, dystrophic lake, and ocean water. It is produced by biodegradation of dead organic matter. It is not a single acid; rather, it is a complex mixture of many different acids containing carboxyl and phenolate groups so that mixture behaves functionally as a dibasic acid or occasionally, as a tribasic acid. Humic acid can

form complexes with iron that are commonly found in the environment creating humic colloids and fulvic acid that is commonly used as a soil supplement in agriculture.

Marine algal seaweed species are often regarded as an underutilized bio resource, many have been used as a source of food, industrial raw materials, in therapeutic and botanical applications for centuries. Moreover, seaweed and seaweed-derived products have been widely used as amendments in crop production system due to the presence of a number of plant growth-stimulating compounds. The effect of seaweed extract is due to the microelements and plant growth regulators such as cytokinin present in it. Seaweed extract is used as a foliar spray, application to soil and for soaking of seeds before sowing. Seaweed extract is effective for ripening of fruits, increasing shelf-life of the produce, improves the quality of produce, and serves as an excellent soil conditioner (Zodape, 2001).

Bone meal which is a by-product contains considerable quantity of macro and micro nutrients and has a great scope for being used as source of organic manure for agricultural crops. Bone meal is essentially meal or powder made from ground up animal bone, normally beef bones, but the can be bones of any animal commonly slaughtered. Pressmud is one of the by-products of sugar factory which is also produced to the tune of 2 per cent of the weight of sugarcane crushed. In India about 5.2 million tonnes of pressmud is produced annually. Pressmud is a good source of organic manure with NPK, and important micronutrients and has established its importance in improving fertility, productivity and other physical properties of the soils. Hence, a study was undertaken with the objective to find the influence of inorganic fertilizers and organic manure granules in growth parameters of hybrid maize (*Zea mays* L.).

Materials and method

The field experimental was conducted to study the influence of inorganic fertilizers and organic manure granules in growth parameters of hybrid maize at Annamalai University, Experimental Farm, Annamalai Nagar, during February–May, 2016. The experimental farm is situated at 11°24' N latitude, 79° 44' E longitude and at an altitude of + 5.79 m above the mean sea level. The weather at Annamalai nagar is moderately warm with hot summer months. The mean annual rainfall received at Annamalai nagar is 1500 mm distributed over 60 rainy days. Out of total rainfall, 1000 mm is received during North East Monsoon, 400 mm is received during South West Monsoon and 100 mm during hot weather period as summer showers. The maximum relative

humidity is 96 per cent during October to December and the least is 76 per cent during May to August. The soil of the Experimental Farm is deep clay, low in available nitrogen, medium in available phosphorus and high in available potassium. Nine treatment combinations were studied in RBD with three replications. The maize variety chosen for the experiment was PIONEER 30B07 with a spacing of 60×30 cm was adopted. The treatment comprised of (T₁) Recommended Dose of Fertilizer (RDF) (250:75:75) NPK kg ha⁻¹, (T₂) 75% RDF + Humic acid granules @ 12.5 kg ha⁻¹, (T₃) 75% RDF + Seaweed extract granules @ 20 kg ha⁻¹, (T₄) 75% RDF + Organic manure granules (Pressmud + ash) @ 100 kg ha⁻¹, (T₅) 75% RDF + Bone meal granules @ 12.5 kg ha⁻¹, (T₆) 50% RDF + Humic acid granules @ 12.5 kg ha⁻¹, (T₇) 50% RDF + Seaweed extract granules @ 20 kg ha⁻¹, (T₈) 50% RDF + Organic manure granules (pressmud+ash) @ 100 kg ha⁻¹, (T₉) 50% RDF + Bone meal granules @ 12.5 kg ha⁻¹. The observation on growth parameters was recorded. The growth parameters which were observed during experiment includes plant height at different growth stages, LAI and DMP.

