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Ready Rekoner Of STCR Based Fertilizer Recommendations For Maize Grown In Mid Hills Of Meghalaya

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ABSTRACT
A maize experiment on soil test crop response (STCR) correlation studies was conducted in mid hills of Meghalaya during Kharif season of 2005. Multiple regressions equations have been calibrated for predicting maize yield through soil and fertilizer nutrients. Using the basic fertilizer response data, crop nutrient requirement per quintal of grain production, efficiency of soil available nutrients and efficiency of fertilizer nutrients were worked out. The nutrient requirement (kg q^{-1}) of N, P_2O_5 and K_2O were found to be 1.86, 1.48 and 1.02, respectively for producing one quintal of maize yield in Meghalaya.. The fertilizer adjustment equations and a ready reckoner of optimum fertilizer doses at varying soil test values for attaining yield target of 40 and 50 qha^{-1} of maize yield have been calibrated based on the targeted yield concept.
Key words*:* Maize, fertilizer equation, fertilizer recommendations, targeted yield

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INTRODUCTION

Maize is the second major cereal crop grown in the NEH Region. Maize plant thrives well in a soil having neutral soil reaction and sandy to silty clay loam in texture. Most of the soils of NEH Region are acidic and light in texture. The productivity of maize crop and per capita availability of maize in North Eastern Region of India is quite low. The production potential of the crop in Meghalaya is much higher than the average production of the crop. There is an impending need to increase the production and productivity of maize to achieve self sufficiency of livestock and for concentrate feed for the poultry. Out of several reasons for its low productivity, besides soil acidity the imbalanced nutrition of N, P and K is the most limiting one. Maize is a heavy feeder of nutrients and response of added fertilizer is very common. The balanced nutrition of NPK assumes greater significance in maize crop to increase use efficiency of NPK and to enhance productivity. Fertilizer recommendations, at present, are usually given for different crops by taking consideration only the available nutrient status of the soil prior to raising a crop, the soil being categorized as low, medium and high fertility classes. These are generalized recommendations and do not take into account the large-scale variations from field to field. An attempt has been made to develop ready rekoner of STCR based fertilizer recommendations for maize grown in mid hills of Meghalaya to achieve targeted yield.

MATERIALS AND METHODS

A field experiment based on STCR methodology on maize with the variety 'RCM 1-1' was conducted at ICAR Research Complex for NEH Region, Umiam in Riboi district from 2004-05 to 2005-06. The soil at Umiam farm was Ultic Hapludalf with pH 4.75, organic carbon 18.3 g kg^{-1}, exchangeable Ca+Mg 1.76 $cmol(p^+)kg^{-1}$, available N (alkaline $KMnO_4$ oxidizable), P (Bray-2) and K (1*N* NH_4OAc extractable) 477, 11.5 and 167 kg ha^{-1}, respectively. All the soil chemical assay was done following the procedures of Jackson, 1973. Initially field was divided into four equal strips in which a gradient in soil fertility was artificially created by applying graded doses of N, P and K fertilizer to get a wide range in soil fertility ($N_0P_0K_0$, $N_{½}P_{½}K_{½}$, $N_1P_1K_1$ and $N_2P_2K_2$; $N_1P_1K_1$: 80, 60, 40kg/ha). After the harvest of exhaustive maize crop in the year 2004 , the four strips of various fertility gradients were divided into 30 plots in

February,2005 which received 27 selected treatments combination comprising of three levels of N, three levels of P_2O_5 and three levels of K_2O. The remaining three sub-plots in each fertility strip were kept untreated as control and experiment was conducted in a RBD. design (Ramamoorthy ,1975, Ramamoorthy and Velayathum,1971). The plant samples viz. grain and straw samples collected at harvest were analysed for N, P and K and the plant uptake of nutrients was calibrated by using grain and straw yield data. Using the grain yield and nutrient uptake data, soil test values and applied fertilizer doses of treated and control plots, the basic data *viz*. nutrient requirement (kg q^{-1}), soil and fertilizer efficiencies (%) for making fertilizer recommendation were estimated by conventional procedure as discussed by Ramamoorthy *et al*. (1967) and followed in the STCR Project.
The soil efficiency was estimated from only unfertilized plots, while the fertilizer efficiency was estimated from fertilized plots. The nutrient requirement was estimated from both the fertilized and unfertilized plots. The computational procedure of basic data generation was done following the procedures of Ramamoorthy *et al*. (1967). The estimates of basic data were used for developing fertilizer adjustment equations for a ready reckoner for different yield targets.

