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Response of Foliar Nutrition on Growth, Yield and B:C Ratio of Hybrid Maize (*Zea mays* L.) in Southern Transition Zone of Karnataka

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ABSTRACT

The field experiment was conducted to study the effect of foliar nutrition on growth and yield of hybrid maize (*Zea mays* L.) in Southern Transitional Zone of Karnataka' at College of Agriculture, Karekere, Hassan. The field experiment was laid out in randomised complete block design with three replications consisting of seven treatments. The soil was red sandy loam with neutral in reaction (pH 6.9) and the electrical conductivity was normal (0.09 dSm^{-1}). The available nitrogen content in the soil was Medium (340.5 kg ha^{-1}), whereas the available phosphorus was high (54.3 kg ha^{-1}) and low potash (217.5 kg ha^{-1}). Soil application of 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS recorded significantly higher accumulation of total dry matter of maize at 60 DAS and at harvest (168.52 and 474.10 g $plant^{-1}$, respectively) (T_8) as compared to recommended UAS-B package (111.61 and 352.99 g $plant^{-1}$, respectively) (T_9). Yield parameters such as cob weight (214.60g), cob length (19.43 cm) and number of kernels per row (18.37) were significantly higher with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS which was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS, 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS.

Keywords : Foliar nutrients, Growth, B:C Ratio, Maize

MAIZE (*Zea mays* L) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. It is cultivated on nearly 150 m ha in about 160 countries having wider diversity of soil, climate, biodiversity and management practices that contributes 36 per cent (782 mt) in the global grain production. The United States of America (USA) is the largest producer of maize which contributes nearly 35 per cent of the total production in the world and maize is the driver of the US economy. The USA has the highest productivity (> 9.6 t ha^{-1}) which is double than the global average (4.92 t ha^{-1}). Whereas, the average productivity in India is 2.43 t ha^{-1}. Maize crop has better yield response to chemical or inorganic fertilizers (Anonymous, 2014). Hence heavy doses of these fertilizers are applied to maize. Though these practices temporary helps to increase the production of crop, it leads to deterioration of natural resources (*viz.* land, water and air) because of high input intensive cultivation. Over reliance on use of chemical fertilizers has been associated with declines in soil physical and chemical properties and crop yield (Hepperly *et al*., 2009) and significant land problems, such as soil degradation due to over exploitation of land and soil pollution caused by high application rates of fertilizers and pesticide application.

Foliar nutrition is designed to eliminate the problems like fixation and immobilization of nutrients. Hence, foliar nutrition is being recognized as an important method of fertilization in modern agriculture especially under moisture limited situation. This method provides for utilization of nutrients more efficiently for correcting deficiencies rapidly. Recently, new generation special fertilizers have been introduced exclusively for foliar feeding and fertigation. Specialty fertilizers are better source for foliar application. These fertilizers have different ratios of N, P and K which are highly water

soluble and amenable for foliar nutrition (Jayabal *et al.,* 1999).

Maize growth and yield are adversely affected under nutrients and moisture stress conductions. Foliar application of major nutrients (NPK) as sole or in combination improves growth, increase yield and yield components of maize under moisture stress condition. Foliar nutrients application not only provides the nutrients to the hungry plants under dry land condition but it also provide water to the thirsty maize plants under drought condition.

Material and Methods

A field experiment was conducted in Randomized Block Design which consists of nine treatments with three replications at College of Agriculture, Hassan, University of Agricultural Sciences, Bangalore during *kharif*-2016. The experimental site is geographically situated in the Southern Transitional Zone (Zone - 7) of Karnataka and located between 12º 13' and 13º 33' N Latitude and 75º 33' and 76º 38' E Longitude at an altitude of 827 m above Mean Sea Level (MSL).

The soil is red sandy loam with neutral in reaction (pH 6.9) and the electrical conductivity was normal (0.09 dSm^{-1}). The available nitrogen content in the soil was Medium (340.5 kg ha^{-1}), whereas the available phosphorus was high (54.3 kg ha^{-1}) and low potash (217.5 kg ha^{-1}).

The experiment consists of nine treatments with three replications laid in RCBD design.

The treatments details are as follows,

Treatment Details

T_1 : 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS

T_2 : 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS

T_3 : 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS

T_4 : 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS

T_5 : 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS

T_6 : 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS

T_7 : 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS

T_8 : 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS

T_9 : Recommended UAS-B package (100:50:25 kg N : P_2O_5: K_2O ha^{-1})

Note: Recommended FYM (10 t ha^{-1}) and $ZnSO_4$ (10 kg ha^{-1}) soil application as per POP is common to all plots. Water soluble macro nutrient 19: 19: 19 (NPK) was sprayed at the rate of one per cent concentration.