The plant height was measured from the base of the plant to tip of the last opened leaf. The plant height was measured at 30, 60 DAS and at harvest and expressed in cm. The leaf area was measured on the leaves of the tagged plants at 30 and 60 DAS and the LAI was calculated by using the formula suggested by Francis *et al.* (1969). The plants selected at random in two border rows were cut at 30, 60 DAS and at harvest for estimating DMP. The collected samples were chopped, air dried and then oven dried at 80°C till concordant values were obtained. The dry weight of samples were recorded and expressed in kg ha⁻¹. Statistical analysis was carried out as per the procedure suggested by Panse and Sukhatme (1978).

Result and discussion

Growth Attributes

The data on plant height was recorded at 30, 60 DAS, and at harvest are given in table 1. Among the treatments, application of 75 per cent RDF + humic acid granules @ 12.5 kg ha⁻¹ (T₂) significantly recorded the highest plant height of 95.36, 224.36, 265.67 cm at 30 DAS, 60 DAS and at harvest stage, respectively. The treatments *viz.*, application of 100 per cent RDF (T₁) and 75 per cent RDF + organic manure granules (pressmud + ash) @ 100 kg ha⁻¹ (T₄) were next in order and were on par with each other. The other treatments, 75 per cent RDF + seaweed extract granules @ 20 kg ha⁻¹ (T₃), 75 per cent RDF + bone meal granules @ 12.5 kg ha⁻¹ (T₅), 50 per

cent RDF + humic acid granules 12.5 kg ha⁻¹ (T₆), 50 per cent RDF + organic manure granules (pressmud + ash) @ 100 kg ha⁻¹ (T₈), 50 per cent RDF + seaweed extract granules @ 20 kg ha⁻¹ (T₇) were next in order of ranking at all the stages of crop growth. The treatment 50 per cent RDF + bone meal granules 12.5 kg ha⁻¹ recorded the lowest plant height of 71.78, 173.86, 200.78 cm respectively, at 30, 60 DAS and at harvest.

With regard to LAI, the application of 75 per cent RDF along with humic acid granules @ 12.5 kg ha⁻¹ at 30 DAS (T₂) significantly recorded the highest LAI values of 3.79, 8.05 at 30 DAS and 60 DAS respectively. The treatments *viz.*, application of 100 per cent RDF (T₁) and 75 per cent RDF + organic manure granules (pressmud + ash) @ 100 kg ha⁻¹ (T₄) were next in order and was on par with each other. The least LAI values of 1.92 and 5.25 respectively at 30 DAS and 60 DAS were observed with 50 per cent RDF + bone meal granules 12.5 kg ha⁻¹ (T₉).

The data on dry matter production was recorded at 30 DAS, 60 DAS and at harvest. The dry matter production (DMP) of maize was influenced by varied management practices. In general the value of DMP showed linear response to advancement in age of the crop. Among the treatments, application of 75 per cent RDF + humic acid granules @ 12.5 kg ha⁻¹ (T₂) was

significantly registered the highest DMP of 3819, 7260 and 10,881 kg ha⁻¹ respectively at 30 DAS, 60 DAS and at harvest stage. The treatments *viz.*, application of 100 per cent RDF (T₁) and 75 per cent RDF + organic manure granules (pressmud + ash) @ 100 kg ha⁻¹ (T₄) were next in order and was on par with each other. The other treatments 75 per cent RDF + seaweed extract granules @ 20 kg ha⁻¹ (T₃), 75 per cent RDF + bone meal granules @ 12.5 kg ha⁻¹ (T₅), 50 per cent RDF + humic acid granules 12.5 kg ha⁻¹ (T₆), 50 per cent RDF + organic manure granules (pressmud + ash) @ 100 kg ha⁻¹ (T₈), 50 per cent RDF + seaweed extract granules @ 20 kg ha⁻¹ (T₇) were next in order of ranking at all the stages of crop growth. The treatment 50 per cent RDF + bone meal granules 12.5 kg ha⁻¹ (T₉) has recorded the lowest DMP of 2819, 5119, 7852 kg ha⁻¹ at 30, 60 DAS and at harvest, respectively.

