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Effect Of Nitrogen Levels And Inhibitors On The Soil Nitrogen Availability Of *Kharif* Maize

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ABSTRACT
The field experiment was conducted at Post Graduate Institute, Mahatma PhuleKrishiVidyapeeth, Rahuri, during 2015-16 to study the effect of nitrogen levels and inhibitors on the soil nitrogen availability, uptake and yield of kharif maize in Inceptisol. The factors and treatments comprised nitrogen levels and Inhibitors (85% and 70%) in form of urea. The results indicated that fertilizer N is combination with nitrogen Inhibitors significantly increased the soil available N, P, K and micronutrients in maize crop. The results of experiment revealed that application of 85 % N-GRDF-Agro-N-Protect coated urea (T_2) to maize significantly increased the soil available N, P, K and micronutrients and improves soil fertility of medium deep black soil. However, this treatment was at par with the treatment of application of 85 % N through Agro-N-protect coated urea + Neem coated urea (T_6), 85 % N-GRDF-Neem coated urea (T_4).In order to study the efficiency of applied nitrogen the recommended dose of nitrogen (120 kg ha^{-1}) is reduce at rate of 15% to obtain the graded levels of nitrogen i.e. 100%, 85% and 70% of recommended dose nitrogen.
Key words : Maize, nitrogen inhibitors, N,P,K and Fe,Zn,Cu,Mn.

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INTRODUCTION

Maize (*Zea mays* L.) belongs to family of grasses (poaceae) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. In India it is cultivated in all the seasons*viz.*,*kharif*, *rabi* and summer. It play key role in human diet, animal feed and provides adequate amount of energy and protein (Ipperissiel*et al*. 1989). It is most important constituent of cattle fodder and poultry feed. Maize is an important staple food crop and provides raw materials for the livestock and agro-allied industries in the world (Bello, 2010).The amide form (NH_2-N) of N is further converted to NH_4^+ form by the activity of urease enzyme. Regulation of nitrification can be done by substrate (NH_4^+-N) limiting mechanism. There is also loss through NH_3 emission. Hence it is required to regulate the activity of urease, so as to get limited supply of NH_4-N. It can be done by the use of nitrogen inhibitor. Ingle *et al.* (2010) showed that the slow release fertilizers are slow acting and facilitate long term availability of the N, P, K and micronutrients often synchronized with the physiological need of plants and are considered as one of the most viable alternative for the sustainable plant productivity. Use of nitrogen inhibitors is demonstrated to have effectiveness in increasing crop nitrogen uptake, soil inorganic nitrogen stock and reducing N_2O and NO emissions, with the effect of nitrogen inhibitors on NH_3 volatilization Liu *et al.* (2013).

MATERIAL AND METHODS.

The experiment was laid out in a Randomized Block Design With 9 Treatments and 3 replications the grossplot size Was 6mx4m and net plot size 4.5mx3.6m. The recommended spacing of 22.5cm was adopted.Composite soil sample from the experimental site was collected and processed for analysis of soil properties and fertility. After collection soil, the soil was air dried under diffused sunlight and processed for initial chemical properties. Well decomposed farmyard manure was procured from cattle project, M.P.K.V, Rahuri and applied as per recommendation@10t ha^{-1} Healthy viable seed of hybrid maize variety Rajarshi was obtained from the Chief Scientist, Central Seed Cell, M.P.K.V., Rahuri for the experiment.

Neem coated urea, Agro-N-protect coated urea, urea, single superphosphate, muriate of potash and zinc sulphate was used as a source of N, P_2O_5, K_2O.

Treatment details:

T_1	:	GRDF(120:60:40 kg ha^{-1} N, P_2O_5 and K_2O +10 t ha^{-1} FYM)
T_2	:	85 % N-GRDF-Agro-N-Protect coated urea
T_3	:	70 % N-GRDF-Agro-N-Protect coated urea
T_4	:	85 % N-GRDF-Neem coated urea
T_5	:	70 % N-GRDF-Neem coated urea
T_6	:	85 % N-GRDF-Agro-N-Protect coated urea + Neem coated urea
T_7	:	70 % N-GRDF-Agro-N-Protect coated urea + Neem coated urea
T_8	:	0 % N-GRDF
T_9	:	Absolute Control

NOTE

1. The nitrogen as per treatments (T_1 to T_8) was applied in splits 1/3 at sowing, 1/3 30 DAS and remaining 1/3 after 45 days of sowing DAS.
2. The recommended dose of P_2O_5, K_2O and FYM was applied as basal dose for treatment T_1 to T_8 at sowing

Parameter	Method used	Reference
Available N	Alkaline permanganate	Subbaih and Asija (1956)
Available P	0.5 *M* $NaHCO_3$ at pH 8.5 Ascorbic acid	Olsen *et.al* (1954)
Available K	N *N* NH_4OAc	Knudsen and Peterson (1982)
Available Fe, Mn, Cu, Zn	DTPA-extract (Atomic Absorption Spectrophotometer)	Lindsay and Norvell (1978)