Results and Discussion

Plant Height

Among all the treatments (T_8), 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS registered significantly taller plants (243.6 cm) and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (235 cm) (T_7), 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (234.33 cm) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (233.33 cm) compared to other treatment and lower plant height was recorded with recommended UAS-B package (201.33cm) (T_9) (Table 1).

The growth of the plant is the net result of the interplay of diverse metabolic activities taking place in the different parts of the plant during its growth and development in accordance with the supply of light, water, temperature and nutrients from the environment. The plant leaves powered by sunlight, convert simple compounds *viz.,* carbon dioxide and water into carbohydrates and other compounds that are required for growth. The synthesis, accumulation and translocation of these metabolites to the economic part of the plant are often influenced by environmental condition. Previous research has shown that plant height correlates highly with biomass or grain yield, so

TABLE 1

Growth parameters of maize as influenced by foliar application of water soluble macronutrients

Treatments	Growth Parameters			
	Plant height at harvest(cm)	Leaf area at 60 DAS(cm^2)	Total dry matter at 60 DAS (g)	Total dry matter at harvest(g)
T_1: 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	207.33	7462	116.43	379.59
T_2: 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	216.00	7637	125.13	392.36
T_3: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	233.33	8619	144.59	422.01
T_4: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	234.33	8817	149.46	434.61
T_5: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	215.67	7964	134.08	403.07
T_6: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	221.33	8103	135.37	412.55
T_7: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	235.00	9026	162.61	455.11
T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	243.67	9166	168.52	474.10
T_9: Recommended UAS-B package (100:50:25 kg $N:P_2O_5:K_2O$ ha^{-1})	201.33	7165	111.61	352.99
SE.m±	6.48	230	8.01	18.40
C.D. (P=0.05)	19.43	690	24.02	55.18
C.V.(%)	10.56	10	10.00	7.70

Note: Recommended FYM (10 t ha^{-1}) and $ZnSO_4$ (10 kg ha^{-1}) soil application as per POP is common to all plots. Water solublmacro nutrient 19: 19: 19 (NPK) was sprayed at the rate of one per cent and two per cent concentration,
DAS : Days after sowing; NS : Non-significant; RDF : Recommended dose offertilizer

it is used for estimating biomass (Salas Fernandez *et al.*, 2009 & Han *et al*., 2019) and grain yield (Yin *et al*., 2011; Barrero Farfan *et al*., 2013 and Geipel *et al*., 2014).

Leaf Area

At 60 DAS, among the treatments, (T_8) 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS registered significantly higher leaf area (9166 cm^2 $plant^{-1}$) (T_8) and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (9026 cm^2 $plant^{-1}$) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (8817 cm^2 $plant^{-1}$) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (8619 cm^2 $plant^{-1}$) (T_3) compared to other treatment and lower leaf area was recorded with recommended UASB package (7165 cm^2 $plant^{-1}$) (T_1) (Table 1).

The increase in leaf area could also be due to increased plant height and number of leaves. All these factors combined together caused increase in dry matter production and its accumulation in fruiting parts (sink) and finally the yield. These results were in concordance with Amanullah *et al.* (2010).

Total Dry Matter (g)

At 60 DAS, among the treatments (T_8), 100 per cent RDF + two per cent water soluble macro nutrient foliar

spray at 30, 45 and 60 DAS registered significantly higher dry matter accumulation in stem (168.52 g plant^{-1}) and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (162.61 g plant^{-1}) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (149.46 g plant^{-1}) T_4 and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (144.59 g plant^{-1}) (T_3) copared to other treatment and lower dry matter accumulation in stem was recorded with recommended UAS-B package (111.61g plant^{-1}) (T_9) (Table 1). All the growth parameters combined together caused increase in dry matter production and its accumulation in fruiting parts and finally the yield. These results were in concordance with Amanullah *et al.* (2010).

At harvest, among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS registered significantly higher dry matter accumulation in stem (474.10 g plant^{-1}) and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (455.11 g plant^{-1}) T_7 and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (434.61g plant^{-1}) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (422.01 g plant^{-1}) (T_3) compared to other treatment and lower dry matter accumulation in stem was recorded with recommended UAS-B package (352.99 g plant^{-1}) (T_9) (Table 1).

