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Evaluation of site specific nutrients management concept for targeted yield in rabi maize

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ABSTRACTS

On farm research studies were conducted during rabi season of 2016-17 in six villages in warangal district with six farmers. The selected farmer's fields were neutral to alkaline in reaction(6.57-8.60), non saline in nature (EC) (0.19-1.0), available N was ranged from 113 to 389 kg /ha, available Phosphorus is 4.51-68kg/ha, available potassium was 265-633kg/ha & available Zinc was 0.49-3.93 mg/kg and based on initial fertility status of soil application of nutrients as per site specific nutrient management (SSNM) practices for targeted yield of 7.5t/ha were designed and compared with soil test crop response (STCR), recommended dose of fertilizers (RDF) and farmers practice (FP). Though the yield difference among treatments was non significant the 80% of targeted yield was achieved by the STCR & SSNM treatments. Hence, the STCR equations for targeted yield for maize in rabi season in Warangal district was functional.

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INTRODUCTION

Maize is the important crop cultivated over 2.0 lakh hactares during *rabi* season in telangana state. Congenial weather conditions coupled with irrigation are the major reasons for higher yields in rabi maize (5.2t/ha). But, farmers with an objective to reap more and more yields indiscriminately applying fertilizers thus deteriorating soil health, polluting environment and increasing their cost of cultivation. For optimum yields in the crop with higher benefit cost ratio, site specific nutrient management plays a pivotal role. As there is need to confirm these nutrient levels in farmers fields, the present investigation was conducted.

MATERIALS AND METHODS

On farm research studies were conducted during *rabi* season of 2016-17 in six villages in warangal district with six farmers. The selected farmer's fields were initially analysed for pH, Electrical conductivity (EC), available N, P, K & Zn and based on initial fertility status of soil application of nutrients as per site specific nutrient management (SSNM) practices for targeted yield of 7.5t/ha were designed and compared with soil test crop response (STCR), recommended dose of fertilizers (RDF) and farmers practice (FP). These 7 nutrient treatments were fixed in 2000 m^2 with maize hybrid DHM -117. The maize sowings were done within the first fortnight of January 2017 and crop matured in 125 days. The yield was recorded at harvest and analysed. The economics were also calculated on the basis of cost of cultivation, gross return, net return and benefit cost ratios. The cost of cultivation for each treatment was calculated by summing all the variable cost items in the production process. Similarly gross returns were calculated based on prevailing market price of the produce. The net returns were obtained after deducting the cost of cultivation from gross returns. Thus, the benefit cost analysis was obtained by dividing total returns from a unit with total cost of a unit.

Table -1: Initial soil fertility status of farmers fields

Soil parameter (Ranges)	Locations					
	1	2	3	4	5	6
pH	6.57-8.25	7.95-8.35	8.10-8.52	8.21-8.46	8.30-8.60	8.10-8.35
EC (dS/m)	0.30-0.73	0.31-1.0	0.26-0.50	0.19-0.36	0.19-0.31	0.27-0.41
Available N (kg/ha)	200-252	226-276	113-176	226-389	240-242	176-251

Available P (kg/ha)	36-77	40-68	4.51-9.02	7.20-9.25	8.1-10.1	13.54-22.57
Available K (kg/ha)	363-467	265-396	363-548	317-589	316-581	378-633
Available Zn (mg/kg)	2.56-3.34	0.66-1.18	0.66-1.04	0.49-0.78	0.52-.65	0.63-3.93

Initial soil fertility status of experimental locations: Initial soil fertility status of experimental locations presented in table-1.

The initial soil samples were analysed for pH (1:2) soil : water suspension, EC by conductivity meter(Jackson 1973), available nitrogen was estimated by alkaline permanganate method (Subbaiah and asija 1956), available P by Olsens method(Olsen *et al.* 1954), available K by ammonium acetate extraction method(Jackson 1973), available Zn, Cu, Fe & Mn was extracted with DTPA and determined using AAS as described by Lindsay and Norvell (1978).

At location 1 the soil was sandy clay loam in texture, pH ranged from 6.57 to 8.25, electrical conductivity (EC) ranged from 0.30 to 0.73 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 200 to 252, 36 to 77, 363 to 467 kg/ha and 2.56 to3.34 mg/kg, respectively.

At location 2 the soil was clay loam in texture, pH ranged from 7.95 to 8.35, electrical conductivity (EC) ranged from 0.31 to 1.0 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 226 to 276, 40 to 68, 265 to 396 kg/ha and 0.66 to 1.18 mg/kg, respectively.

At location 3 the soil was clay loam in texture, pH ranged from 8.10 to 8.52, electrical conductivity (EC) ranged from 0.26 to 0.50 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 113 to 176, 4.51 to 9.02, 363 to 548 kg/ha and 0.66 to 1.04 mg/kg, respectively.

At location 4 the soil was clay in texture, pH ranged from 8.21 to 8.46, electrical conductivity (EC) ranged from 0.19 to 0.36 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 226 to 389, 7.20 to 9.25, 317 to 589 kg/ha and 0.49 to 0.78 mg/kg, respectively.

