Nutrient uptake by maize (*Zea mays* L) in traditional weed management methods

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ABSTRACT

Field experiment was conducted to study the influence of various traditional weed management methods on nutrient uptake by maize at Tamil Nadu Agricultural University during kharif 2017. Various traditional inputs like common salt (30%), vinegar (20%) and a preparation of traditional formulation containing cow urine, lemon fruit and dried fruits powder of *Terminalia chebula* were applied for controlling the weeds. Results revealed that hand weeding twice on 20 and 45 days after sowing (DAS) removed higher amount of nutrients by maize which was merely comparable with post-emergence application of vinegar 20 per cent + hand weeding on 45 DAS. This was followed by early post-emergence application of traditional formulation @ 10 l/ha + hand weeding on 45 DAS. All the weed management treatments recorded significantly higher nutrient uptake by maize compared to weedy check.

Keywords: Maize; weed; traditional weed management; vinegar; nutrient

INTRODUCTION

In India maize (*Zea mays* L) is cultivated in an area of 10.2 Mha with a production of 26.3 MT and productivity of 2574 kg/ha (http://www.faostat.org). The demand of maize crop is increasing day by day due to higher demand of poultry and cattle feed. Among various biotic constraints affecting maize production weeds are a major problem which leads to a potential yield loss of 30-40 per cent (Rao et al 2014). Weed competition is more due to initial dawdling growth of maize. These unwanted plants in field compete with maize crop for moisture, light, space and nutrients. They become major consumers of nutrients applied to plants unless and otherwise controlled (Bajwa et al 2014) and the loss vary from 30 to 40 per cent (Chopra and Angiras 2008). In reality nutrients depletion by weeds is a huge loss which otherwise are absorbed and utilised by maize crop effectively. Weed management attempts are advantageous in checking the extraction of nutrients by weeds. Due to increased awareness among public for safe food now farmers are concentrated towards cultivation without the use of synthetic chemical inputs. This can be achieved by way of non-chemical weed management methods to some extent where traditional weed management methods are a possible replacement to synthetic herbicides. Traditional methods of weed control by utilizing natural compounds and plant-derived inputs are a suitable alternative. Traditional weed management in maize has got little attention. Hence an effort was made to study the effect of various traditional weed management methods on nutrient uptake by maize.

MATERIAL and METHODS

Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during kharif 2017 using maize hybrid COH (M) 6 as the test crop. Soil of the experimental site was sandy loam with moderately alkaline nature (pH 8.4), high in organic carbon (0.972%), low in available nitrogen (219 kg/ha), medium in available phosphorus (15 kg/ha) and high in potassium (449.8 kg/ha). The experiment was laid out in randomized block design with ten treatments replicated thrice. Weed management was done as per the

treatment schedule. The spraying operations like early post-emergence (EPOE) applications were done at 2-6 leaf stage of weeds (15th day of sowing) and post-emergence (POE) at 20th day of sowing using knapsack sprayer fitted with deflector type nozzle and hood to avoid direct contact of the spray fluid with crop plants (protected spray). The different traditional weed management methods comprised T_1 (EPOE 30% common salt), T_2 (EPOE 30% common salt + hand weeding at 45 DAS), T_3 (POE vinegar 20%), T_4 (POE vinegar 20% + hand weeding at 45 DAS), T_5 [EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *Terminalia chebula*)], T_6 [EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS], T_7 [EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*)], T_8 [EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS], T_9 (Hand weeding twice at 20 and 45 DAS), T_{10} (Weedy check). Traditional formulation was prepared by mixing 3 kg finely grounded powder of dried fruits of *T chebula*, juice of ten numbers of lemon fruit in 10 litre of one month old cow urine. This was kept for 15 days under shade after covering with gunny bag. Regular stirring was also done. Before spraying the formulation was sieved using a muslin cloth. Recommended dose of fertilizer @ 250:75:75 kg NPK/ha was applied to the crop. Full dose of phosphorus and potassium and 25 per cent of nitrogen were applied as basal and remaining N was top-dressed at 25 (50%) and 45 DAS (25%). Dry matter production of maize at 30 and 60 days of sowing (DAS) and harvest were recorded. Standard procedures as suggested by Humphries (1956) for nitrogen and Jackson (1973) for phosphorus and potassium estimation were used. Nutrient content (%) was multiplied with dry matter (kg/ha) to arrive at nutrient removal. Procedure given by Gomez and Gomez (1984) was used for statistical analysis.

