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Effect of soluble fertilizers on yield and quality parameters of maize

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Abstract

The objective of this experiment was to evaluate the impact of foliar fertilizers applied on maize (*Zea mays* L.). Fertilizers were applied at different growth stages of maize. A field experiment was conducted during kharif 2012-13 on the research farm of Department of Soil Science and Agricultural Chemistry, VNMKV, Parbhani to study the effect of soluble fertilizers on yield and quality parameter of maize. The treatments comprised of basal soil application dose @ 150:75:75: N, P₂O₅, K₂O kg ha⁻¹ and foliar applications of starter (11:36:24 NPK kg ha⁻¹), booster (08:16:39 NPK kg ha⁻¹) and multi micronutrient notified grade-II. The experiment was laid out in Randomized Block Design with ten treatments replicated thrice. The soil and plant samples were collected at various plant development stages. The application of 100% RDF + two spray of 2% starter and booster recorded maximum height, number of leaves, number of cobs and chlorophyll content. Similarly higher grain and dry matter yield was achieved with the application of 100% RDF + two spray of 2% starter and booster and the quality parameters *viz.* protein and carbohydrate content were found higher in the same treatment. Thus, it can be concluded that the application of 100% RDF + 2% Two sprays of starter and booster resulted in higher yield and improve quality of produce was observed with the application of 100% RDF and 2% two sprays of each starter and booster of Maize.

Keywords: Total yield, grain yield, fodder yield, protein, carbohydrate

Introduction

Maize (*Zea mays* L) is one of the most important cereal of the world and known as queen of cereals because, it has the highest genetic yield potential among the cereals. It occupies third position next to wheat and rice, since it has been cultivated for grain and fodder purpose. (Kumar *et al.*, 2007) [5]. Maize provides nutrients for human and animals. It also provides protein known as 'Zein' and every part of maize has economic value *viz.* grain, leaves, stalk and cob, which is used to produce large quantity of food and nonfood products thus known as a miracle crop. Indian soils are generally deficient in N, P, K, S and micronutrients. Some soils have characteristics such as low or high pH, presence of poorly available minerals or have undergone certain processes (erosion, leaching, etc.), which make nutrients depleted. Thus the lack of nutrients has become a worldwide problem. Furthermore, the resources of mineral P will be exhausted in the near future, causing an even larger problem in agriculture. In an intensive agriculture, plants lack of an optimal levels of essential nutrients, particularly micro-elements, 'Zein' and every part of maize has economic value *viz.* grain, leaves, stalk and cob, which is used to produce large quantity of food and nonfood products thus known as a miracle crop. Micro elements availability in soil is closely related to their solubility. A deficiency of macro and micronutrients drastically affects the growth, metabolic activities and reproductive phase in plants. To fulfill the deficiencies of nutrients in soil, farmers apply fertilizers in large quantities which is the key factor for good growth and high yield. However, fertilizer application should be in optimum quantity to meet the crop nutrient requirement and to achieve targeted yield on sustainable basis.

The advantage of foliar application is direct involvement of nutrients into metabolism of the plant tissue, with a very low consumption of energy for transportation within the plant. The absorption of nutrients through leaves is virtual opportunity to combine fertilizer application with that of pesticides, and in many cases it is with synergistic effects. Hence, whenever nutrients are not available to plant, at specific stage of crop, under such situation, use of water soluble fertilizers through foliar application is a better way for enhancing crop productivity (El-Fouly *et al.* 2012) [1].

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Methodology

A field experiment was conducted in order to study effect of specialty fertilizers on experimental farm of Department of Soil Science and Agricultural Chemistry, MKV during *kharif* 2012-2013. The experimental site was slightly alkaline in reaction, medium in organic carbon, non calcareous in nature, low in available N and P and high in available K and sufficient in micronutrient. The recommended fertilizer dose 150:75:75 N, P₂O₅, K₂O kg ha⁻¹. The basal dose of nitrogen, phosphorus and potassium were applied in soil at the time of sowing. Nitrogen can be applied in two splits at the time of sowing and after 60 days of sowing with NPK sprayed by starter and booster and micronutrients were applied through Grade II. Composition of starter, booster and grade II - Starter 11:36:24 + Trace Element, Booster 08:16:39 + Trace Element, Grade II Cu (1%), Zn (3%), B (0.5%), Mn (1%), Fe (2.5%) and Mo (0.1%). Three replication with 10 treatment.

