e-planet **19** (1): 39-45 (June 2021)

Response of hybrid maize to application of nutrients in laterite soil

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Date of receipt : 24.10.2020 Date of acceptance : 06.05.2021

ABSTRACT

A field experiment was conducted during *kharif* 2019 at the Instructional Livestock Farm, of OUAT, Bhubaneswar, India, to study the response of hybrid maize to application of nutrients in laterite soil. The hybrid maize variety Kalinga Raj (OMH 14-27) was grown for the experiment. There were eight treatments comprising nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) such as T_1-120:60:60 kg ha^{-1},T_2-120:60:60 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1},T_3-150:75:75 kg ha^{-1},T_4-150:75:75 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}, T_5-180:90:90 kg ha^{-1}, T_6-180:90:90 kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1}+Borax @10 kg ha^{-1},T_7-STBFR (150:39:45 kg N:P_2O_5:K_2O ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1} and T_8- STCR (216: 15: 21 kg N:P_2O_5:K_2O ha^{-1}) laid out in Randomized Block Design with three replications. Results revealed that, T_7 – Soil Test Based Fertilizer Recommendation (STBFR) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} recorded maximum grain yield (8256 kg ha^{-1}) and stover yield (10353 kg ha^{-1}) followed by treatment T_8- Soil Test Crop Response (STCR) based fertilizer application. Minimum grain yield (6737 kg ha^{-1}) and stover yield (9644 kg ha^{-1}) were recorded in treatment of T_1, the conventional farmers' practice is being followed in Odisha since long. The treatment T_7 also recorded the most effective plant growth parameters such as plant height (212.87 cm) and number of green leaves per plant (11.73), leaf area index (2.26), dry matter accumulation (1423.76 g m^{-2}) and crop growth rate (6.54 g m^{-2} day $^{-1}$) at the time of harvest, number of days to 50% tasseling (56.33), number of days to 50% silking (58.00) followed by T_8 which was at par with T_7. T_7 treatment also recorded significantly maximum yield attributes such as cob length (18.06 cm), cob girth (15.94 cm), number of rows per cob (15.2), number of grains per row (32.13), 1000 grain weight (282.74 g) followed by T_8. Cost of cultivation was Rs. 36000 ha^{-1} in T_1. T_7 fetched the maximum gross return (Rs.141678 ha^{-1}) and net return (Rs. 99178 ha^{-1}) with benefit: cost ratio of 3.33 which was found to be highest as compared to other approaches of nutrient management practices.

Key words: Growth parameters, hybrid maize, STBFR, STCR fertilizer application, yield attributes

INTRODUCTION

Maize (*Zea mays* L.) is the 3rd most important food crop after rice and wheat in world. Due to its photoperiod insensitivity, it can be grown throughout the year under varied climatic conditions. It has very high genetic yield potential because of its C_4 pathway, is known as the "Queen of cereals". The average *kharif* maize productivity of Odisha is higher (2098 kg ha^{-1}) than the national average productivity (2015 kg ha^{-1}). Maize is being cultivated in an area of 2.52 lakh hectares with a production of 7.45 lakh tones and productivity of

2098 kg ha^{-1} (Anon., 2016-17). The *kharif* maize contributes to the tune of 92 % to the total maize production. It is rich in carbohydrates, protein and fairly good source of calcium, phosphorus, iron, and vitamin-A, nicotinic acid and riboflavin (Kumar et al., 2016). Being an exhaustive crop, it's yield level depends on nutrient supplying capacity of the soil and requires both micro and macro nutrients in adequate quantity to obtain high growth and yield (Ghosh and Anchal, 2019). The cultivation of maize in Odisha is dependent on monsoon rainfall and nutrient removal is far excess of their replenishment under intensive cropping led to widespread multi nutrient deficiency related low productivity of crop. Fertilizer management is one of the most important factor that influence the growth and yield of maize crop. Soil test based application of plant nutrient helps to realize higher response and benefit: cost ratio as the nutrients are applied in proportion to the magnitude of the deficiency of a plant nutrient and its correlation with the nutrients imbalance in soil, helps to harness the synergistic effects of balanced fertilization (Rao and Srivastav, 2000). STCR targeted yield approach has been found to be beneficial which recommends balanced fertilization considering the soil available nutrient status and crop needs. Keeping in view the above facts, the experiment was undertaken to assess the performance of hybrid maize (var. Kalinga Raj) under various nutrient management practices in laterite soil of Bhubaneswar.