RESULTS and DISCUSSION

Nutrient uptake by maize

Adoption of different traditional weed management methods conspicuously influenced uptake of nutrients viz nitrogen, phosphorus and potassium and the data are presented in Table 1.

Nitrogen: T_9 (Hand weeding twice at 20 and 45 DAS) recorded higher nitrogen (N) uptake of 10.42 kg/ha at 30 DAS that was followed by T_4 (POE vinegar 20% + hand weeding at 45 DAS) (8.45 kg/ha) and T_3 (POE vinegar 20%) (8.41 kg/ha) the latter two being on par with each other. At 60 DAS and at harvest the highest N uptake was found in T_9 (204.50 and 227.60 kg/ha respectively) which was at par with T_4 (197.80 and 221.40 kg/ha respectively). T_6 [EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS] was proved to be the next best treatment at 60 DAS and at harvest with 159.87 and 202.40 kg/ha N uptake respectively.

Phosphorus: At 30 DAS the highest P uptake was observed in T_9 (1.97 kg/ha) which was closely followed by T_3 and T_4 (1.79 kg/ha each). However at 60 DAS and at harvest T_9 (14.00 and 16.40 kg/ha respectively) and T_4 (13.54 and 15.95 kg/ha respectively) were found at par. Like N, T_6 was proved to be the next best treatment at 60 DAS and at harvest with 10.94 and 14.58 kg/ha P uptake respectively.

Potassium: Almost similar trend was observed in case of K. At 30 DAS the K uptake was maximum under T_9 (13.87 kg/ha) which was followed by T_4 (11.25 kg/ha) and T_3 (11.19 kg/ha) the latter two being at par. At 60 DAS and at harvest T_9 (73.00 and 85.43 kg/ha respectively) and T_4 (71.01 and 83.10 kg/ha respectively) were found at par for K uptake. Like N and P in this case also next best treatment was T_6 with 64.91 and 75.97 kg/ha K uptake at 60 DAS and at harvest respectively.

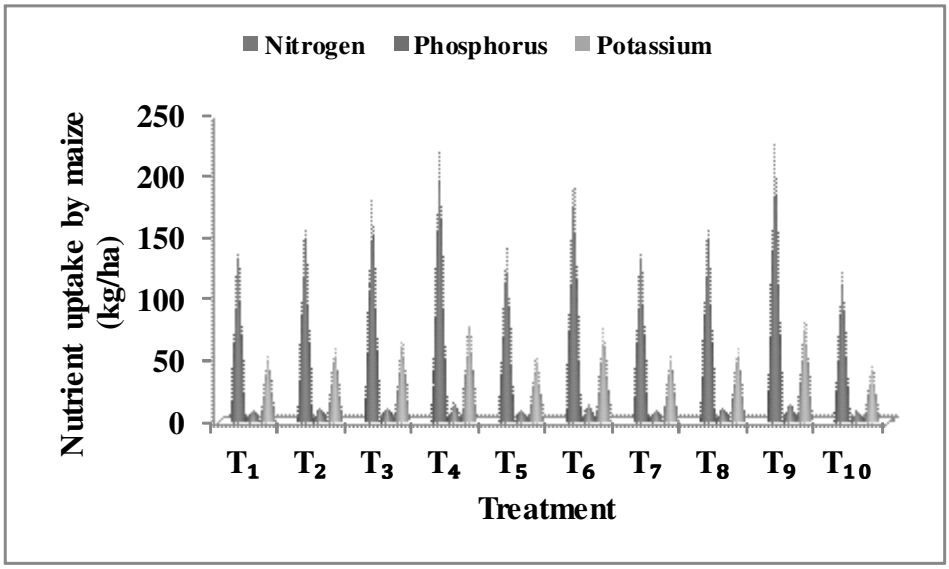
Physical disturbances created manually might have improved the soil structure, porosity and aeration which could be the probable reason for higher N, P and K uptake at 30 DAS in hand weeding twice on 20 and 45 DAS. This was followed by POE vinegar 20 per cent + hand weeding on 45 DAS and POE vinegar 20 per cent which were comparable with each other. Use of vinegar 20 per cent resulted in direct killing of weeds as reported by Radhakrishnan et al (2002) and inhibition of the weed seedling growth due to the presence of allelochemicals in *T chebula* (Manikandan and Rejula 2008) which is an ingredient of traditional formulation that might have created lesser competition between weeds and maize for nutrients. Finally the efficient weed management reduced weed competition and physical disturbance created by hand weeding further favoured better growing environment by means of improvement in soil texture and aeration which lead to superior nutrient uptake in maize (Fig 1). The results are in accordance with the results of Malviya et al (2012) and Lakshmi and Luther (2017). Lower nutrient uptake by maize due to heavy weed competition and

