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Effect of Tillage and Nitrogen Levels on Growth, Yield and Economics of *rabi* Maize (Zea Mays L.)

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ABSTRACT

A field experiment was conducted at the Agricultural College Farm, Bapatla to study the effect of tillage and nitrogen levels in *rabi* maize. Results indicated that drymatter accumulation and grain yield were high with conventional tillage with herbicides and it was on par with zero tillage with herbicides. Application of 240 kg N ha^{-1} produced significantly higher amount of drymatter, plant height and grain yield. The highest gross and net returns were recorded under conventional tillage with herbicides with 240 kg N per ha and highest BCR (3.46) was recorded from maize grown under zero tillage with herbicides under 240 kg N ha .

Key words : Tillage, Nitrogen and *Rabi* Maize.

In view of the increasing production costs and environmental degradation with conventional practices, resource conservation technologies including minimum tillage or zero tillage are being adopted. Maize under zero tillage occupies an area of 1.3 m ha in India. It is now being grown under zero till conditions in Andhra Pradesh which has come as a revolution occupying an area of 2.66 lakh ha during 2011-2012 (http: www. indiastat. com). Zero tillage improves the short and long term economics of farming and protects the soil and moisture. Fertilizers played a key role in modernization of Indian agriculture. It is estimated that 50 per cent of the total grain output can be directly attributed to fertilizer use (Sarma *et al.,* 2000). Being a C4 plant, maize requires more nitrogen for maximization of yields in no-tilled soils and so, higher nitrogen rates have been recommended. Keeping this in view, the present investigation was conducted to evaluate different tillage methods and nitrogen levels on growth and yield of maize.

MATERIAL AND METHODS

A field experiment was conducted during the rabi season of 2012-2013 at the Agricultural College Farm, Bapatla. The soil was clay loam in texture, alkaline in reaction with pH 8.2, low-in organic carbon and available nitrogen (242.5 kg ha^{-1}), medium in phosphorus (35 kg ha) and high in available potassium (780 kg ha^{-1}). Four tillage methods (conventional tillage alone, conventional tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1} asPE fb paraquat @ 0.6 kg a.i ha-1at 3WAS), zero tillage alone, zero tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1}as PE fb paraquat @ 0.6 kg a.i ha^{-1} at 3WAS)) and four nitrogenlevels (120, 160, 200 and 240 kg N ha) were tested in split plot design with three-1replications. Maize was planted at an inter- and intra-row spacing of 75 cm x 20 cm during the second week of October 2012 and harvested during last week of January 2013. The herbicides were applied as per treatment using spray volume of 500 lt ha^{-1} . Nitrogen was applied in the form of urea as per the treatments in three split doses one at sowing, second at30 DAS and third at 45 DAS. Uniform dose of phosphorus (60 kg P O ha^{-1}) in the form of 25 single super phosphate was applied at the time of sowing as basal. Potassium (50 kg K O2ha) in the form of muriate of potash was applied in two splits, one at the time of sowing and-1second at 45 DAS.

RESULTS AND DISCUSSION

Crop growth and yield

Among the tillage methods, the highest drymatter accumulation, number of grains cob^{-1} and grain yield were recorded with conventional tillage with herbicides which was on par with zero tillage with herbicides (T4) treatments (Table 1). The

Table 1. Growth parameters and yield attributing characters of maize as influenced by tillage methods and nitrogen levels.