MATERIALS AND METHODS

The study was undertaken at the Instructional Livestock Farm of Odisha University of Agriculture and Technology, Bhubaneswar (20°17'N, 85 47 E, 25.9 m above mean sea level) during *kharif* season of 2019 with hybrid maize variety Kalinga Raj (OMH 14-27).The soil of the experimental site is a well drained upland land with loamy sand in texture. The pH (1:2.5, soil: water suspension), EC, soil organic carbon, available nitrogen, phosphorus, potassium, sulphur, zinc and boron content of the experimental soil were found to be 5.15, 0.65 dS m^{-1}, 0.48%, 162.5 kg ha^{-1}, 100.6 kg ha^{-1}, 413 kg ha^{-1}, 16.66 kg ha^{-1}, 14.08 kg ha^{-1} and 2.158 kg ha^{-1}, respectively. The experiment was conducted with eight treatments (T_1-120:60:60 kg N:P_2O_5:K2O kg ha^{-1}, T_2 120: 60: 60 kg N:P_2O_5: K_2O kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}, T_3-150:75:75 kg N: P_2O_5: K_2O ha^{-1}, T_4- 150:75:75 kg N: P_2O_5: K_2O ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}, T_5-180:90:90: N:P_2O_5: K_2O kg ha^{-1}, T_6-180:90:90:N:P_2O_5: K_2O kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}, T_7- STBFR (150:39:45 kg N:P_2O_5: K_2O ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} and T_8-STCR (216:15:21 N: P_2O_5: K_2O kg ha^{-1}) laid out in Randomized Block Design with three replications .The recommended dose of NPK was 120-60-60 kg N: P_2O_5: K_2O kg ha^{-1}. A uniform dose of 10 t ha^{-1} well decomposed FYM was applied during final land preparation and mixed thoroughly with soil. The chemical sources of fertilizers used for N, P and K were Urea, DAP and MOP and these were applied for the treatments. For Zn 25 kg ha^{-1} Zn SO_4 and for B borax @ 10 kg ha^{-1} were applied as per the treatments. Full dose of Zn, B, P_2O_5, K_2O and 1/3rd of N were applied as basal. The second split of N (1/3rd of total N requirement) was top dressed at knee high stage and third split of rest 1/3rd N was applied at tasseling stage. In T_7 macro nutrients were applied on the basis of Soil Test Based Fertilizer Recommendation (STBFR). In T_8 it was on the basis of Soil Test Crop Response (STCR). Soil Test Crop Response (STCR) approach is a comprehensive approach of fertilizer utilization, where in fertilizer would be applied based on the yield target, site specification, crop specification and soil test values. This equation includes parameter like:

i. Nutrient requirement (NR) kg q^{-1} of economic product,

ii. Efficiency of soil estimated nutrient (%) =Cs,

iii. Efficiency of organic matter (%) and

iv. Efficiency of fertilizer nutrient (%) =Cf

$$\text{FD (kg ha}^{-1}) = \frac{\text{NR X 100 X T}}{\text{Cf}} - \frac{\text{Cs}}{\text{Cf}} \text{ X SN or SP or SK}$$

T= Target yield in q ha^{-1}, S= soil estimated nutrient kg ha^{-1}

Here, T= 8t ha^{-1}= 80 q ha^{-1}

FN= 3.96 x T – 0.62 SN, FP_2O_3= 1.56 x T – 1.93 $SP_2O_5FK_20$= 1.66 x T – 0.27 K_2O

Hence, fertilizer dose required = 216: 15: 21 kg N: P_2O_5: K_2O kg ha^{-1}

Biometric observations were taken following standard procedure. The economics was calculated and statistical analysis of data was done following standard formulae.

RESULTS AND DISCUSSION

Data presented in Table 1 reveals that, significantly taller plants at harvest were recorded with T_7-STBFR+ $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1} followed by T_8-STCR, where as the minimum plant height was observed in T_1 due to low nutrient level. A significant and positive correlation between fertilizer dose and plant height was also observed by Kumar et al. (2007).

