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Response of Maize to Different Levels of Nitrogen under Zero-till Conditions after Rice

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ABSTRACT

Field experiments were conducted at Agricultural College Farm, Bapatla, to study the response of maize to different N levels under zero-till conditions after rice during *rabi* seasons of 2008 and 2009. The experiment was conducted in split plot design with four replications. The treatments consisted of four nitrogen -levels (No: No nitrogen, NI: 75 kg ha $^{-1}$, N2: 150 kg ha^{-1} and N3: 225 kg ha^{-1}) as sub plots and the six nitrogen management practices (M_1:120 kg N ha^{-1}, (M2:180 kg N ha^{-1}, M3: 240 kg N ha^{-1}, M4: 120 kg N ha^{-1}+ GLM@ 10 t ha^{-1}, M5: 180 kg N ha^{-1}+ GLM @ 10 t ha^{-1} and M6: 240 kg N ha^{-1} + GLM @ 10 t ha^{-1}) imposed in preceding rice crop as main plots. The soil was sandy clay loam in texture, slightly alkaline in reaction, low in organic carbon and available N and medium in available phosphorus and high in available potassium. The study of the investigation revealed that each unit increase in N level led to significant increase in growth characters and yield of maize. Popular maize hybrid pioneer 30 V 92 was used for the study. Data collected on growth characters viz., plant height, dry matter accumulation, number of number of days to 50% tasseling, number of days to 50% silking, kernel yield, stover yield, economic returns were significantly influenced by different N levels given to maize. Higher plant height (231.1 and 247.3 cm, respectively) and dry matter accumulation of maize at tasseling (4078 and 4950 kg ha ^{1,} respectively) and at maturity (13224 and 13429 kg ha^{-1}, respectively) was recorded with application of 225 kg N ha ^{1} during both the years of study. The plot that received 240 kg N ha^{-1} + GLM @ 10 t ha^{-l}in *kharif* rice (M6) as main plot and 225 kg N ha^{-1} to maize (N3) recorded higher net returns and B: C ratio during both the years of study.

Key words: *Glyricidia leaf manure, Maize, Nitrogen levels, Zero-till conditions.*

Cultivation of maize gained momentum during *rabi* season especially under zero-tillage in rice fallows in Andhra Pradesh. The area under maize in Andhra Pradesh has been increased from 428000 ha in 2001-02 to 863000 ha in 2009-10 and it is 2.81 lakh hectares during *rabi* season. Among several management practices that affect crop productivity, fertilizer application especially nitrogen in cereals is of paramount importance for its role in growth and development of the crop. Farmers in the Krishna delta region at present are using chemical fertilizers indiscriminately to get good yields in maize under rice-fallow situations. The nutrient requirement in particular, N requirement for zero till crop has been thought to be higher due to undisturbed soil condition in comparison to the crop raised under normal and conventional method of cultivation with proper preparation of land. To improve and sustain the productivity of maize in rice fallows under zero-till conditions, the fertilizer N need is yet to be quantified. Hence, the present investigation was taken up to study the response of maize in rice fallows to different nitrogen levels under no-till condition.

MATERIAL AND METHODS

Field experiments were conducted at Agricultural College Farm, Bapatla, during *rabi* seasons of 2008 and 2009. The experimental soil was sandy clay loam in texture, having soil pH of 7.8 and EC of 0.3 d Sm^{-l}, **low** in organic carbon content (0.3%) and available soil nitrogen(144 kg N ha^{-l}), and medium in phosphorus (34 kg) and high in potassium content (591 kg). The experiment was laid out in split plot design comprising of four levels of nitrogen (No: No nitrogen, N1: 75 kg ha^{-l}, N2: 150 kg ha^{-l} and N3: 225 kg ha^{-l}) as sub plots and the six nitrogen management practices *viz.,* M1:120 kg N ha^{-l}, M2:180 kg N ha^{-l}, M3: 240 kg N ha^{-l}, M_4:

Table 1. Growth characters of maize as influenced by different N levels under zero-till conditions and nitrogen management in rice during *kharif*.

