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Effect of Tillage Methods and Nitrogen Levels on Weed Control and Nitrogen use Efficiency of *rabi* Maize

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ABSTRACT

A field experiment was conducted at the Agricultural College Farm, Bapatla to study the effect of tillage methods and nitrogen levels on weed control and nitrogen use efficiency in *rabi* maize. Results indicated that weed drymatter was lowest and highest weed control efficiency was obtained with conventional tillage with herbicides. Among nitrogen levels it was highest with 240 kg N ha^{-1}. Nitrogen uptake by grain was highest with conventional tillage with herbicides and it was on par with zero tillage with herbicides. Conventional tillage with herbicides has maximum nitrogen uptake by stover. Nitrogen uptake by grain and stover increases with increase of nitrogen level and it was highest with application of 240 kg N ha^{-1}. The maximum nitrogen use efficiency was observed in conventional tillage with herbicides (69) was followed by Zero tillage with herbicides (55) at 160 kg N ha^{-1}.

Key words : Tillage, Nitrogen use efficiency, *Rabi* Maize, Weed control.

Tillage is considered to reduce weed infestation. Repetitive tillage operations are not necessary if weeds are controlled by cultural or chemical methods (Shekhawat and Gautam, 2002). 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. Zero tillage with use of herbicides for controlling existing vegetation is gaining popularity among the farming community which results in substantial saving of time, irrigation and monetary costa. The yield and N uptake of maize were negatively correlated with that of weeds. The extent of nutrient loss by weed varies from 30-40% of applied nutrients (Mundra *et al*., 2002). So management of weeds is vitally important not only to check out the yield losses caused by them, but also to increase the uptake of nutrients, fertilizer use efficiency and productivity of the crop by decreasing the biomass and nutrient removal by weeds. Keeping this in view, an experiment was conducted to evaluate different tillage methods and nitrogen levels on weed growth, nutrient uptake by crop and nitrogen use efficiency of maize.

MATERIAL AND METHODS

The 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 P^H 8.2, low in organic carbon and available nitrogen (242.5 kg ha^{-1}), medium in phosphorus (35 kg ha^{-1}) 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} as PE fb paraquat@ 0.6 kg a.i.ha^{-1} at 3 WAS), 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 3 WAS) and four nitrogen levels (120, 160, 200 and 240 kg N ha^{-1}) were tested in split plot design with three replications. Maize was planted by adopting a spacing of 75cmx20cm during last week of January 2013. The herbicides were applied as per the treatments in three split doses one at sowing, second at 30 DAS and third at 45 DAS. Uniform dose of phosphorus (60 kg P_2O_5 ha^{-1}) in the form of single super phosphate was applied at the time of sowing as basal. Potassium (50 kg K_2O ha^{-1}) in the form of muriate of potash was applied in two splits one at time of sowing and second at 45DAS.

Table1. Effect of tillage and weed management on weed growth and nutrient uptake by maize crop.

Treatments	Weed drymatter (g m^{-2})	Weed control efficiency (%)	Nitrogen uptake by grain (kg ha^{-1})	Nitrogen uptake by stover (kg ha^{-1})	Total nitrogen upake (kg ha^{-1})
Tillage methods (T)					
T_1: Conventional tillage	20.2	7	61.8	35.3	97.2
T_2: Conventional tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1} as PE fb paraquat@ 0.6 kg a.i.ha^{-1} at 3 WAS)	5.7	74	69.2	43.0	112.2
T_3: Zero tillage alone	21.8	0	58.0	32.7	90.8
T_4: Zero tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1} as PE fb paraquat@ 0.6 kg a.i.ha^{-1} at 3 WAS)	6.8	69	66.7	40.0	106.8
SEm±	0.3	0.9	0.8	0.5	1
CD(0.05)	1.0	3.2	2.8	1.9	3.5
CV%	7.1	8.9	4.6	4.9	3.5
Nitrogen levels (kg ha^{-1}) (N)					
N_1:120	11.8	39.8	42.3	24.7	67.0
N_2:160	13.0	37.0	55.2	33.9	89.0
N_3:200	14.0	37.2	70.8	42.1	112.8
N_4:240	15.5	36.3	87.6	50.5	138.1
SEm±	0.3	1.0	0.8	0.6	1.0
CD(0.05)	0.8	NS	2.5	1.9	2.9
CV%	6.9	8.5	4.4	6.0	3.4
Interaction	NS	NS	NS	NS	NS

