

Research Article

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Development of STCR equation for maize in dominant maize growing areas of Northern transitional zone of Karnataka

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Summary

An investigation was undertaken at the College of Agriculture, Dharwad to establish soil test crop response correlation for soil test based balanced fertilizer prescription for Maize var. NK-6240 in Vertisols of Northern Karnataka. The field investigation consisted of fertility gradient experiment, STCR experiment and technology verification trial. The desired gradient in soil fertility was created in one and the same field by applying graded doses of N, P and K fertilizers and raising fodder maize var. South African Tall.

Key words : STCR, Nutrient requirement, Targeted yield, Fodder maize**How to cite this article :** Neelgar, M.N. and Yeledhalli, N.A. (2017). Development of STCR equation for maize in dominant maize growing areas of Northern transitional zone of Karnataka. *Asian J. Soil Sci.*, 12 (2) : 320-322 : DOI : 10.15740/HAS/AJSS/12.2/320-322.**Introduction**

Maize is the third most important crop of our country after rice and wheat. Its grain is used as feed, food and industrial raw material. It is cultivated round the year, however more than 80 per cent is grown in rainy or *Kharif* season. The most important maize growing states are Karnataka, Andhra Pradesh, Uttar Pradesh and Madhya Pradesh, which account for more than 80 per cent of the total maize area of the country and also account for similar share in production. In maize, both area and production have been steadily increasing. In India since 1950, area under maize has increased from 3.31 to 9.0 million ha and production from 1.73 to 24.4 million tonnes in 2013-14. The increase has been very rapid during the last 10 years as a result of increase in productivity and expansion of area due to spread of its cultivation in non traditional areas of Karnataka and

Andhra Pradesh.

In Karnataka, it is estimated that maize demand will continue to increase because of its diversified uses. To meet the growing demands, enhancement of maize yield in coming years across both traditional and non-traditional areas is a big challenge in the era of climate change. Meeting such challenge will only be possible through science-based technology interventions like single cross hybrid technology and application of novel production techniques in maize improvement, specifically the nutrient management.

The soil test crop response (STCR) is cost effective and plant need based approach. The STCR approach provides principles and tools for supplying crop nutrients as and when needed to achieve higher yield.

The STCR approach not specifically aims to either reduce or increase fertilizer use. Instead, it aim to apply

nutrients at optimal rates and time to achieve higher yield and higher efficiency of nutrient use by the crop, leading to more net returns per unit of fertilizer invested. Soil test calibration permits balanced fertilization through right kind and amount of fertilizers. In this regard, targeted yield approach had been found to be beneficial recommending balanced fertilization considering the soil available nutrient status and crop needs (Ramamoorthy *et al.*, 1967).

Resource and Research Methods

To establish significant relationship between soil test values, uptake for NPK and yield, a gradient rice crop experiment was carried out in Plot No. 66, "C" block, Main Agriculture Research Station, University of Agriculture sciences Dharwad, Karnataka on *Vertisol* during 2014-2015. Soil samples (0-20 cm in depth) were collected from each experimental unit, dried and passed through 2 mm sieve and analyzed for physico-chemical properties by the following methods. Available nitrogen by alkaline permanganate method (Subbiah and Asija, 1956), available phosphorus (Olsen *et al.*, 1954) and available potassium by ammonium acetate method (Jackson, 1973). Soil was clayey in texture with a bulk density of (1.34 Mg m⁻³) moderately alkaline in reaction (8.1) and electric conductivity (0.17dS m⁻¹). The initial soil fertility status showed low organic carbon (5.1 g kg⁻¹) and available nitrogen (213 kg ha⁻¹), medium available P₂O₅ (26 kg ha⁻¹) and K₂O (271 kg ha⁻¹). The available Cu, Fe and Mn were in the sufficient range (1.21, 5.03 and 7.85 mg kg⁻¹) while Zn was in the deficient range (0.45 mg kg⁻¹).

The approved treatment structure and design followed in the All India Co-ordinate Research Project for Investigation on soil test crop response (AICRP-STCR) correlation based on inductive targeted yield model (Ramamoorthy *et al.*, 1967) was adopted in the present study. A field (30 guntas), representative of the major soil type in the region was selected. The field was divided into three (L₁, L₂ and L₃) equal strips. The first strip received no fertilizer, the second and third received

one and two times the recommended dose (100:50:50) of N, P₂O₅ and K₂O, respectively. Source of nutrients N, P and K were urea, single super phosphate and muriate of potash fertilizers, respectively.