At location 5 the soil was clay in texture, pH ranged from 8.30 to 8.60, electrical conductivity (EC) ranged from 0.19 to 0.31 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 240 to 242, 8.1 to 10.1, 316 to 581 kg/ha and 0.52 to 0.65 mg/kg, respectively.

At location 6 the soil was clay loam in texture, pH ranged from 8.10 to 8.35, electrical conductivity (EC) ranged from 0.27 to 0.41 dSm^{-1}, available nitrogen, phosphorus, potassium and available Zn ranged from 176 to 251, 13.54 to 22.57, 378 to 633 kg/ha and 0.63 to 3.98 mg/kg, respectively.

Table-2: Grain and stover yield of maize as influenced by different fertilizer treatments

Treatments	N, P, K (kg /ha)	Grain yield (kg/ha)	Stover yield (kg/ha)
(FP)	300-80-40	6119	6133
(RDF)	250-80-80	6171	6014
(STCR)	195-102-55	6157	5909
(SSNM-1)	187-103-73	6133	5974
(SSNM-2)	194-100-83	6298	5817
(SSNM-3)	184-100-65	6164	5790
(SSNM-4)	184-105-72	6185	5816
SE m±		**29**	**92**
CD (0.05%)		**NS**	**NS**

Table-3: Economics of applied inputs to maize crop as influenced by different fertilizer treatments

Treatments	N, P, K (kg /ha)	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
(FP)	300-80-40	58860	122380	63520	2.08
(RDF)	250-80-80	59010	123420	64410	2.09
(STCR)	195-102-55	58927	123140	64213	2.09
(SSNM-1)	187-103-73	59222	122660	63438	2.07
(SSNM-2)	194-100-83	59373	125960	66587	2.12
(SSNM-3)	184-100-65	58905	123280	64375	2.09
(SSNM-4)	184-105-72	59266	123700	64434	2.09

RESULTS AND DISCUSSION

Grain and stover yield of maize presented in table-2.

Grain and stover yield: Application of varying levels of N, P & K non significantly influenced the grain and stover yields of maize. However, higher grain and stover yield (6298 & 6133kg/ha, respectivily) was recorded by the application of 194-100-83 (SSNM-2) and 300-80-40 kg N, P & K/ha(FP), respectively and lower grain and stover yield (6119 & 5790 kg/ha, respectively) was recorded by the application of 300-80-40(FP) and 184-100-65kg N, P &K /ha (SSNM-3), respectively. Though the yield difference among treatments was non significant the 80% of targeted yield was achieved by the STCR & SSNM treatments. Hence, the STCR equations for targeted yield for maize in rabi season in Warangal district was functional.

Economics of applied inputs to maize crop: Economics of applied inputs to maize crop presented in table-3.

Cost of cultivation (Rs/ha): The cost of cultivation was higher (59,373) in case of application of 194-100-83 kg N, P & K /ha (SSNM-2) due to higher application of potassium and phosphorus, over the other treatments. Lower cost of cultivation (58,860) was observed by the application of 300-80-40 kg N, P & K kg/ha (FP) due to lower application of potassium though they have applied higher quantity of nitrogen over the other treatments.

Gross income (Rs/ha): The gross income was higher (1, 25, 960) in case of application of 194-100-83 kg N, P & K /ha (SSNM-2) due to higher grain yields (6298 kg/ha) over the other treatments. Lower gross income (1, 22,380) was observed in the treatment 300-80-40 kg N, P & K kg/ha (STCR) due to lower grain yield (6119kg/ha) over the others.

Net income (Rs/ha): The net income ranged from 63,438 to 66,587/- rupees per hectare. The highest net income (66,587) was recorded by the application of 194-100-83 kg N, P & K /ha (SSNM-2) due to higher grain yields and even though recorded higher cost of cultivation over the other treatments. Lower net income 63,438 was found with the application of nutrients 187-103-73 kg N, P&K /ha (SSNM-1) due to lower grain yields and higher cost of cultivation.

Benefit cost ratio: The benefit cost ratio ranged from 2.07 to 2.12. The highest benefit cost ratio (2.12) was found with application of 194-100-83 kg N, P & K /ha (SSNM-2) and lowest benefit cost ratio (2.07) was found with application of 187-103-73 kg N, P & K /ha (SSNM-1) The higher B:C ratio was found with application of 194-100-83 kg N, P & K /ha (SSNM-2). Hence, the STCR equations for targeted yield were working in rabi maize for Warangal district.

These results clearly showed that the fertilizer requirements varied with the soil test values for the same level of crop production. Hence, balanced fertilization through soil testing becomes essential for increasing crop production. It is obvious from these findings that there was net saving of fertilizers in same target.

CONCLUSION

For clay loam soils of Warangal district with lower available nitrogen, medium available phosphorus and higher available potassium level and non deficient in available zinc, application of 200-100-80 kg N, P & K/ha was found to be optimum for higher yield and income in rabi maize.

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