Significantly maximum number of leaves per plant and LAI were recorded in T_7- STBFR + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} .This might be due to balanced nutrient management with primary, secondary and micronutrients. The LAI determines the dry matter production in the plant in influencing the photosynthetic efficiency. Application of STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} in T_7 resulted in more vigorous crop growth at all phases of growth and produced maximum dry matter followed by T_8. Significantly minimum dry matter was produced in the treatment which received only 120:60:60 kg N: P_2O_5: K_2O ha^{-1} (T_1). The LAI, dry matter accumulation in T_7 were 1.29 and 1.15 per cent higher respectively than that recorded in T_1. This was in agreement with the findings of Arya and Singh (2000) and Kumar et al. (2007). More dry matter with the application of STBFR (150:39:45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @25 kg ha^{-1} + Borax @10 kg ha^{-1} (T_7) over other nutrient management practices is attributed to more number of green leaves per plant, plant height, leaf area index and dry matter production.

The results pertaining to number of days taken to 50 per cent flowering (i.e. silking in female parent and tasseling in male parent) of maize hybrid as influenced by the nutrient management practices are furnished in Table 2. The significant difference was observed on days to 50 per cent silking and tasseling in female and male parents of maize hybrid respectively due to the effect of different treatment of fertilizer applications. The female parent took maximum number of days to 50 per cent silking of 58.00 days with the application of STBFR (150:39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1} in T_7 followed by 57.33 days with the application of STCR (216:15:21 kg N: P_2O_5: K_2O ha^{-1}) in T_8. Hence, treatment T_7 was observed to be significantly superior to other treatments. Similarly, the male parent of hybrid maize took highest mean number of days to 50 per cent tasseling of 56.33 days in T_7 followed by T_8. Whereas significantly minimum number of 53.33 days were taken for 50 per cent tasseling by the male parent in T_1.

The dry matter production during post anthesis period depends upon potential ability of the plant to photosynthesize (source capacity and intensity) and the capacity of the grain (sink capacity and intensity) to accept the photosynthates. The sink is composed of cob length, cob girth, number of rows per cob, number of grains per row and grain weight. All these components have been found to be markedly influenced by the nutrient approaches applied during the period of study. Application of STBFR (150:39:45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} in T_7 recorded significantly maximum cob length (18.06 cm), cob girth (15.94 cm), number of rows per cob (15.2), number of grains per row (32.13) with bolder grains (thousand grain wt-282.74 g) followed by T_8-STCR (216: 15:21 kg N: P_2O_5: K_2O ha^{-1}). The number of grains per row and thousand grain weight in T_7 and T_8 were at par. Increased length of cobs with increased fertilizer application could be attributed to the increased physiological processes leading to higher growth and increased transport of photosynthates to sinks. Similar trend was noticed in the cob girth as that of cob length. This was due to higher rate of fertilizer application which enhanced photosynthetic rate. Similar results were reported by Arun Kumar et al. (2007).The number of rows per cob also followed same trend as that of girth and length of cob. In T_8-STCR (216:15: 21 kg N: P_2O_5: K_2O ha^{-1}) the number of rows per cob

was found to be 14.6 and the significantly least number of rows per cob (12.6) was recorded in the treatment T_1-120:60:60 kg N: P_2O_5: K_2O ha^{-1}. These results corroborated with the findings of Umesh et. al. (2014). The numbers of grains per row were 31.67 in T_8 and the lowest number of grains per row (27.48) was recorded in T_1 (Table 3). This finding was similar to the results reported by Joshi et al. (2016).

Table 1. Growth parameters at harvest as influenced by nutrient management practices in hybrid maize crop

Treatments	Plant height (cm)	Green leaves per plant (no.)	Leaf Area Index	Dry matter (g m^{-2})
T_1-120:60:60 kg N:P_2O_5:K_2O kg ha^{-1}	194.67	10.53	1.62	1234.25
T_2-120:60:60 kg N:P_2O_5:K_2O kg ha^{-1} + $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	196.27	10.87	1.77	1252.54
T_3-150:75:75 kg N:P_2O_5:K_2O kg ha^{-1}	198.53	11.00	1.85	1277.93
T_4-150:75:75 kg N:P_2O_5:K_2O kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}	201.07	11.27	1.87	1306.53
T_5-180:90:90 kg N:P_2O_5:K_2O kg ha^{-1}	204.93	11.33	1.94	1327.98
T_6-180:90:90 kg N:P_2O_5:K_2O kg ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1}	206.27	11.53	2.02	1348.69
T_7-STBFR(150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + ZnSO4 @ 25 kg ha^{-1} + Borax @10 kg ha^{-1}	212.87	11.73	2.26	1423.76
T_8-STCR (216: 15: 21 kg N: P_2O_5: K_2O kg ha^{-1})	209.60	11.67	2.17	1381.81
SEm (±)	1.27	0.08	0.028	2.01
CD (P=0.05)	3.88	0.23	0.061	6.16