Treatments Details

T1 - Control

T2 - 100% RDF 150:75:75 NPK (kg ha⁻¹)

T3 - 100% RDF NPK (kg ha⁻¹) + Water spray

T4 - 100% RDF NPK (kg ha⁻¹) + one spray each of starter and booster

T5 - 100% RDF NPK (kg ha⁻¹) + two spray of starter and booster

T6 - 80% RDF NPK (kg ha⁻¹) + one spray each of starter and booster

T7 - 80% RDF NPK (kg ha⁻¹) + two spray of starter and booster

T8 - 60% RDF NPK (kg ha⁻¹) + one spray each of starter and booster

T9 - 60% RDF NPK (kg ha⁻¹) + two spray of starter and booster

T10 - 100% RDF +Multimicronutrient Grade II

Result and Discussion

Grain and fodder Yield

The grain yield of maize during 2012-13 ranged from 29.50 to 45.23 q ha⁻¹. The significantly highest grain yield (45.23 q ha⁻¹) was recorded with application of 100% RDF + two spray of 2% starter and booster over control. Foliar spray of shelter (Combination of micronutrients) involved in enzyme activation, membrane integrity, chlorophyll formation, stomata regulation and starch utilization at early stage, while enhanced accumulation of assimilate in the grains, which results in heavier grains of wheat at later stages Khan *et al.*, (2010)^[3].

Table 1: Effect of foliar application of soluble fertilizers on grain yield, dry matter yield and total biomass

Tr. Code	Treatment	Grain yield (q ha ⁻¹)	Fodder yield (q ha ⁻¹)	Total biomass (q ha ⁻¹)
T ₁	Control	29.50	47.60	76.56
T ₂	RDF 150:75:75 NPK kg ha ⁻¹	37.70	56.70	95.40
T ₃	100% RDF + water spray	39.36	58.90	98.26
T ₄	100% RDF + one spray of starter and booster	43.60	64.10	108.03
T ₅	100% RDF + two spray of starter and booster	45.23	66.51	111.55
T ₆	80% RDF +one spray of starter and booster	41.56	62.26	103.83
T ₇	80% RDF + two spray of starter and booster	42.83	63.31	106.15
T ₈	60% RDF + one spray of starter and booster	33.56	51.16	84.83
T ₉	60% RDF + two spray of starter and booster	35.56	54.93	90.50
T ₁₀	100%RDF + four spray of multimicronutrient Grade II	40.83	60.93	101.76
	S.E(m)±	1.65	2.06	2.67
	CD at 5%	4.90	6.14	7.95

The highest fodder yield (66.51 q ha⁻¹) was obtained from treatment receiving 100% RDF + two spray of 2% starter and booster (T₅) and were found at par with treatments T₄, T₇, T₆ and T₁₀. Similarly, Hanan *et al.*, (2012)^[2] has also noticed that, foliar application of macro and micronutrients has recorded

highest dry matter yield as compared to other methods of fertilizer application. The probable reason for this might be the beneficial effect of foliar application of soluble fertilizers which has proved effective in harvesting the higher fodder yield.