Treatments	Plant height (cm) at 90 DAS		Dry matter accumulation (kg ha^{-1})at tasseling		Dry matter accumulation (kg ha^{-1})at maturity		Days to 50% tasseling		Days to 50% silking	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Treatments given to rice in *kharif* (M)										
M_1-120 kg N ha^{-1}	188.6	213.6	3099	3468	7601	8622	64.2	63.5	70.3	69.2
M_2- 180kg N ha^{-1}	199.6	220.7	3221	3771	8198	8921	63.7	63.3	70.4	69.1
M_3- 240 kg N ha^{-1}	204.3	228.7	3339	3937	8291	9148	63.4	63.0	69.8	68.8
M_4- 120 kg N ha^{-1} + GLM	223.1	237.5	3452	4423	9926	10633	62.3	61.9	69.7	68.3
M_5- 180 kg N ha^{-1} + GLM	231.2	241.2	3530	4524	10542	10899	62.0	61.7	68.3	68.2
M_6- 240 kg N ha^{-1} + GLM	235.4	242.7	3602	4740	10866	11137	61.8	61.6	68.3	68.2
SEm(±)	4.2	3.8	171	156	592	363	0.5	0.3	0.8	0.4
CD(0.05)	18.0	11.6	NS	475	1353	773	1.2	0.9	NS	0.9
CV (%)	8.1	5.7		8.8	11.0	9.0	2.0	2.7	3.3	1.7
Nitrogen (kg ha^{-1}) given to maize										
N_0	189.6	203.4	3366	4091	4921	6087	63.8	64.4	72.0	70.7
N_{75}	209.2	229.3	3882	4523	8742	9482	62.9	63.1	69.9	69.0
N_{150}	224.8	240.2	4120	5003	10062	10575	62.5	61.4	68.1	67.7
N_{225}	231.1	247.3	4728	5562	13224	13429	62.4	61.1	67.1	67.0
SEm(±)	2.9	1.8	219	238	598	226	0.3	0.2	0.4	0.2
CD(0.05)	8.8	5.5	439	513	1411	453	0.8	0.5	1.2	0.4
CV (%)	6.7	4.2	9.6	9.8	10	7.0	1.6	1.3	2.1	0.9

Glyricidia leaf manure (GLM) @ 10 t ha^{-1}

Table 2. Yield attributes of zero-till maize as influenced by different nitrogen levels and nitrogen management in *kharif* rice.

Treatments	No. of cobs Plant $^{-1}$		No. of kernels cob $^{-1}$		Kernel wt. cob $^{-1}$(g)		Test weight (g)		Kernel yield (kg ha^{-1})		Stover yield (kg ha^{-1})	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Treatments given to *kharif* rice												
M_{1-} 120 kg N ha^{-1}	1.5	1.6	235.2	265.2	49.6	58.0	21.5	22.5	3260	3783	4095	4632
M_{2-} 180kg N ha^{-1}	1.6	1.7	238.9	272.6	54.5	60.2	21.9	22.9	3540	3971	4389	4757
M_{3-} 240 kg N ha^{-1}	1.9	1.8	248.8	277.3	55.5	62.5	22.1	23.1	3669	4090	4420	4836
M_{4-} 120 kg N ha^{-1} + GLM	1.8	1.8	288.3	312.8	67.5	72.7	23.2	23.8	4436	4792	5296	5569
M_{5-} 180 kg N ha^{-1} + GLM	1.9	1.8	297.9	322.0	71.5	74.4	23.6	23.9	4725	4968	5574	5717
M_{6-} 240 kg N ha^{-1} + GLM	1.9	1.9	305.8	330.6	73.7	77.3	23.8	24.1	4862	5106	5714	5868
SEm (±)	0.09	0.06	5.8	10.2	2.3	2.5	0.32	0.27	153	107	156	86
CD(0.05)	0.19	0.14	17.6	21.8	6.3	5.3	0.95	0.58	461	323	469	441
CV (%)	14.1	10.2	7.6	9.2	7.4	9.0	3.9	3.1	15.0	9.6	12.7	11.2
Nitrogen (kg ha^{-1}) given to *rabi* maize(N)												
N_0	1.4	1.3	177.8	255.7	29.1	38.9	21.2	22.4	1915	2512	2721	3346
N_{75}	1.7	1.8	249.2	273.5	58.9	64.0	22.4	22.7	3878	4245	4714	5002
N_{150}	1.9	1.9	293.6	308.2	68.0	71.8	23.1	23.6	4476	4795	5345	5590
N_{225}	2.0	2.0	356.1	349.7	92.2	95.4	24.0	24.8	6060	6255	6886	6980
SEm (±)	0.06	0.05	4.6	5.6	1.3	2.0	0.31	0.24	79	76	92	69
CD(0.05)	0.13	0.11	13.8	11.3	3.9	4.0	0.86	0.48	224	214	260	195
CV (%)	12.6	10.5	7.8	6.3	5.6	8.9	4.6	3.4	9.5	8.3	9.2	6.5

Glyricidia leaf manure (GLM) @ 10 t ha^{-1}

120 kg N ha^{-1} + GLM,i) 10 t $ha.^{-1}$, M5: 180 kg N ha^{-1} + GLM @ 10 t ha^{-1} and M6: 240 kg N ha^{-1} +GLM @ 10 t ha^{-1} imposed in preceding rice crop as main plots. After harvesting of rice crop, the maize hybrid (pioneer 30 V 92) seed was dibbled into the moist soil at the rate of one seed per hill by adopting a spacing of 60x25 cm, without disturbing the layout of the experiment. To control the weeds and to prevent the ratooning from the harvested rice stubbles one spray of atrazine @ 5 g L^{-1}+ paraquat @ 10 g L^{-1} was given on the next day of sowing.