After applying fertilizer, fodder maize (South African Tall an exhaustive crop) was grown for 60 days adopting recommended package of practice of UAS Dharwad and harvested. Stover yield from each strip was recorded and plant samples were also collected from each strip and analyzed for the content of nitrogen, phosphorus, potassium and calculated total nutrients uptake.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Fodder yield and nutrient uptake :

The effect of application of graded levels of fertilizers on yield and nutrient uptake by fodder maize shown in Table 1.

Green fodder yield :

The fodder yield of maize in strip-I where no fertilizers were applied was 12,100 kg ha⁻¹ where as in strip-II where 100 per cent RDF was applied, the fodder yield obtained was 27,500 kg ha⁻¹ and in strip-III where 200 per cent RDF was applied, the yield was 41,800 kg ha⁻¹. This might be due to better nutrient uptake by the crop which favourably influenced the growth and yield of rice as reported by Santhi and Kumari (1999) from the STCR gradient crop experiment, it is concluded that an application of graded levels of NPK fertilizers significantly influenced straw yield of South African tall fodder maize crop.

Nutrient uptake:

The increasing levels of fertilizer doses resulted in increased uptake of N, P and K. Nitrogen uptake progressively increased from strip I to strip III and the mean values were 24.2, 59.4 and 99.2 kg ha⁻¹,

Parameter (kg ha ⁻¹)	Strip-I	Strip-II	Strip-III
Green fodder yield	12,100	27,500	41,800
N uptake	24.2	59.4	99.2
P uptake	3.7	9.9	18.3
K uptake	35.0	81.7	126.9

Table 2 : Basic parameters derived from the main experiment and targeted yield equation developed for hybrid maize

Particulars	Nitrogen (N)	Phosphorus (P)	Potassium (K)
NR (kg q ⁻¹)	1.45	0.577	2.11
CS (%)	10.68	43.43	31.0
CF (%)	31.33	24.70	64.5
Targeted yield equations			
F.N=4.62 T – 0.340 S.N			
F.P ₂ O ₅ = 2.33 T – 1.75 S.P ₂ O ₅			
F.K ₂ O.= 3.27 T – 0.480 S. K ₂ O			

Where, T = Targeted yield (q ha⁻¹)
 F.N. = Nitrogen supplied through fertilizer (kg ha⁻¹)
 F.P₂O₅ = Phosphorus supplied through fertilizer (kg ha⁻¹)
 F.K₂O. = Potassium supplied through fertilizer (kg ha⁻¹)

respectively. The mean uptake values for phosphorus were 3.7, 9.9 and 18.3 kg ha⁻¹, respectively. Similarly the potassium uptake values were 35.0, 81.7 and 126.9 kg ha⁻¹, respectively. The results indicated that the existence of operational range of variations in the experimental field (Table 1).

The basic data *viz.*, nutrient requirement for producing one quintal grain yield of maize, per cent contribution of nutrients from soil (CS) and contribution of nutrients from fertilizer (CF) have been calculated and furnished in Table 2. These basic parameters were used for developing the fertilizer prescription equations. The nutrient requirement of N, P₂O₅ and K₂O were 1.45, 0.57 and 2.1 kg q⁻¹ of grains, respectively. The per cent contribution of nutrients from soil and fertilizers were found to be 10.68 and 31.33 for N, 43.43 and 24.70 for P₂O₅ and 31.00 and 64.50 for K₂O. The estimated Cf clearly revealed the fact that the magnitude of contribution by fertilizer K₂O was 2.6 times higher than P₂O₅ and twice (2.05) as that of N. With regard to N and K₂O, comparatively more contribution was recorded from fertilizers than from the soil. However, in the case of P₂O₅, the contribution was more from soil than from fertilizer.

Conclusion :

In the present study, the sustainable plant nutrient system on soil test crop response correlation studies was developed for maize on *Vertisol* of Northern Karnataka

taking into account the nutrient requirement, contribution of NPK from the internal and external nutrient sources. From the STCR gradient crop experiment, it is concluded that an application of graded levels of NPK fertilizers significantly influenced NPK uptake and straw yield of fodder maize crop (South African Tall). Fertilizer recommendations based on the concept of STCR are more quantitative, precise and meaningful because combined use of soil and plant analysis is involved in it.

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