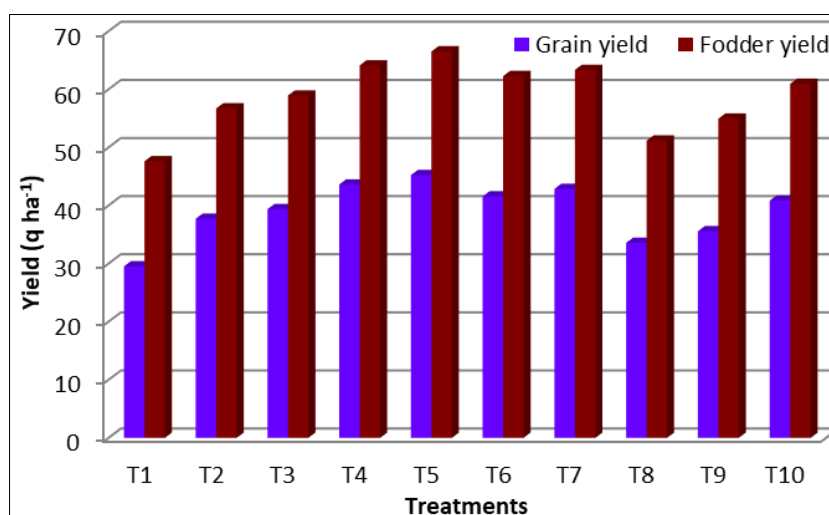


Fig 1: Treatment details

Among the different foliar applications, the treatment T₅ (RDF + two spray of 2% starter and booster) recorded maximum total biomass production (111.55 q ha⁻¹). The minimum biomass production (76.56 q ha⁻¹) was recorded in treatment T₁ (Control). Effect of fertilizers and micronutrients sprays were significant on corn biological yield. Foliar application of macro and micronutrient increased biological yield as reported earlier by Piri Issa *et al.*, (2012)^[6].

Protein and carbohydrate content in maize

The protein content in grain was significantly higher in treatment 100% RDF +two spray of starter and booster (11.24%) and it was lowest in T₁ treatment (9.81%), however,

treatment T₅ was at par with T₄ (11.12%), T₇ (11.05%), T₆ (10.99%) and T₁₀ (10.85%). Increased protein content in maize grain may be due to the most important role of nitrogen fertilizer in plant is mainly in its presence in nucleic acid protein structure. In addition, nitrogen is also found in chlorophyll molecule. Spraying with 1% urea increase in protein yield, this may be due to stimulating effect of urea through improving the physiological performance of plants and multiple advantage of foliar application method such rapid and efficient response to the need of plant and independence of soil conditions. Similar type of results were also reported by Yildirim *et al.*, (2007)^[7].

Table 2: Effect of foliar application of soluble fertilizers on protein and carbohydrate content in maize

Tr. Code	Treatment	Protein (%)	Carbohydrate (%)
T ₁	Control	9.81	65.62
T ₂	RDF 150:75:75 NPK kg ha ⁻¹	10.49	66.94
T ₃	100%RDF + water spray	10.60	68.87
T ₄	100% RDF + one spray of starter and booster	11.12	72.18
T ₅	100% RDF +two spray of starter and booster	11.24	72.98
T ₆	80% RDF +one spray of starter and booster	10.99	70.85
T ₇	80%RDF + two spray of starter and booster	11.05	71.74
T ₈	60% RDF + one spray of starter and booster	10.14	65.66
T ₉	60% RDF + two spray of starter and booster	10.30	66.67
T ₁₀	100% RDF + four spray of multimicronutrient Grade II	10.85	69.88
	S.E(m)+	0.18	0.45
	CD at 5%	0.53	1.34

The carbohydrate content in maize grain was significantly higher in treatment T₅ (72.98%), over treatment T₁ (65.62%) It is suggested that SA application might activate the metabolic consumption of soluble sugar to from new cell constituents as a mechanism to stimulate the growth of maize plant Khodary (2004)^[4]. The starch, amylase and amylopectin are significantly increased by application of STR + micronutrients spray Kumar (2007)^[5].

Conclusion

Based on obtained results, it can be concluded that foliar fertilizing with fertilizer which contains NPK and micronutrient in the soluble form expressed positive effects on the maize parameters. The best results in the grain yield increase were observed with the application of 100% RDF + two spray of starter and booster. It can be concluded that the foliar application of 2% Two sprays of starter and booster along with RDF resulted in the significant increase in grain and straw yield and improve quality parameters *viz.* protein and carbohydrate content of maize were found higher in the same treatment.

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