A common dose of phosphorus @ 60 kg $ha^{-1}$and potassium @ 50 kg ha^{-1} was applied through single super phosphate and muriate of potash respectively, as per the recommendation. Entire dose of phosphorus and 50% of potassium was applied at the time of planting. The remaining 50% of potassium was applied at the time of tasseling by hill placement. Nitrogen was applied in the form of urea (46% N) by hill placement as per the treatments in three equal splits, one each at planting, knee high stage and tasseling stage. All other recommended agronomic and plant protection measures were adopted to raise the crop. Observations on growth parameters, kernel yield and stover yield of maize were recorded. Economics of different treatments were estimated based on prevailing local market prices of different commodities.

RESULTS AND DISCUSSION

The maximum plant height of maize was recorded with application of 225 kg N ha^{-1} might be due to cell division and cell elongation as promoted by nitrogen. Dry matter accumulation increased significantly with each increment in N level from 75 to 225 kg ha^{-1} during both the years of the study. Dry matter accumulation at tasseling and at maturity increased significantly with each increment in N level from 75 to 225 kg ha^{-1} during both the years of the study. Adequate nitrogen might have helped the maize plants to increase their growth which in turn putforth more photosynthetic surface, thus contributed to more dry matter accumulation.

Across the N levels applied to maize, the plots received 225 kg N ha^{-1} took significantly less number of days to reach 50% tasseling and 50% silking than that at lower levels of N (0 and 75 kg N ha^{-1}) but, it was on a par with that of application of 150 kg N ha^{-1}. Irrespective of nitrogen management given to preceding rice crop during *kharif,* the increased levels of N (150 and 225 kg N ha^{-1}) application to maize hastened up tasseling and silking during both the years of the study because of faster growth and development noticed in these treatments. Similar findings were also reported by Yadav *et al.* (1982), Reddy *et al.* (1988) and Mercy *et al.* (2012).

The yield attributing characters *viz.,* number of cobs $plant^{-1}$, number of kernels cob^{-1}, kernel weight cob^{-1}, and test weight increased significantly with increase in level of N application to maize. Application of 225 kg N ha^{-1} recorded significantly higher number of cobs per plant and it was found on a par with that of 150 kg N ha^{-1} during both the years of the study. The least number of cobs per plant was noticed with no nitrogen (No) application to maize. Irrespective of the year of the study, there was a progressive increase in number of kernels cob^{-1} and test weight of maize with increase in N application from 0 to 225 kg N ha^{-1}. However, the highest was with 225 kg N ha^{-1}. The increased level of N might have resulted in easy and greater availability of N to the crop plants, which consequently improved the growth parameters and yield attributes of maize crop. These findings are in close conformity with those of Shivay and Singh (2000), Patel *et al.* (2006), and Jaliya *et al.* (2008).

The improvement in yield attributes noticed across different treatments was reflected in kernel yield and stover yield of maize. A significant enhancement on kernel and stover yield was observed with increase in N level from 0 to 225 kg N ha^{-1}. The kernel yield (6060 kg ha^{-1} and 6255 kg ha^{-1} during 2008 and 2009, respectively) and stover yield (6886 kg ha^{-1} and 6980 kg ha^{-1} during 2008 and 2009, respectively) was significantly higher with application of 225 kg N ha^{-1}. Irrespective of the residual effect of treatments imposed in preceding rice crop. The similar results were also reported by Mercy *et al.* (2012).

LITERATURE CITED

Jaliya M M, Falaki A M, Mahamud M and Sani Y A 2008 Effect of sowing date and NPK fertilizer rate on yield and yield components of quality protein maize. *ARPN Journal of Agricultural and Biological Science,* 3 (2): 23-29.

Mercy Zakkam, Chandrasekhar K and Subbaiah G 2012 Response of maize *(Zea mays* L.) to planting densities and nitrogen levels under late *rabi* conditions. *The Andhra Agricultural Journal,* 59(4): 517-519.

Patel J B, Patel V J and Patel J R 2006 Influence of different methods of irrigation and nitrogen levels on crop growth rate and yield of maize *(Zea mays* L.). *Indian Journal of Crop Science ,1* (1&2): 175-177.

Reddy N C, Reddy S R V, Raja V and Munuswamy V 1988 Response of some new maize germplasm to nitrogen levels. *Haryana Journal of Agronomy,* 4: 69-73.

Shivay Y S and Singh R P 2000 Growth, yield attributes, yield and nutrient uptake of maize *(Zea mays* L.) as influenced by cropping systems and nitrogen levels. *Annals of Agricultural Research* 21 (4): 494-498.

Yadav R P, Shrivastava U K, Namdea K N Agarwal S K and Rastogi V K 1982 Response of some promising maize varieties to nitrogen levels under irrigated condition. *Madras Agriculture Journal,* 69 (6): 372-375.

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