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Lalita Verma
Department of Agronomy, Vasantrao Naik Marathwada Agriculture University, Parbhani, Maharashtra, India

Vijay Kumar
Department of Entomology, SKRAU, Bikaner, Rajasthan, India

Suresh Kumar Kumawat
Department of Agronomy, SKNAU, Jobner, Jaipur, Rajasthan, India

Priynka Kumari Jat
Department of Horticulture, SKNAU, Jobner, Jaipur, Rajasthan, India

Corresponding Author:
Lalita Verma
Department of Agronomy, Vasantrao Naik Marathwada Agriculture University, Parbhani, Maharashtra, India

Effect of nitrogen, phosphorus and potassium (kg ha^{-1}) on soil after harvesting of maize (*Zea mays*)

Lalita Verma, Vijay Kumar, Suresh Kumar Kumawat and Priynka Kumari Jat

Abstract
The experiment was conducted on cotton research station of Vasantrao Marathwada Agricultural University, Parbhani during kharif season 2015 to study the Effect of split application of nitrogen on growth and yield of *kharif* maize. The test crops were raised on field during *kharif*-2015. The experiment was laid out in randomized block design (RBD). The treatment details of experiment consisted of 7 treatment: (1) T1 –100% Nitrogen at sowing, (2) T2 –75% N at sowing +25%N at 30 DAS, (3) T3 – 50% N at sowing +50% N at 30 DAS, (4) T4 – *25% N at sowing +75% N at 30 DAS,* (5) T5 –25%N at sowing +50% N at 30 DAS + 25% at 60 DAS, (6) T6 – *33%N at sowing + 33%N at 30 DAS +33% at 60 DAS and* (7) T7 – 25% N at sowing + 25%N at 30 DAS+25% at 60DAS +25% N at 75 DAS The maximum increase in N,P and K status increased the soil nutrient status after harvesting. Maximum nutrient status found in treatment where 100% nitrogen applied at the time of sowing which is not good for soil health. However, the treatment found the significantly superior than other treatments where *33% N at sowing + 33% N at 30 DAS + 33% at 60 DAS applied*.

Keywords: Maize, nitrogen, phosphorus, potassium

Introduction

Maize (*Zea mays*) is an annual plant which belongs to family Poaceae (*Gramineae)*. It is grown from 58^{o}N to 40^{o}S from below sea level to altitudes higher than 3000 m and in areas with 250 mm to more than 5000 mm of rainfall per year (Shaw, 1988, Dowswell *et al.*, 1996) [6, 2] and with a growing cycle ranging from 3 to 13 months (Anonymous, 2000). Maize is one of the most important versatile cereal crops grown in tropical and temperate regions of the world. India ranks sixth in area and third in production and productivity among cereal crops (Anonymous, 2009) [1]. Potentiality of maize crop for its growth and development can be fully exploited by adopting suitable agronomic practices such as optimum spacing, fertilizer, soil conditions, growing season and water availability.

Split and delayed basal fertilizer applications are possible strategies to improve the crop yield and reduce nutrient loss through leaching in sandy soils, but their effectiveness under high rainfall regimes to produce a maize growth response needs further investigation. The primary purpose is to adjust the nitrogen supply according to the demand of a growing crop. This can improve nitrogen use efficiency. Split application reduces the risk of losses through leaching. Split application of nitrogen can increase grain yield and grain protein content. Split application is a N management strategy that will likely gain momentum in the next 5 to 10 years.

For the split application of nitrogen to be successful, the farmer has to make many decisions in the planning stage and specify the plans during the growing season. Split application is the process of matching nitrogen supply for a pre-established target yield and a given level of soil moisture, and then supplying the remaining nitrogen as moisture conditions improve. Split applications of nitrogen give producers greater flexibility in their fertilizer program. This practice minimizes the risk of placing all the nitrogen at the time of seeding. By providing nitrogen to meet the changing demands of a growing crop, producers can potentially increase nitrogen use efficiency. Split application reduces the exposure of nitrogen in saturated soils where the potential for losses such as leaching and denitrification are increased. It also reduces the amount of product a producer must handle during the busy seeding period. Finally, proper timing and placement of nitrogen may help reduce nitrous oxide emissions. Split application of nitrogen fertilizer may substantially improve corn nitrogen use efficiency, particularly during wet growing seasons.

Corn extracts less than 15% of its seasonal nitrogen uptake before rapid vegetative growth begins.

