ENVIROM HOLDING AFRICA LTD REPORT

THE EFFECT OF LIQUID FERTILIZER CBX ON MAIZE YIELD EITHER APPLIED THROUGH SOIL OR ON FOLIAGE WHEN COMPLEMENTING PRIMARY GRANULAR FERTILIZERS & POULTRY MANURE

SEPTEMBER 2017

SUBMITTED BY: MARTHE MUKARUGINA

SEASON B 2017

ABSTRACT

Essential plant nutrients are mainly applied to soil and plant foliage for achieving maximum economic yields. Soil application method is more common and most effective for nutrients, which required in higher amounts. However, under certain circumstances, foliar fertilization is more economic and effective. This field experiment was designed to investigate effects of organic liquid fertilizer CBX on Maize yield. Field experiment was carried out at Gako farm, in Gasabo district during season B 2017. Zea mays (ZM 225) were sown. The experimental design used was Randomized Complete Bloc Design, with seven treatments (The control plots were (T0 and T1) ;T1 was amended with poultry manure (10tone/ha) and DAP (200kg/ha) +Urea(100kg/ha), (T2) were amended of CBX soil applied alone(20L/ha), (T3) were amended with poultry manure(10tones/ha) +CBX soil applied(20L/ha), (T4)were amended by poultry manure (10tons/ha)+DAP(120kg/ha)+UREA(60kg/ha)+CBX soil applied (20l/ha), T5 were amended of poultry manure(10tons/ha)+DAP(120kg/ha)+UREA (60kg/ha)+CBX foliar applied (6.25l/ha),T6 were amended with poultry manure(10tones/ha) +CBX foliar applied(6.25L/ha). The soil application fertilizers used were poultry manure, DAP (Diamonium Phosphate) Urea and CBX applied through soil. The soil and foliar applied fertilizer was CBX diluted in water before use. Statistical data analysis was done by using SPSS16.0 software and Processed by EXCEL for presentation. The data collected were number grain per cob, thousand grain weight, total grain weight per hectare. The findings from this study indicated that the complementation of soil applied fertilizers with the organic liquid fertilizer CBX increase, number of grains per cob, total grain yield per hectare compared to control.

Keywords: Poultry manure, DAP, Urea, CBX soil and foliar application, maize yield.

INTRODUCTION

Maize is the third most important cereal after wheat and rice and used as staple food in many countries (Frova et al., 1999). It nourishes the millions of the people in the form of bread, cake and porridge especially in Asia, Africa and America (Bukhsh et al., 2011). To meet the current and future food requirements of increasing population and their rising dietary needs it is necessary to boost up crop yields (Gao et al., 2010). Nutrient deficiencies often occur for a variety of reasons, but can be rectified by timely applications of the deficient nutrient. This usually entails some sort of soil application but, after canopy closure during flowering and fruit development, foliar applications may be more appropriate (Oosterhuis, 2009).

The causes of yield gap include injudicious use of fertilizer by the farmers, judicious use of proper fertilizer combination, to replenish the nutrient supply systems, is a key factor in the system aiming at intensification of crop production for sustainable agriculture (Amanullah et al., 2009a). Foliar application of NPK could increase crop productivity many fold under moisture stress condition. Foliar spray not only provides the nutrients but can also provide a significant amount of water in the time of water stress. In addition to supplying a nutrient for plant growth, N application could enhance drought tolerance of plant to increase yield under water. Research shows that N application during grain filling could enhance the remobilization from stored carbohydrates in vegetative organs to grain under moderate water stress (WS), which might benefit starch synthesis and grain yield formation under post-anthesis drought (Yang et al., 2000). Foliar-applied N can be up to seven times more efficient than soil applied N (Dixon, 2003). In order to bridge this gap in maize productivity, the package of latest production technology involving the use of foliar fertilizer application under water stress condition at appropriate time need to be used to increase maize production as well as net profit of the farmers. According to previous investigations, humic seem to have a particular favorable effect on the nutrient supply. Foliar sprays of these substances also promote growth, and increase

yield and quality in a number of plant species (Karakurt et al., 2009) at least partially through increasing nutrient uptake, serving as a source of mineral plant nutrients and regulator of their release (Atiyeh, et al., 2002). Moreover, humic acid influence respiration process, the amount of sugars, amino acids and nitrate accumulated (Boehme et al., 2005). Chemical and organic fertilizers are an essential process in plant management. Adequate fertilizers led to increase the crop yields, improves the nutrient element concentration in plant tissue and soil macro and micro nutrient status. The addition of organic fertilizers efficiently ensures high production and continuous crops by improving soil properties and increase roots development and soil microorganisms' activity (Abou EL-Magd et al., 2006; Ayoola and Maknide, 2009). Some researchers reported that spraying with humic acid improve plant growth and yield (Akinci et al., 2009). Adding humic acid caused a significant increase in dry matter production by crop (El-Ghozoli, 2003). The fact that fertilization solve the problem of low yield of common bean, by supplementing many elements to a crop that may be limiting production at a time when nutrient uptake from the soil is inefficient or nonexistent, thus, research was conducted to assess the impact of application of organic liquid fertilizer CBX containing(N P K Ca Fe Mn Co Zn Cu Mo HA &FA) on growth and yield of common bean in Rwanda, as contributing to the productivity, profitability, and sustainability of the soybean production system.