Cob Weight (g)

Foliar application of water soluble macro nutrient had significant influence on cob weight of maize. Among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS found significantly superior with respect to cob weight (214.60 g) as compared to other treatments and it was at par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (205.60 g) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (196.27 g) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (188.50 g) (T_3), while recommended UAS-B package registered significantly lower cob weight (166.20g) (T_9) (Table 2). These results were in concordance with Drocelle Nirere *et al.* (2019). This increase in yield components was mainly due to high dry matter production and its partition in fruiting parts which in turns give significantly high yield. Similar results were reported by Abd EL-Fattah *et al.* (2012) in maize and also Hasina *et al.* (2011) in wheat.

Cob Length (cm)

Cob length of maize was significantly influenced by foliar application of water soluble macro nutrient. Among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS found significantly superior with respect to coblength (19.43 cm) as compared to the treatments and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (18.03 cm) (T_7), 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (17.13 cm) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (16.91 cm) (T_3). While recommended UAS-B package registered significantly lower cob length (13.90 cm) (T_9) (Table 2). These results were in concordance with Drocelle Nirere *et al.* (2019).

Number of Kernel Rows per Cob

Among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS recorded significantly more number of kernel rows per cob (18.37) as compared to other treatments and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (18.01) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (17.33) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (16.54) (T_3). While recommended UAS-B package registered significantly

lower number of kernel rows per cob (14.40) (T_9) (Table 2). These results were in concordance with Drocelle Nirere *et al.* (2019).

Kernel Weight per Plant

The kernel weight per plant in maize varied significantly due to foliar application of water soluble macro nutrient. Among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS recorded significantly higher kernel weight plant^{-1} (181.73 g) as compared to other treatments and it was at par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (176.44 g) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (171.56 g) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (169.68g) (T_3). While recommended UAS-B package registered significantly lower kernel weight plant^{-1} (129.37 g) (T_9) (Table 2). These results were in concordance with Drocelle Nirere *et al.* (2019).

Kernel Yield

The seeds yield of maize was significantly influenced by foliar application of water soluble macro nutrient. Among the treatments, T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS recorded significantly higher kernel yield (101.50 kg ha^{-1}) as compared to the treatments

TABLE 2

Yield parameters of maize as influenced by foliar application of water soluble macro nutrients

Treatments	Cob weight (g)	Cob length (cm)	No .of kernel row cob^{-1}	Kernel weight plant^{-1}(g)	Kernel yield(qha^{-1})	Harvest index
T_1: 75 per cent RDF + one per cent water soluble nutrient macro foliar spray at 30 and 45 DAS	173.50	14.50	15.01	139.26	77.50	0.58
T_2: 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	178.90	15.00	15.40	149.46	81.87	0.59
T_3: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	188.50	16.91	16.54	169.68	91.80	0.60
T_4: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	196.27	17.13	17.33	171.56	94.60	0.61
T_5: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	183.17	15.94	15.90	159.46	83.66	0.57
T_6: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	186.17	16.01	16.01	161.84	86.66	0.59
T_7: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	205.60	18.03	18.01	176.44	99.11	0.61
T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	214.60	19.43	18.37	181.13	101.50	0.62
T_9: Recommended UAS-B package (100:50:25 kg N:P_2O_5:K_2O ha^{-1})	166.20	13.90	14.40	129.37	60.63	0.48
SE.m±	8.19	0.65	0.64	5.01	2.55	0.01
C.D. (P = 0.05)	24.57	1.95	1.93	15.02	7.67	0.05
C.V. (%)	7.54	11.45	8.81	8.53	10.75	7.73

Note: Recommended FYM (10 t ha^{-1}) and $ZnSO_4$ (10 kg ha^{-1}) soil application as per POP is common to all plots. Water soluble macro nutrient 19: 19: 19 (NPK) was sprayed at the rate of one per cent and two per cent concentration
DAS : Days after sowing ; NS : Non significant; RDF : Recommended dose of fertilizer

and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (99.11 q ha^{-1}) (T_7) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (94.60 q ha^{-1}) (T_4) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (91.80q ha^{-1}) (T_3). While recommended UAS-B package registered significantly kernel yield (60.63 q ha^{-1}) (T_9) (Table 2).

