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EFFECT OF NITROGEN, PHOSPHORUS AND POTTASSIUM ON YIELD PERFORMANCE OF MAIZE UNDER MID HILLS OF MIZORAM

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Maize is the second most important crop of Mizoram net to paddy and occupied an area of 8,681 ha with a production of 16,589 mT (Anonymous, 2000). The productivity of maize is very low as compared to other North Easter states is due to non adoption of modem technologies, low and non-judicious use of organic or inorganic sources. The major soil productivity constraints are attributed to shifting cultivation, steep slopes, torrential rainfall, high soil erosion, low fertilizer use efficiency, soil acidity and other associated problems (Patiram *et al.* 1994 and Laxminarayana & Azad Thakur 1999). As the response of various nutrients was not evaluated under mid hill conditions of Mizoram, the present investigation was carried out to study the effect of different graded doses of N, P and K on yield performance of maize.

A field experiment was conducted during kharif (rainy seson) of1998 under upland terraces at ICAR Research Complex for NEH. Region, Mizoram Centre, Kolasib, Mizoram. Initial soil sample was collected, processed and analyzed for textural components (Piper 1966), organic carbon (Walkley and Black 1934) and other chemical constituents (Jackson 1973). The experiment was laid out in three replications in a randomized block design with 10 treatments. (Table 2)

Farmyad manure (FYM) was applied @ 10 t/ha uniformly to all the plots well in advance of sowing of the crop. Nitrogen was applied as per the treatments in the form of urea in three split doses (half at basal, ¼ at crown root initiation and 1/4 at tasseling stages, respectively). Phosphorus and potassium were applied as basal in the form of single super phosphate and muriate of potash, respectively as per the treatments. The maize (cv RCM 1-1) seeds were dibbled at 45 x 30 cmcm spacing and the crop was harvested at 110 days after sowing and the yield parameters were recorded.

The experimental soil is sandy loam in texture (Table 1) and belogs to Typic Hapludults, acidic in nature (pH 5.2), non saline (EC 0.25 dS/m). The soil contains medium status of organc carbon (0.67%), low in available N (224 kg./ha) low in available P_2O_5 (14.7 kg/ha) and medium in available K_2O (292 kg/ha). High intensity and uneven distribution of rainfall at higher altitudes and decrease of temperature slows down the rate of decomposition of organic matter, leading to wider C:N ratio and deficiency of available N in the soils (Nath & Deori 1976; Singh & Datta 1988; patiram et al. 1994). A close perusal of the date in Table 2 revealed that all the yield parmeters were significantly increased with the application of different grade

doses of N, P and K over control. Highest grain yield (4435 kg/ha) was recorded with the application of 80 kg P_2O_5/ha followed by 150 kg N/ha (4258 kg /ha) and 120 kg P_2O_5/ha 4130 kg/ha)

Response of nitrogen on yield performance

It was observed that the grain yield was progressively and non significantly increased with the increased doses of N up to 150 kg N/ha. Among the treatments highest grain yield 4258 kg/ha) was recorded with the application of 150 kg N/ha followed by 100 kg N ha (3884 kg/ha). Other yield parameters like number of cobs/plant, number of grains/cob, test weight and cob yield were progressively increased with the application of graded doses of N. Highest yield response (49%) in terms of grain yield was recorded with the application of 50 kg N/ha than 100 kg N/ha (14%) and 150 kg N/ha (10%). These results are in conformity with the findings of Patiram & Rai (1988) in the soils of Sikkim. Higher crop respone to the applied N in these soils was due to deficiency of available N, which might be attributed to leaching and erosion losses and slower rate of mineralization of organic mater at higher altitudes (Prasad et al. 1981 and Patiram et al. 1994).