envirom green

COMPOSITION OF CBX

CBX is an environmentally friendly biostimulant that is based on nature's own processes. Envirom CBX balances the different biological systems in the soil and increases microbiological activity and growth. Increased microbiological activity creates a soil environment that promotes healthy plant growth and development. The composition of Envirom CBX can recreate healthy soil in most environments regardless of location, climate or soil type. Healthy soil needs less water, repels pathogens and prevents diseases, requires less tillage and is a more efficient stimulant for plant growth. The major components of CBX are:

- Macronutrients
- Micronutrients
- Humic and Fulvic acids

METHOD AND MATERIALS

Field experiment was conducted Maize variety of ZM225 in season B 2017, at Gasabo district, Masaka sector, and Gako cell. The physical characteristics of this soil are likely suited for carrots production in the above district. The experimental design used was randomized Complete Bloc Design, with seven treatments replicated twice. The soil application fertilizers used were poultry manure, DAP, and liquid CBX. The top dress fertilizer was liquid CBX.

Treatment plot were: T0= no fertilizers, T1=poultry manure(PM)+DAP (100kg/ha) +UREA (100kg), T2=CBX alone, T3=Poultry manure(PM)+CBX(10L/ha once)soil applied, T4=Poultry manure(PM)+DAP(60kg/ha)+UREA(60kg/h a)+CBX(10L/ha once)soil applied, T5=poultry manure(PM)+DAP(60kg/ha)+ UREA(60kg/ha)+CBX(1.25L/ha once)foliar applied, T6=Poultry manure(PM)+CBX(1.25L/ha once)foliar applied. CBX soil applied was made twice on recommended treatments; i.e. CBX foliar applied was 5ml in 1L of water while CBX soil applied was 1liter in 20l of water. The application of liquid CBX foliar was always used in late evening and shaken well before use.

The materials used were: hoes, scale, jerrycan for fetching water, knapsack for spraying insecticide and foliar fertilizer, and bags (packages) for transportation and balance for measuring Maize weight. Statistical data analysis was done by using SPSS16.0 software and Processed by EXCEL for presentation.

RESULTS AND DISCUSSION

The effect of organic liquid fertilizer CBX on number of grain per cob.

Data presented in figure 1 shows the effect of organic liquid (soil and foliar fertilizer) CBX on number of grains per cob.

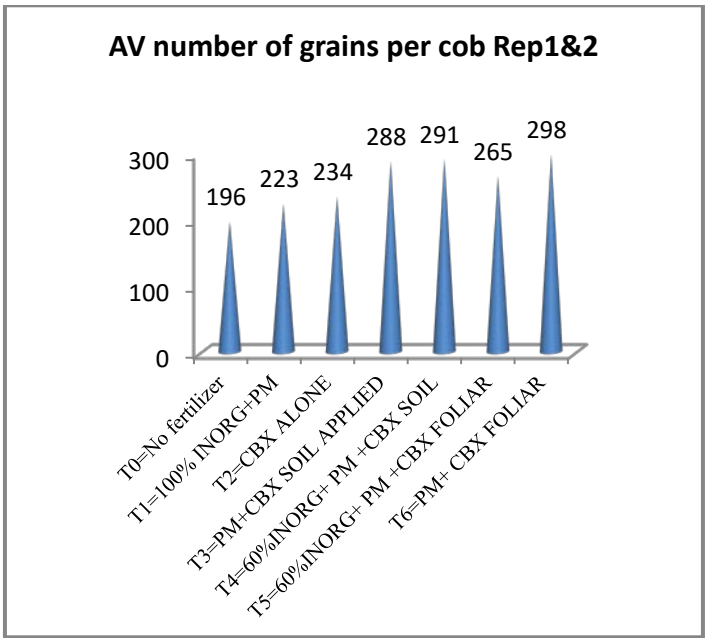

Fig.1

Analysis of data indicated that grains were significantly affected by CBX both soil and foliar application used as complement to mineral fertilizer and poultry manure (T3, T4, T5, T6). The maximum number of grains per cob were obtained from T6(298), followed by T4, T3, T5 respectively with 291 grains/cob,288 grains/cob,265 grains/cob compared to T0 (no fertilizer) and T1 respectively with 196 grains /cob and 223 grains /cob. This increase in grains/cob might be due to the properties of HA to increase nutrients availability which results in more number of grains /cob similar results were reported by Sarir et al. (2005) who reported maximum number of grains ear-1 in maize and wheat with the application of HA to the soil. Similarly, Akhtar (2001) found that grains were significantly increased by increasing levels of N. Amanullah et al. (2010a)