This increased yield in above treatments were mainly attributed to better availability of plant nutrients as per the crop need, since, foliar nutrition through WSF easily penetrates the leaf cuticle or stomata and enter the cells facilitating easy and rapid utilization of nutrients. These results are in line with the findings of Amanullah *et al.* (2014) who reported that combined application of water soluble macro nutrient through foliar spray produced maximum kernel yield in maize as compared to application of individual nutrients only. With respect to frequency of application, foliar application of nutrients at two per cent in 30, 45 and 60 DAS at vegetative and reproductive stage found to be better as compared to 30 and 45 at vegetative stage and one per cent in 30, 45 and 60 DAS at vegetative and reproductive stage. Similar findings were also reported by Abd El-Fattah *et al.* (2012) and Singh *et al.* (2005) in maize and Chaurasia *et al.* (2005) in tomato and Muhammad Arif *et al.* (2006) in wheat. Drocelle Nirere *et al.* (2019).

Harvest Index

The harvest index of maize differed significantly due to foliar application of water soluble macro nutrient. The significantly higher harvest index was registered with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (0.62) (T_8) as compared to recommended UAS-B package (0.48) and it was on par with 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (0.61) (T_9) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (0.61) and 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (0.60) (T_3) and 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (0.59) (T_6) and 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (0.57) (T_5) and 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (0.59) (T_6) and 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (0.58) (T_1) (Table 2). This was mainly attributed to better source-sink relationship in T_{89}. In foliar nutrition treated plot the leaves remain green even after harvest of crop and they efficiently synthesized food and translocated to sink.

Economics

The data on cost of cultivation, gross returns, net returns and B:C ratios are given in the Table 3. The cost of cultivation was higher in the treatment: T_8 receiving 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (Rs.39,141 ha^{-1}) followed by 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (Rs.38,981 ha^{-1}) (T_7). While, the higher gross returns were obtained in the treatment: T_8 receiving 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (Rs.1,08, 207 ha^{-1}) followed by 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (Rs.105,681 ha^{-1}) (T_7). The results of present investigation are in conformity with the findings of Asghar *et al.* (2011) who reported 40.06 per cent higher gross returns of maize to the foliar fertilization over the application of 100 per cent recommended fertilizers (Table 2).

The net returns was found higher in the treatment (T_8) receiving 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (Rs.69,066 ha^{-1}) followed by 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (Rs.66,699 ha^{-1}) (T_7). The results are in line with Parasuraman, *et al.* (2008) who recorded the 28.19 per cent higher net income of maize to the foliar fertilization of multi-nutrients on maize over application of 100 per cent soil applied fertilizers. Asghar *et al.* (2011) in his study also recorded the

TABLE 3

Economics of maize cultivation as influenced by foliar application of water soluble macro nutrients

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B : C ratio
T_1: 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	37248	82707	45459	2.2
T_2: 75 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	37608	83806	46198	2.2
T_3: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	38631	97906	59275	2.5
T_4: 100 per cent RDF + one per cent water soluble macro nutrient foliar spray at 30, 45 and 60DAS	38791	100880	62089	2.6
T_5: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	37998	89286	51288	2.3
T_6: 75 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	38358	92453	54095	2.4
T_7: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS	38981	105681	66699	2.7
T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS	39141	108207	69066	2.8
T_9: Recommended UAS-B package (100:50:25 kg N:P_2O_5:K_2O ha^{-1})	36881	64904	28023	1.8

Note: Recommended FYM (10 t ha^{-1}) and $ZnSO_4$ (10 kg ha^{-1}) soil application as per POP is common to all plots. Water soluble macro nutrient 19: 19: 19 (NPK) was sprayed at the rate of one per cent and two per cent concentration.
DAS : Days after sowing
NS: Non-significant; RDF : Recommended dose of fertilizer; BC ratio : Benefit cost ratio

high returns (Rs.41,170 ha^{-1}) of maize to the foliar fertilization of multi-nutrients over the RDF (Rs.19,927 ha^{-1}).

The B:C ratio was found higher in the treatment (T_8) receiving 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS (2.8) followed by 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30 and 45 DAS (2.7) (T_7).

The higher B:C ratio was attributed to the more gross returns with lower cost of cultivation involved with it. The above results are concomitant with the findings of Parasuraman *et al.* (2008) where the higher B:C of 3.5 over the application of RDF alone (3.1) was recorded. Also, the Asghar *et al.* (2011) reported the higher B:C ratio of 1.07 to the foliar fertilization on maize over RDF alone (0.54) (Table 3).

From the study it can be concluded that (T_8) : T_8: 100 per cent RDF + two per cent water soluble macro nutrient foliar spray at 30, 45 and 60 DAS recorded significantly higher growth and yield parameters like plant height, number of tillers, green fodder, dry fodder, crude protein and ash content as compared to other treatments. Significantly higher gross and net returns was also recorded in T_8, compared to other treatments.

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