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Comparative effect of chemical fertilization and manure on the grain yield of hybrid maize in the forest zone of Nigeria

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ABSTRACT: Field trials were conducted at the International Institute of Tropical Agriculture, Ibadan, Nigeria (IITA) experimental field in 1985 and 1986 to compare the effect of chemical fertilization and organic manure on the grain yield of hybrid maize Variety: TZSR Y. The result shows significantly lower grain yield from the untreated plots (the control, where no fertilization was carried out) than plots treated with manure together with inorganic fertilizer.

Key words: - Inorganic, manure, fertilization, hybrid maize, grain yield.

Introduction

Many fertilizer trials have been conducted on tropical soils and particularly in Nigeria. Hybrid maize was introduced into Nigeria in 1979 and its production actually started in 1982. Hybrid maize is higher yielding than most open-pollinated varieties. For the extra crop, more nutrients will be required for the yield potential to be attained. Hybrid maize, therefore, is thought to require more nutrient elements than the local or the improved respectively to be open-pollinated varieties. About 120kg of N/ha and greater than 90kg of P₂O₅/ha were found by Obi (1991) and Rouanat (1987) adequate for the improved open-pollinated variety TZSR-W at Mokwa and Zaria. This may not be true with the hybrid maize. Moreover, the response of crops to fertilizers is governed by source of the nutrient elements, location, timing of application, the variety in question, spacing and the cropping method. It is then very imperative that fertilizer trials be conducted on hybrid maize in Nigeria.

If hybrid maize requires higher dosage of chemical fertilizers, the adverse effect of long term application could be dangerous. Commercial fertilizers we all know to influence plant nutrition with little effect on soil water conservation, soil physical properties and erosion control. They make the soil fertile and not necessarily productive, especially if there are physical limitations.

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Manure is very important in crop production from the stand point of fertility, soil physical properties and sustaining those properties once achieved. Manures improve soil structure which increase the water holding capacity of the soil, aeration, drainage, encourage good root growth and preventing the soil from being too rigid when dry or completely water logged when wet.

Hence the objective of this study was to determine the comparative effect of chemical fertilization and manure on the grain yield of hybrid maize in the forest zone of Nigeria.

Materials and Method

Field trials were conducted at the experimental field of International Institute of Tropical Agriculture (IITA) Ibadan in 1985 and 1986 wet seasons to compare the effect of chemical fertilization and manure on the grain yield of hybrid maize in the forest zone of Nigeria. The field was cleared, ploughed, harrowed and ridged at 75cm inter – row spacing, two seeds were planted per hole.

The treatments tested consist of the control (untreated) where no fertilization was carried out, 30t/ha of horse manure, 30t/ha of horse manure + 60: 60: 60 NPK and 120: 60: 60 (NPK). Randomised complete block with three replications was adopted for this experiment. The gross plot area was 11.25m² (3.75 x 3m) contained six rows of maize with intra row spacing of 25cm. The maize variety used for this experiment was TZSR-Y.

The manure was treated (cured) using single super phosphate and sprinkling water, and manure was applied through incorporation using short handle hoe a month before planting. While the inorganic fertilizer was applied split, half was applied at 3 weeks after planting (WAP) through side placement method, while the remaining half was applied at 8 WAP as top dressing.

Results and Discussion

The detail of the soil physicochemical properties of the site is shown in Table 1 and the nutrient composition of the horse manure used is shown in Table 2. Data collected included the grain yield (t/ha) and yield index along with the soil samples collected from 25cm depth from four randomly selected spots from the experimental field to determine the physico-chemical properties of the soil.

The result in Table 3 shows that grain yield when no inorganic fertilizer and manure was applied (the untreated control) was only significantly lower than the year when manure together with fertilizer was applied. The little response obtained was due to the medium fertility status of the soil before planting and imposing treatments (Table 1). The soil had been under cultivation for years and with application of commercial fertilizers in other words, the response could be more under replenished soils for example the 1986 experiment was on a sandy soil, cultivated for years without fallow or application of commercial fertilizers (Table 2). The yield without fertilization or manuring was about 16.6% of yield obtained at 120 - 60 - 60 of NPK or 14.5% of the yield obtained at 10t/ha of manure + basal NPK (Table 3).

Table 1: Chemical Properties of Treated Horse Manure.

Chemical Properties	Treated
Total N (%)	1.38
Total P (%)	0.86
Ca (%)	0.82
Mg (%)	0.52
K (%)	1.4
Na (PM)	1083
Mn (PPM)	1210
Fe (PPM)	9266
Cu (PPM)	13
Zn (PPM)	114

Table 2: Chemical and Physical Characteristics of the Forest Soil.

	IITA, Ibadan
pH in H ₂ O	6.6
% Organic C	2.7
Total N (%)	0.27
Available Bray - 1 (PPM)	136.5
Exchangeable K (Meq/100g)	1.16
Exchangeable Mg (Meq/100g)	2.25
Exchangeable Mn (Meq/100g)	Traces
CEC (Meq/100g)	9.6
% Sand	7.6
% Silt	20
% Clay	4
Texture	Sandy Loam

Table 3: Response of Hybrid Maize to Manure and Chemical Fertilizers in the Forest Zone of Nigeria.

	1985 Main Season Yield (t/ha)	Residual Effect Tested During 2 nd Season 1986 (t/ha) in Forest
	Forest	
No Fertilization	5.3	1.8
120 : 60 : 60 (NPK)	5.7	1.9
30t/ha of Manure	5.8	2.4
30t/ha of Manure + 60-60-60	6.3	2.3
LSD 5%	0.8	0.5
C.V.	14.3	11.7

Conclusion

From the two experiments, the following conclusion could be made: 10t/ha of manure + basal NPK 60 - 60 - 60 NPK could be recommended for hybrid maize farmers for this ecology. The residual effect of manure and the advantage of it in the late season planting are obvious from Table 1; hence the use of manure should be encouraged. 120 - 60 - 60 of NPK could also be recommended for hybrid maize production under sole maize especially where soil organic matter is fairly still high.

If the manure is well constituted, it can be used to grow maize without the commercial fertilizer because the commercial fertilizer and the growth of microbes which will accelerates the decomposition of manure and the subsequent loss of the nutrients to run-off, crop removal and deep percolation.

References

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