RESULTS AND DISCUSSION:

Results were observed that the available nitrogen was significantly increased by the applications of urea coated with nitrogen inhibitors over T_1, T_8 and T_9. The highest value of available N, P and Kwas under the treatment (T_2) of urea blending with 85 % N-GRDF-Agro-N-protect coated urea this treatment was at par with the treatment of application of 85 % N through Agro-N-protect coated urea + Neem coated urea (T_6), 85 % N-GRDF-Neem coated urea (T_4). The available N found increased with nitrogen levels applied and nitrogen inhibitor used.Variations in N availability of the treatments might be due to variations in applied levels of N. Similarly there might be effect due to N inhibitors responsible for avoiding N losses.Thus it can be concluded that availability of increased with N levels and use of N inhibitors.Also conformity with observations (Chen *et al.,* 2008).

Table-1 :Residue Soil fertility as influenced by different N Inhibitors at harvest of maize.

Tr. No.	Treatment	Soil available nutrients (kg ha^{-1})		
		N	P	K
T_1	GRDF	191.29	14.84	377.2
T_2	85 % N-GRDF- ANPU	251.50	16.63	410.5
T_3	70 %N-GRDF- ANPU	210.11	14.42	369.6
T_4	85 % N- GRDF – NU	233.11	15.80	387.6
T_5	70 % N- GRDF –NU	205.97	13.49	351.9
T_6	85 % N- GRDF- ANPU + NU	241.40	16.08	403.2
T_7	70 % N- GRDF- ANPU + NU	206.65	14.14	362.1
T_8	0 % N- GRDF	183.98	11.27	339.7
T_9	Absolute Control	167.85	9.86	318.2
	Initial	260.21	16.84	463.3
	S.E. $\pm$	3.92	0.41	9.45
	CD at 5 %	11.85	1.24	28.57

The highest available P and K was recorded in treatment of application of urea blending with 85 % N through Agro-N-protect (T_2) was at par with treatment of T_6 and T_4. Reported that there was a significant

increase in the available P status of the soil in plots receiving fertilizer N, P and FYM application over the rest of the treatments and similar results were also reported byMathur (1997), Ingle *et al* (2010).The availability of NH_4^+ ion in soil might have presented K fixation helpful for increased K availability in soil. The availability of K increased because of more availability of N through applied N inhibitors also reported byPettigrew (2008).Application of organic nitrogen sources the soil available N, P_2O_5 and K_2O buildup was higher in all the treatments over the initial whereas, the DTPA-extractable micronutrients were also enhanced due to the application of organic nitrogen sourcesimilar results were also reported byKadam *et al.* (2010).

Table-2:Effect of N inhibitors on soil available DTPA-Micronutrient

Tr. No.	Treatment	DTPA-Micronutrient (mg kg^{-1})			
		Fe	Mn	Zn	Cu
T_1	GRDF	3.13	5.47	0.53	2.40
T_2	85 % N-GRDF- ANPU	3.75	6.31	0.54	2.71
T_3	70 %N-GRDF- ANPU	3.32	5.70	0.51	2.51
T_4	85 % N-GRDF –NU	3.54	6.00	0.52	2.58
T_5	70 % N-GRDF –NU	3.12	5.44	0.48	2.46
T_6	85 % N-GRDF- ANPU + NU	3.65	6.10	0.53	2.62
T_7	70 % N-GRDF- ANPU + NU	3.22	5.50	0.50	2.45
T_8	0 % N- GRDF	3.02	5.02	0.47	2.37
T_9	Absolute Control	2.85	4.81	0.44	2.10
	Initial	4.7	7.2	0.56	3.10
	S.E. $\pm$	0.064	0.139	0.003	0.032
	CD at 5 %	0.19	0.41	0.01	0.09

The highest value of available Fe, Zn, Cu and Mn was under the treatment (T_2) of urea blending with 85 % N-GRDF-Agro-N-protect coated urea this treatment was at par with the treatment of application of 85 % N through Agro-N-protect coated urea + Neem coated urea (T_6), 85 % N-GRDF-Neem coated urea (T_4). The available N found increased with nitrogen levels applied and nitrogen inhibitor used. Application of recommended NPK along with FYM (10 t ha^{-1}) significantly increased the available DTPA-Zn and Mn over inorganic fertilizers. Similar results were also reported byBellakki and Badanur (1997). The DTPA - Cu and Fe level was high in NPK + FYM and NPK + FYM + Zn treatments. Similar results have been singh et al (1999).It might be due to N application through coated of urea with the Agro-N-protect and neem coated urea increased availability of N in the form of NH_4^+-N and NO_3^--N. Hence inhibitors will useful for slow release N to crop as per its requirement.

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