Table 1. Effect of traditional weed management methods on nitrogen, phosphorus and potassium uptake by maize at different growth stages

Treatment	Nitrogen uptake (kg/ha) at			Phosphorus uptake (kg/ha) at			Potassium uptake (kg/ha) at		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
T_1	6.52	79.28	143.80	0.92	5.43	10.36	8.68	46.12	53.97
T_2	6.50	107.25	163.10	0.89	7.34	11.75	8.89	52.32	61.23
T_3	8.41	136.70	183.20	1.79	9.36	13.20	11.19	58.76	68.76
T_4	8.45	197.80	221.40	1.79	13.54	15.95	11.25	71.01	83.10
T_5	7.52	80.69	144.00	1.40	5.52	10.37	10.01	46.18	54.05
T_6	7.48	159.87	202.40	1.26	10.94	14.58	9.96	64.91	75.97
T_7	6.43	76.52	143.40	0.93	5.24	10.33	8.56	45.99	53.82
T_8	6.64	109.50	164.30	0.95	7.50	11.84	8.84	52.69	61.66
T_9	10.42	204.50	227.60	1.97	14.00	16.40	13.87	73.00	85.43
T_{10}	2.93	56.85	124.40	0.70	3.89	8.96	3.90	39.89	46.69
SEd	0.37	8.01	8.9	0.08	0.53	0.63	0.48	2.78	3.21
$CD_{0.05}$	0.77	16.84	18.7	0.17	1.11	1.33	1.01	5.84	6.75

T_1: EPOE 30% common salt, T_2: EPOE 30% common salt + hand weeding at 45 DAS, T_3: POE vinegar 20%, T_4: POE vinegar 20% + hand weeding at 45 DAS, T_5: EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *Terminalia chebula*), T_6: EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS, T_7: EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*), T_8: EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS, T_9: Hand weeding twice at 20 and 45 DAS, T_{10}: Weedy check

EPOE: Early post-emergence, POE: Post-emergence, DAS: Days after sowing



T_1: EPOE 30% common salt, T_2: EPOE 30% common salt + hand weeding at 45 DAS, T_3: POE vinegar 20%, T_4: POE vinegar 20% + hand weeding at 45 DAS, T_5: EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *Terminalia chebula*), T_6: EPOE traditional formulation @ 10 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS, T_7: EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*), T_8: EPOE traditional formulation @ 7.5 l/ha (cow urine + lemon fruit + *T chebula*) + hand weeding at 45 DAS, T_9: Hand weeding twice at 20 and 45 DAS, T_{10}: Weedy check

EPOE: Early post-emergence, POE: Post-emergence, DAS: Days after sowing

Fig 1. Effect of traditional weed management methods on nutrient uptake (kg/ha) by maize at harvest

lower maize dry matter production corroborate the results of Nazreen et al (2017).

CONCLUSION

The experiment revealed that higher nutrient uptake by maize was recorded in hand weeding twice on 20 and 45 DAS which was comparable with post-emergence application of vinegar 20 per cent + hand weeding on 45 DAS. Next best in nutrient uptake was early post-emergence application of traditional formulation @ 10 l/ha (Cow urine + Lemon fruit + *T chebula*) + hand weeding on 45 DAS. Hence POE vinegar 20 per cent or EPOE traditional formulation @ 10 l/ha (Cow urine + Lemon fruit + *T chebula*) along with hand weeding on 45 DAS will be an alternative in non-chemical weed management to increase the nutrient uptake in maize.

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