Table 2. Number of days to 50% tasseling and 50% silking as influenced by nutrient management practices in hybrid maize crop

Treatments	50 % tasseling	50% silking
T_1-120:60:60 kg N:P_2O_5:K_2O ha^{-1}	53.33	54.33
T_2-120:60:60 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	53.33	54.67
T_3-150:75:75 kg N:P_2O_5:K_2O ha^{-1}	53.67	55.00
T_4-150:75:75 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}	54.00	55.67
T_5-180:90:90 kg N:P_2O_5:K_2O ha^{-1}	54.33	55.67
T_6-180:90:90 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$@25 kg ha^{-1} + Borax@10 kg ha^{-1}	54.67	56.33
T_7-STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1}	56.33	58.00
T_8-STCR (216: 15: 21 kg N: P_2O_5: K_2O ha^{-1})	55.00	57.33
SEm (±)	0.52	0.54
CD (P=0.05)	1.61	1.66

Table 3. Effect of nutrient management practices on yield attributing characters in hybrid maize crop

Treatments	Cob length (cm)	Cob girth (cm)	No. of rows per cob	No. of grains Per row	1000 grain weight (g)
T_1-120:60:60 kg N:P_2O_5:K_2O ha^{-1}	15.48	14.09	12.6	27.48	269.75
T_2-120:60:60 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	15.93	14.19	13.0	28.73	272.31
T_3-150:75:75 kg N:P_2O_5:K_2O ha^{-1}	16.38	14.31	13.2	28.26	274.65
T_4-150:75:75 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$@25 kg ha^{-1}+Borax@10 kg ha^{-1}	16.57	14.43	13.6	28.61	276.39
T_5-180:90:90 kg N:P_2O_5:K_2O ha^{-1}	16.83	14.66	13.8	29.52	277.82
T_6-180:90:90 kg N:P_2O_5:K_2O ha^{-1} +$ZnSO_4$@25 kg ha^{-1}+Borax@10 kg ha^{-1}	17.18	14.86	14.2	30.76	279.46
T_7-STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1})+$ZnSO_4$@25 kg ha^{-1} +Borax @10 kg ha^{-1}	18.06	15.94	15.2	32.13	282.74
T_8-STCR (216: 15: 21 kg N: P_2O_5: K_2O ha^{-1})	17.55	15.67	14.6	31.67	281.59
SEm (±)	0.09	0.14	0.19	0.29	2.42
CD(P=0.05)	0.29	0.42	0.51	0.92	7.52

Nutrient management practices influenced the grain yield significantly. Significantly maximum grain yield of 8256 kg ha^{-1} was obtained with the application of STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} inT_7 followed by STCR (216: 15: 21 kg N: P_2O_5: K_2O ha^{-1}) fertilizer application in T_8, where the grain yield recorded was 8184 kg ha^{-1} which were at par with each other. This yield variation was due to differences in nutrients applied and variation among the yield attributes recorded in the respective treatments in Table 4. It corroborates the findings of Singh and Patiram (2012). Enhancement in growth attributes led to photosynthesis partitioning and better source-sink relationship, which enhanced yield attributes (Kumar et al., 2015). Stover yield recorded in different treatments also followed similar trend as grain yield. The variation in stover yield due to different nutrient combinations was attributed to consequent variations in plant height, number of green leaves and total dry matter accumulation capacity of the treatments. Harvest index (HI) increased progressively with nutrients management practices significantly. Among the nutrient management practices, application of STCR (216: 15: 21 kg N: P_2O_5: K_2 O ha^{-1}) in T_8 recorded the significantly highest HI of 44.40 which was at par with T_7-STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} (44.36).