Response of phosphorus on yield

Highest and significant increase of cob yield (5030 kg/ha) and grain yield (4435 kg/ha) was recorded with the application of 80 kg P_2O_5/ha over control. Other yield attributes were also progressive increased with the application of graded doses of P up to 80 kg P_2O_5/ha. However, the yield were on par with the increased doses of P up to 120 kg P_2O_5/ha as compared with the application of 80 kg P_2O_5/ha. Highest yield response of maize was observed to the application of P in comparison with N and K. The undulating topography, excess rainfall, texture of the soil accelerated the leaching and erosion of soil surface rich P, slower rate of mineralizaiton of organic P due to low temperature and fixation of P by Fe and Al oxides and hydroxides leads to deficiency of available P cotent in the soils and the crop response of the application of P (Patiram et al. 1994 and Laxminarayana & Azad Thakur 1999). The response in terms of per cent increase in grain yield was 42,94 and 81, respectively with the application of 40,80 and 120 kg P_2O_5/ha as compared with the control. However,the yeld response was positively increased with the application of graded doses of P i.e. 40 kg P_2O_5 ha (42%), 80 kg P_2O_5/ha (37%), while it showed negative response with higher doses of P application. These results corroborate with the findings of Prasad et al (1981) and Datta et al. (1983).

Response of potassium on yield

Though the available K in the soils of Mizoram is medium to high, the crops still showed significant response to the applied K. The grain yield and other yield attributes were progressively increased with the appiication of graded doses of K over control. Highest and significant grain yield (kg/ha) was recorded with the applicationof 60 kg K_2O/ha (3530) followed by 90 kg K_2O/ ha (3426) and 30 kg K_2O/ha (2914). In line with the grain yield other yield parameters were significantly increased with the application of 60 kg K_2O/ha over control. The per cent yield response was highest (54) with the application of 60 kg K_2O/ha followed by 90 kg K_2O/ha (50) and 30 kg K_2O)/ha (28) over control. Lower crop response to the limited supply of fertilizer K might be due availability of inherent soil K, which meets the crop requirement. Among the

graded doses of K, highest yield response (28%) was recorded with the application of 30 Kg K_2O/ha, while it was 21% with the increased doses of K up to 60 kg K_2O/ha. Similar higher response of maize to the application of 60 kg K_2O/ha in the soils of Sikkim was reported by Patiram et al. (1990).

From the foregoing results, it can be concluded that application of 150-80-60 kg N, P_2O_5 and K_2O/ha was found to be economical dose of fertilizers to obtain higher yields of maize under mid hill terraced conditions of Mizoram. Among the nutrients, highest yield response was obtained with the application of P followed by N and K and further investigations are needed to study the response of maize at higher doses of P with different sources in the acidic soils of Mizoram.

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Table 1. Initial properties of the experimental soil

Property of soil	Value
Sand (%)	62.4
Silt (%)	23.8
Clay (%)	13.8
PH (1:2.5)	5.2
EC (dS m^{-1})	0.25
Organic carbon (%)	0.67
Cation exchange capacity [c mol (p+) kg^{-1}]	4.60
Availabel N (kg ha^{-1})	223.70
Available P_2O_5 (Kg ha^{-1})	14.68
Available K_2O (Kg ha^{-1})	291.94

Table 2, Effect of nitrogen, phosphorus and potassium on yield parameters of maize

Treatment	Plant height (cm)	Number of Cobs $plan^{t-1}$	Number of grains cob^{-1}	100 seed wt (g)	Cob yield (kg ha^{-1})	Grain yield (kg ha^{-1})
Control	171.3	0.86	277.8	20.33	3024	2284
$N_{50}P_0K_0$	202.7	1.00	352.9	26.80	4017	3397
$N_{100}P_0K_0$	205.5	1.04	389.7	29.33	4440	3884
$N_{150}P_0K_0$	213.0	1.27	416.7	29.00	4697	4258
$N_0P_{40}K_0$	182.8	1.10	320.4	25.67	3817	3244
$N_0P_{80}K_0$	204.6	1.32	346.8	29.67	5030	4435
$N_0P_{120}L_0$	195.1	1.19	339.3	28.33	4580	4130
$N_0P_0K_{30}$	179.1	0.93	311.6	24.40	3477	2914
$N_0P_0K_{60}$	187.50	1.18	338.1	26.42	4120	3530
$N_0P_0K_{90}$	178.7	1.09	319.3	25.70	4051	3426
CD (P=0.05)	27.8	0.12	74.9	3.19	1209	1024