The increase in the growth parameters of maize in the humic acid granules treatments is due to the improvement of soil condition of the root zone and also soil analysis indicated that humic acid maintain soil nutrients supply compared to control. These results are in conformity with the findings of Ihsanullah Daur and Ahmed Bakhaswain (2013). The increase in the plant height in the humic acid granules treatment is also due to the improvement of growth of the root zone. Humic acid

Table 1: Effect of different sources of organic manure granules on the growth of hybrid maize.

Treatments	Plant Height (cm)			Leaf area index		Dry matter production (kg ha ⁻¹)		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	30 DAS	60 DAS	harvest
T ₁ - Recommended Dose of Fertilizer (RDF) (250:75:75) NPK kg ha ⁻¹	92.68	218.45	257.83	3.61	7.76	3699	7005	10489
T ₂ - 75% RDF + Humic acid granules @ 12.5 kg ha ⁻¹	95.36	224.36	265.67	3.79	8.05	3819	7260	10881
T ₃ - 75% RDF + Humic acid granules @ 12.5 kg ha ⁻¹	86.16	206.45	243.27	3.26	7.31	3470	6550	9783
T ₄ - 75% RDF + Organic manure granules (Pressmud + ash) @ 100 kg ha ⁻¹	90.37	212.78	250.83	3.48	7.58	3591	6803	10150
T ₅ - 75% RDF + Bone meal granules @ 12.5 kg ha ⁻¹	83.25	198.73	235.16	2.96	7.02	3326	6297	9412
T ₆ - 50% RDF + Humic acid granules @ 12.5 kg ha ⁻¹	80.38	192.48	226.84	2.74	6.49	3203	6018	9047
T ₇ - 50% RDF + Seaweed extract granules @ 20 kg ha ⁻¹	74.59	180.42	209.53	2.18	5.83	2941	5416	8241
T ₈ -50% RDF + Organic manure granules (pressmud+ash) @ 100 kg ha ⁻¹	77.53	186.53	218.47	2.35	6.24	3067	5712	8657
T ₉ - 50% RDF + Bone meal granules @ 12.5 kg ha ⁻¹	71.78	173.86	200.78	1.92	5.25	2819	5119	7852
S.Ed	1.25	2.77	3.43	0.07	0.11	55.45	117.50	169.91
CD(p=0.05)	2.67	5.88	7.29	0.16	0.23	117.56	249.11	360.21

generally increases plant growth through chelating different nutrients to overcome the lack of nutrients, and has useful effects on increased growth, production, and quality improvement of agricultural products due to having hormonal compounds. The improvement in plant height and LAI with the use of humic acid granules enhanced the plant growth and dry matter (Khattak and Muhammad, 2008). These results are in line with the findings of Hamid *et al.* (2014).

The consistent increments observed with the values of plant height and LAI might have positively reflected on dry matter production. Increments in values of growth attributes of maize through the integration of inorganic fertilizers and organic manure granules were also reported by Kamran Azeem *et al.* (2015). Application of organic manure granules improvement in soil physical properties *viz.*, texture, structure and porosity and making a suitable environment for root's growing. The soil application of humic acid granules has remarkable effects on vegetative growth of plant and increases photosynthetic activity and leaf area index of maize. These results were also in line with the findings of Halime *et al.* (2011).

Application of 50 per cent of recommended dose of fertilizers + bone meal granules 12.5 kg ha^{-1} (T_9) resulted in the least values of growth parameters attributable to the absence of beneficial effect of humic acid and lesser levels of NPK. The slow release pattern of nutrients from bone meal might be the reason for lower values of varied growth attributes of maize with bone meal granules. The results are in conformity with the findings of Simoes *et al.* (2012).

Among the treatments integrated nutrient management approach of application of 75 per cent RDF + humic acid granules @ 12.5 kg ha^{-1} (T_2) significantly resulted in the highest plant height, leaf area index and

dry matter production in maize. The growth parameters, including plant height, LAI and dry matter yield generally indicated improvement with soil application of humic acid granules.

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