TxN: To compare two sub plot treatment means at a given main plot treatment
NxT: To compare two main plot treatment means at each level of sub plot treatment

Table2. Effect of tillage and weed management on Nitrogen use efficiency (kg grain kg^{-1} fertilizer N) of maize.

Treatments	Nitrogen use efficiency			
	Nitrogen levels (kg N ha^{-1})			
	120	160	200	240
Tillage methods (T)				
T_1: Conventional tillage	-	43	35	32
T_2: Conventional tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1} as PE fb paraquat@ 0.6 kg a.i.ha^{-1} at 3 WAS)	-	69	47	39
T_3: Zero tillage alone	-	27	25	24
T_4: Zero tillage with herbicides (atrazine@ 1.25 kg a.i.ha^{-1} as PE fb paraquat@ 0.6 kg a.i.ha^{-1} at 3 WAS)	-	55	40	35

The data for recording weed drymatter, weeds were removed from a quadrat of 0.25m^2 at 60 DAS randomly in two places at each plot.

RESULTS AND DISCUSSION

Effect of tillage on weeds

The dominant weed flora of the experimental plot consisted of *Cynodon dactylon, Echinochloa crusgalli, Cyperus rotundus, Trianthema portulocastrum, Phyllanthus niruri, Digera arvensis, Physalis minima, Euphorbia hirta, Aristolachia bracteata, Meremmia everta, Commelina benghalesis, Sida acuta* and *Cleome viscosa*.

The lowest weed drymatter at 6ODAS was observed with conventional tillage with herbicides among all the tillage treatments (Table1). Weed drymatter increased with increase of nitrogen levels and it was highest with 240 kg N ha^{-1} and lowest with 120 kg N ha^{-1}. The highest weed control efficiency at 60 DAS was recorded with conventional tillage with herbicides (T_2) with 74 percent. This could be due to the intial weed population which was controlled by pre emergence herbicides and the later emerged weeds were controlled by the non-selective post emergence herbicide. The results are in accordance with the findings of Sreenivas *et al*., (1922).

Nitrogen uptake by crop

Nitrogen uptake by grain was highest with conventional tillage with herbicides and it was on par with zero tillage with herbicides (Table1). Nitrogen uptake by stover and total nitrogen uptake by grain and stover was highest with conventional tillage with herbicides and lowest with zero tillage alone. Nitrogen uptake by grain, stover and total nitrogen uptake by of grain and stover increased with increase of nitrogen level and it was highest with application of 240 kg N ha^{-1}. The increased nutrient uptake in these treatments was due to maintenance of weed free environment at critical stages of crop growth which resulted in more crop drymatter accumulation and ultimately higher grain yield. The interaction etween tillage methods and nitrogen levels was not significant. The results are akin to those reported by Kumar *et al.,* (2002) and Hedge *et al.,* (2007).

Nitrogen use efficiency

Nitrogen use efficiency decreased with increase in nitrogen level in each system of tillage methods. The maximum Nitrogen use efficiency was recorded with conventional tillage with herbicides (69) followed by zero tillage with herbicides (55) at 160 kg N ha^{-1} (Table2). It might be due to pulverization of soil under conventional tillage. This might have facilated the penetration of plant roots, improved soil aeration and increased infiltration of water, apart from destroying the weeds, which resulted in increased nitrogen use efficiency. This results were online with Walia *et al*., (1991).

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