Material and Methods

The details of material used and experimental techniques adopted during the present investigation are described in this chapter. An experiment was carried out on Experimental farm of cotton research station, Vasantrao Naik Marathwada Agriculture University, Parbhani during *kharif* season 2015. The soil was medium deep black and well drained. The topography of the experimental field was fairly uniform and levelled. Soil samples up to 30 cm were randomly collected from different locations of field before starts of the experiments during *Kharif* -2015 and a composite soil sample was prepared and analyzed for various physicochemical properties of the soil.

Table 1: Physico-chemical properties of composite soil sample

Sr. No	Particulars	Value (%)	Method used	Reference
I	**Mechanical composition**			
A	Course sand	10.45	International pipette method	(Piper, 1966) [5]
B	Fine sand	13.50		
C	Silt	20.70		
D	Clay	55.35		
II	**Chemical composition**			
A	Available N (kg ha^{-1})	165.9	Alkaline potassium permanganate	(Subbiah and Asija, 1956) [7]
B	Available P_2O_5 (kg ha^{-1})	12.2	Olsen's method	(Olsen *et al.*, 1954) [4]
C	Available K_2O (kg ha^{-1})	387..30	Flame photometer	(Piper, 1966) [5]
D	Soil pH	8.25	Glass electrode pH meter	(Jackson, 1967)

The results of the soil analysis (Table No.1) revealed that the soil of the experimental plot was clayey in texture, low in available nitrogen, low in available phosphorus, high in available potassium and slightly alkaline reaction. Geographically Parbhani is situated at 409 m mean sea level altitude 19°16' North latitude and 76°47' E longitude. Its height from mean sea level is about 879 m and distributed in 57 rainy days mostly during june to September. The winter rains are low and uncertain. Most of the rainfall is received from South-West monsoon. The precipation is assured for *Kharif* crops. The mean daily maximum temperature was 36 ^{o}c. The temperature varies from 30.8^{o}c in winter (December) to about 45^{o}c in summer (may), whereas mean minimum temperature varies from 11.9^{o}c in winter to about 24.9^{o}c in summer. The mean relative humidity ranges from 30 to 90%. Thus Parbhani has hot dry summer and cool winter. However, July, August and September months are humid. Hence Parbhani is grouped in assured rainfall zone with *Kharif* cropping pattern.

Result and Discussion

Status of N, P and K (kg ha^{-1}) as influenced by different treatments after harvesting of maize crop

Application of split application of Nitrogen in different treatments 33%N at sowing + 33%N at 30 DAS + 33% at 60 DAS (T_6) recorded the lower nitrogen content(136.7kg ha^{-1}) in soil after harvest the maize crop. The highest nitrogen content value was obtained in treatment (285.7kg ha^{-1}) 100% nitrogen at sowing time(T_1).

Application of split application of nitrogen in different treatments33%N at sowing + 33%N at 30 DAS + 33% at 60 DAS(T_6) recorded the higher phosphorus content(10.0kg ha^{-1}) in soil after harvest the maize crop. The lowest phosphorus content value (16.1 kg ha^{-1}) was obtained in treatment 100% nitrogen at sowing time(T_1).

Treatments	N	P	K
T1 –100% Nitrogen at sowing	285.7	16.1	485.8
T2 –75%N at sowing +25%N at 30 DAS	218.7	15.9	424.8
T3 – 50%N at sowing +50% N at 30 DAS	213.4	14.9	387.3
T4 – *25% N at sowing +75%N at 30 DAS*	196.9	14.2	377.4
T5 –25%N at sowing +50% N at 30 DAS + 25% at 60 DAS	146.3	10.9	295.8
T_6- T6 – *33%N at sowing + 33%N at 30 DAS + 33% at 60 DAS*	136.7	10.0	286.5
T7 – 25% N at sowing + 25%N at 30 DAS+25% at 60DAS +25% N at 75 DAS	149.3	12.2	350.0

Application of split application of potash in different treatments 33%N at sowing + 33%N at 30 DAS + 33% at 60 DAS(T_6) recorded the lowest potash content (286.5kg ha^{-1}) in soil after harvest the maize crop. The highest nitrogen content value (485.8kg ha^{-1}) was obtained in treatment 100% nitrogen at sowing time (T_1).

Effect of split application of nitrogen on soil N, P and K content after harvesting

The N, P, and K content in soil was observed lowest in T_6 (33% N at sowing + 33%N at 30 DAS + 33% at 60 DAS) 136.7, 10.0 and 295.8 respectively. The highest N, P and K content was found in T_1 (100% N at sowing) 285.7, 16.1 and 485.8 respectively. This might be due to the fact that in present investigation, the plant of T_6 being superior treatment, got the highest uptake of N and the least content was left in soil. On the other hands, T_1 treatment was least acceptable among all treatments. Thus N, P and K uptake by plant was lowest and it was found highest in soil.

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