Treatments	Plant height (cm) at harvest	Drymatter accumulation (kg ha^{-1}) at harves	Number of cobs plant^{-1}	Number of grains cob^{-1}	Test weight (g 100 grain)-1
T : Conventional tillage alone	241.4	12100	1.1	491.2	31.9
T : Conventional tillage with 2 herbicides (atrazine@1.25 kg a.i.ha^{-1} as PE fb paraquat@0.6 kg a.i.ha at 3WAS)	248.5	13004	1.2	547.5	33.9
T : Zero tillage alone	239.6	1114	1.1	483.8	31.9
T : Zero tillage with herbicides 4 (atrazine@ 1.25 kg a.i.ha-1 as PE fb paraquat @ 0.6 kg a.i.ha at 3WAS)	246.2	12478	1.1	511.6	33.3
SEm±	5.9	333.5	0.06	15.2	0.5
CD (0.05)	NS	1153.9	NS	41.3	NS
CV%	8.5	9.5	7.39	10.3	5.2
Nitrogen levels (kg ha) (N)					
N : 120	234.7	9069	1.1	491.2	31.9
N : 160	245.3	11127	1.2	547.5	33.9
N : 200	247.4	13154	1.1	483.8	31.9
N : 240	248.2	15345	1.1	511.6	33.3
SEm±	3.2	366.2	0.06	15.2	0.5
CD (0.05)	9.5	1068.9	NS	41.3	NS
CV%	4.6	10.4	7.39	10.3	5.2
Interaction	NS	NS	1.1	491.2	31.9

T X N = To compare two sub plot treatment means at a given main plot treatment
N X T = To compare two main plot treatment means at each level of sub plot treatments

highest plant height was recorded with application of 240 kg N ha^{-1}was at par with application of 200 kg N ha^{-1} and160 kg N ha^{-1}. Application of 240 kg N ha^{-1} produced significantly high qualitity and amount of drymatter and grain yield over rest of the nitrogen levels. Number of cobs plant^{-1}, number of grains cob^{-1}and test weight were highest with treatment that received 240 kg N ha-1 over other nitrogen levels. However, number of cobs plant^{-1} was on par with 160, 200 kg N ha^{-1} and 200, 240 kg N ha^{-1} treatments. Higher accumulation of drymatter in plant and effective translocation of photosynthates from source to sink might have improved these parameters. The interaction between tillage methods and nitrogen levels was not significant.Similar findings were reported by Singh *et al*. (2000) and Deshmukh *et al.* (2009).

Economics

Among all the methods, the highest gross (Rs. 82548) and net returns (Rs. 57874)were recorded under conventional tillage with herbicides (T4) with 240 kg N ha^{-1} (N) (Table 2).The benefit was mainly due to substantial gain in maize productivity. However, the highest BCR (3.35) was recorded from maize grown under zero tillage with herbicides (T4) under 240 kg N ha-1(N). This improvement in remunerative returns can be attributed to lower cost of cultivation under zero tillage. This was closely followed by conventional tillage with herbicides under 240 kg N ha^{-1}. These findings were in agreement with those reported by Kandasamy and Chandrasekhar (1998), Subramanyam *et al*. (2001).

Table 2. Economics of maize as influenced by tillage methods and nitrogen levels.

Treatment	Yield (kg ha-1)	Gross returns (Rs)	Net returns (Rs)	Returns per rupee of investment
T1N1	2614.0	31368	9596	1.44
T1N2	3882.3	46588	24328	2.09
T1N3	4920.0	59040	36291	2.60
T1N4	5958.3	71500	48262	3.08
T2N1	3847.3	46168	22960	1.99
T2N2	4914.3	58972	35276	2.49
T2N3	5948.3	71380	47195	2.95
T2N4	6879.0	82548	57874	3.35
T3N1	2149.7	25796	6649	1.35
T3N2	3214.0	38568	18933	1.96
T3N3	4181.3	50176	30052	2.49
T3N4	5079.0	62136	41523	2.96
T4N1	3443.3	41320	20737	2.01
T4N2	4358.0	52296	31226	2.48
T4N3	5365.0	64380	42820	2.99
T4N4	6363.3	76360	54311	3.46

INPUT COST OUTPUT COST: Rs. 12 kg-1

Land preparation : Rs. 2625*Seed* : Rs. 210 kg-1*Labour wages* : Rs. 147 head-1

Fertilizers :Urea : Rs. 5.62 kg-1SSP : Rs. 7.8 kg-1MOP : Rs. 17.64 kg-1

chemicals : Chlorpyriphos : Rs. 260 L-1 Dichlorvos : 480 L-1Carbofuran : Rs. 60 kg-1 Thiodicarb : 2400 kg-1

Herbicides: Atrazine : Rs. 320 per kg Paraquat : Rs. 280 per L Glyphosate: Rs. 330 per L

Spraying cost : Rs. 300 per ha

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