RESULT AND DISCUSSION

The basic data *viz*., the nutrient requirement (kg q^{-1}) for producing one quintal of maize yield, soil and fertilizer efficiencies or the percent contribution from soil and fertilizer nitrogen, phosphorus and potassium have been calculated from each plot based on the data and have been presented. The estimates of nutrient requirement (kg q^{-1}) value of nitrogen, phosphorus and potassium based on yield maximum method were 1.86, 1.48 and 1.02, respectively. The percent nutrient contributions from soil and fertilizer nutrients in Ultic Hapludalf were found to be 22.63, 11.30 and 4.87; 38.50, 26.24 and 23.00 for nitrogen, phosphorus and potassium, respectively under yield maximum method. This result indicated that nutrient contributions from the fertilizer source are more than from the soil source which is in close conformity with the results reported by Rao *et al.* (1997).
Using fertilizer adjustment equations derived under yield maximum method (Table 1), ready reckoner showing optimum N, P and K fertilizer doses at varying soil test values for attaining yield targets of 40 and 50 q ha^{-1} of maize yield is given in table 2 &3. The result clearly indicates that the fertilizer dose required for attaining a specific yield target of maize yield is decreasing with increasing soil test values.
Field verification trials were conducted in two villages of Riboi district for attaining a yield target of 40 and 50 q ha^{-1} during kharif 2006. The doses tested are based on the fertilizer adjustment equations calibrated for maize crop, along with the farmers' practice (FP). The yield target of 40 q ha^{-1} could be achieved in both location tested, but 50 q ha^{-1} yield target could not be achieved.

CONCLUSION

Hence it may be concluded from the experiment and subsequent field trials that the fertilizer adjustment equations and the ready reckoner of optimum fertilizer doses at varying soil test values developed for maize grown in mid hills of Meghalaya may be recommended for large scale use for the soil testing laboratories of Meghalaya.

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Table2.Fertilizer adjustment equations for maize

Crop	Fertilizer equation
Maize	FN = 1.99 x T- 0.11x SN
	FP_2O_5 = 1.49 x T- 0.11 x SP
	FK_2O = 0.83 x T- 0.06 x SK

Note: FN, FP_2O_5 and FK_2O are fertilizer N, fertilizer P_2O_5 and fertilizer K_2O, respectively, and SN, SP and SK are the soil test values for N, P and K in their elemental form and T is the predetermined crop yield target (qha^{-1}).

Table 2. Ready Reckoner for Fertilizer Application for soil testing low, medium and high in NPK for test crop Maize

Target yield (q/ha)	Fertilizer dose in Low NPK soil			Fertilizer dose in Medium NPK soil			Fertilizer dose in High NPK soil		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
10	8.90	13.80	2.30	None	12.70	None	None	12.15	None
20	28.80	28.70	10.60	12.30	27.60	4.60	None	27.05	None
30	48.70	43.60	18.90	32.20	42.50	12.90	4.70	41.95	6.90
40	68.60	58.50	27.20	52.10	57.40	21.20	24.60	56.85	15.20
50	88.50	73.40	35.50	72.00	72.30	29.50	44.50	71.75	23.50

Table 3. Ready recknoer of different doses at varying soil test values for specific yield targets of maize in Ultic Hapludalf.

Soil available nutrient (kg ha^{-1})			Fertilizer nutrients required (kg ha^{-1}) for yield target of					
			40q ha^{-1}			50q ha^{-1}		
N	P	K	N	P_2O_5	K_2O	N	P_2O_5	K_2O
150	5	100	63.10	83.00	27.20	83.00	73.95	35.50
175	10	125	60.35	80.25	25.70	80.25	73.40	34.00
200	15	150	57.60	77.50	24.20	77.50	72.85	32.50
225	20	175	54.85	74.75	22.70	74.75	72.30	31.00
250	25	200	52.10	72.00	21.20	72.00	71.75	29.50
275	30	225	49.35	69.25	19.70	69.25	71.20	28.00
300	35	250	46.60	66.50	18.20	66.50	70.65	26.50
325	40	275	43.85	63.75	16.70	63.75	70.10	25.00
350	45	300	41.10	61.00	15.20	61.00	69.55	23.50
375	50	325	38.35	58.25	13.70	58.25	69.00	22.00
400	55	350	35.60	55.50	12.20	55.50	68.45	20.50
425	60	375	32.85	52.75	10.70	52.75	67.90	19.00
450	65	400	30.10	50.00	9.20	50.00	67.35	17.50
475	70	425	27.35	47.25	7.70	47.25	66.80	16.00
500	75	550	24.60	44.50	Nil	44.50	66.25	8.50

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