found that grains ear-1 in maize increased when foliar urea was sprayed at the rate of 6% at the V12 stage. It is necessary to exhibit the yield-forming role of nitrogen during flowering and at the beginning of kernel growth. Adequate supply of nitrogen is decisive for the activity of enzymes responsible for the number of starch granules in developing kernels. Therefore, the adequate supply of nitrogen affects the sink capacity of cobs for assimilates during the reproductive period of growth via controlling the potential number of kernels and/or their individual capacity – weight. Maize plant sufficiently supplied with zinc were able to increase both yield of grains and to keep the primary level of total nitrogen content in grains (Cazetta et al. 1999).

The effect of CBX on AV weight of 100 grains and AV total weight per m2

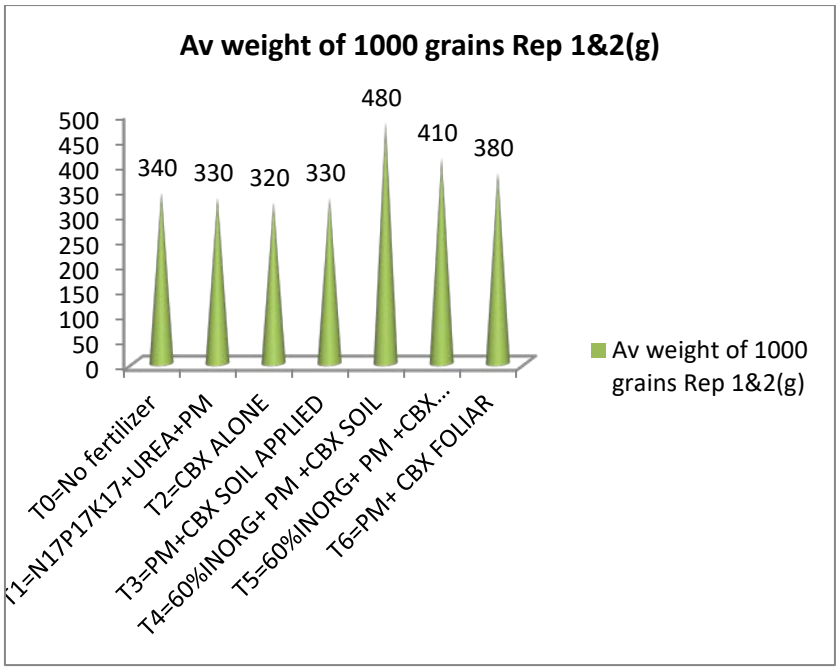

Fig.2

Thousand grain weight has significantly affected by CBX (soil and foliar applied). The maximum grain weight was obtained where CBX soil applied was used with 60% of inorganic and PM on T4 (480g) followed by T5(410g) where CBX was applied through foliar compared to T0 (control) and

T1 (relative) respectively with 340g and 330g. As reported by Sanjeev et al. (1997) that individual grain weight or 1000 grain weight are regarded as the basis for final economic yield, higher nitrogen rate can promote leaf area development during vegetative development and maintaining functional leaf area during growth period may be the possible reason for photo assimilate formation and increase in grains weight. In case of wheat, Parvez et al. (2009) concluded that the foliar spray of 4% urea solution gave heavier grains. Arif et al. (2006) found that three sprays of combine of NPK resulted in heavier grains (26.8 g) followed by two sprays (25.7 g) while control (water spray) treatment produced grains with least weight (20.8 g) in wheat crop at Peshawar.