The treatment T_7-STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} gave the maximum gross return of Rs. 141678 ha^{-1} (Table 5), whereas RDF recorded significantly less gross return of Rs. 97597 ha^{-1}. The increase of gross return by T_7 over T_8 and T_1 were 1.10 and 1.45 % respectively. The increase in net return due to STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1} in T_7 over T_8- STCR (216: 15: 21 kg N: P_2O_5: K_2O ha^{-1}) and T_1-120:60:60 kg N: P_2O_5 :K_2O ha^{-1} were 1.11 and 1.61 % respectively. Highest benefit: cost ratio of 3.33 was recorded in T_7 followed by T_8 and T_1. This was in conformity with the findings of Chander et al. (2013), where soil test-based nutrient balancing was done through the application of nitrogen, phosphorus, and potassium in addition to sulphur, boron, and zinc increased crop productivity and hence proved favorable to scale-up balanced nutrition.

Table 4. Effect of nutrient management practices on yield of hybrid maize crop

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest Index (%)
T_1-120:60:60 kg N:P_2O_5:K_2O ha^{-1}	6737	9644	41.12
T_2-120:60:60 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	6867	9692	41.47
T_3-150:75:75 kg N:P_2O_5:K_2O ha^{-1}	7293	9812	42.62
T_4-150:75:75 kg N:P_2O_5:K_2O ha^{-1} +$ZnSO_4$@25 kg ha^{-1}+Borax@10 kg ha^{-1}	7503	9950	42.98
T_5-180:90:90 kg N:P_2O_5:K_2O ha^{-1}	7654	10015	43.31
T_6-180:90:90 kg N:P_2O_5:K_2O ha^{-1} +$ZnSO_4$@25 kg ha^{-1}+Borax@10 kg ha^{-1}	7892	10136	43.77
T_7-STBFR(150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$@25 kg ha^{-1} + Borax @10 kg ha^{-1}	8256	10353	44.36
T_8-STCR (216: 15: 21 kg N: P_2O_5: K_2O ha^{-1})	8184	10247	44.40
SEm (±)	79.04	99.56	0.61
CD (P=0.05)	247.66	389.30	1.9

Table 5. Economics of production as influenced by different approaches of fertilizer management practice in hybrid maize crop

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B:C Ratio
T_1- 120:60:60 kg N:P_2O_5:K_2O ha^{-1}	36000	97597	61597	2.71
T_2- 120:60:60kg N:P_2O_5:K_2O ha^{-1}+ $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	39500	108931	69431	2.76
T_3- 150:75:75 kg N:P_2O_5:K_2O ha^{-1}	37500	109207	71707	2.91
T_4- 150:75:75 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1}	40500	121207	80707	2.99
T_5-180:90:90 kg N:P_2O_5:K_2O ha^{-1}	40500	124391	83891	3.07
T_6-180:90:90 kg N:P_2O_5:K_2O ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1}+ Borax @ 10 kg ha^{-1}	43500	138459	94959	3.18
T_7-STBFR(150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25kg ha^{-1} + Borax @ 10 kg ha^{-1}	42500	141678	99178	3.33
T_8-STCR (216: 15: 21 kg N: P_2O_5:K_2O ha^{-1})	40000	129046	89046	3.23

CONCLUSION

Thus it could be concluded that application of STBFR (150: 39: 45 kg N: P_2O_5: K_2O kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + Borax @10 kg ha^{-1} produced the maximum grain yield of 8256 kg ha^{-1} and stover yield of 10353 kg ha^{-1} in hybrid maize during *kharif* season. The growth parameters and yield attributes followed the same pattern as that of grain yield. It recorded highest net return and benefit: cost ratio of Rs. 99178 per ha and 3.33 respectively. For efficient hybrid maize production in acid sandy loam soil low in organic carbon under Bhubaneswar agro-climatic condition higher fertilizer dose than the recommended according to the soil test based recommendation need to be applied i.e. Soil Test Based Fertilizer Recommendation (STBFR) and addition of Zn and B are essential for maintaining the macro and micronutrient and to improve and sustain productivity and quality of hybrid maize grown during *kharif* season.

ACKNOWLEDGEMENT

Authors are thankful to the Vice Chancellor, OUAT, Bhubaneswar for providing necessary financial and technical support for conducting the study. Also authors extend their thanks to the staffs of ICAR-AICRP project on Maize for their co-operation to undertake the study

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