The effect of CBX on yield (ton/ha)

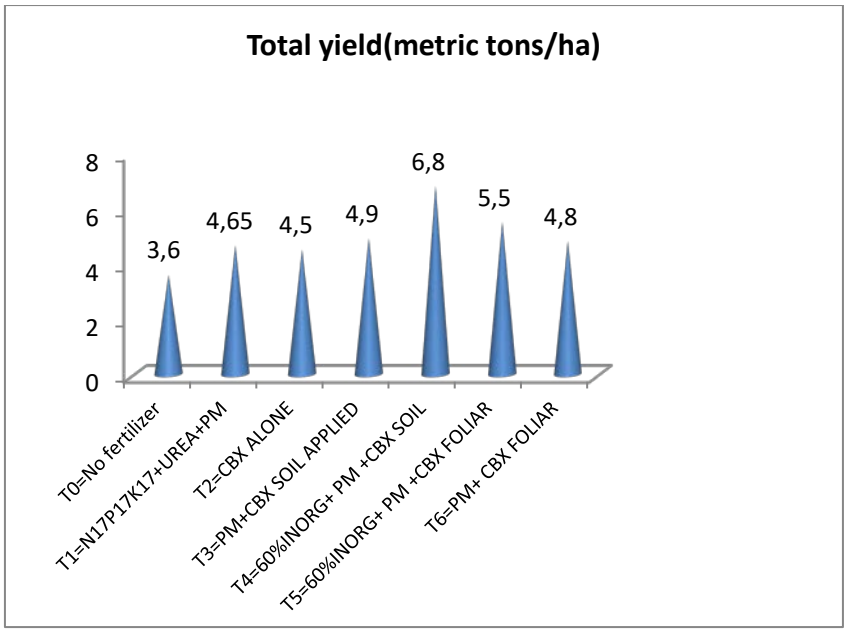

Fig.3

Data presented on above figure, shows that CBX soil and foliar applied combined with 60% of inorganic and PM show significant effect on grain yield compared to plots where CBX were not applied. The maximum grain yield was recorded on T4 with 6.8 ton/ha followed by T5with 5.5 ton/ha while low grain yield was recorded on T0 with 3.6 ton/ha and T1 with 4.65ton/ha. Similar

results were reported by Maralian (2010), Yilmaz et al. (1997), Seilsepour (2007) and El-Majid et al. (2000) found that the average grain yield increased by using Fe and Zn (3170 and 3300 kg/ha, respectively) and they are compared with those of (Zhao Ai-Qing, et al., 2011) stated that micro-elements are crucial substances for crop's growth; however, they are used in lower amounts compared to macronutrients, such as N, P and K. Micronutrients have a major role in cell division and development of meristematic tissues, photosynthesis, respiration and acceleration of plant maturity as reported by (Zeidan et al., 2010).

The ability of HA to release the nutrient slowly due to the decomposition of residue for a longer time could be the possible explanation for improved grain yield due HA application (Dev & Bhardwaj, 1995) and Sharif et al. (2003) who reported that humic acid alone can increase the grain yield by 21-25% with nutrients accumulation. These results are in agreement with Ortiz Monasterio et al. (1997) who reported that N application increased biomass and grain yield of the crop. Yield and yield components was significantly increased by nitrogen levels (El-sheikh, 1998; Samira et al., 1998). Zeidan and Amany (2006) reported that nitrogen fertilizer increased vegetative growth and enhancing seed yield.

CONCLUSION AND RECOMANDATION

Soil and foliar application of nutrients is an important crop management strategy in maximizing crop yields and correcting nutrients imbalance in the soil, therefore, for better yield foliar fertilization can supplement soil fertilization. When nutrients are applied to soils, they absorbed by plant roots and translocate to aerial parts. In case of foliar application, the nutrients penetrate the cuticle of the leaf or the stomata and then enter the cells. It can be concluded that in order to correct Macro and Micronutrients deficiency, and minimize environmental pollution; spraying organic liquid fertilizer CBX in vegetative stage and reproductive stage is effective to maximize grain yields. Farmers are recommended to combine soil applied fertilizers and foliar fertilizer in order to boost maize yield.

REFERENCES

Akhtar, M. M. (2001). Effect of varying levels of nitrogen on growth and yield performance of two new Response of wheat to foliar application of nutrients. Journal of Agriculture & Biological Science 1: 3034wheat cultivars (pp. 84-86). M.Sc (Hons) thesis, Department of Agronomy, Uni. of Agri. Faisalabad.

Arif, M., M.A. Chohan, S. Ali, R. Gul and S. Khan. 2006.

Cazetta J., Seebauer J., Below F. (1999): Sucrose and nitrogen supplies regulate growth of maize kernels. Annals of Botany, 84: 747–754

Derby, N. E., Casey, F. X. M., Knighton, R. E., & Steel, D. D. (2004). Midseason nitrogen fertility management for corn based on weather and yield prediction. Agron. J., 96, 494-501. http://dx.doi.org/10.2134/ agronj2004.0494

Dev, S. P., & Bhardwaj, K. K. K. (1995). Effect of crop wastes and nitrogen levels of biomass production and nitrogen uptake in wheat-maize sequence. An. Agric. Res., 16, 264-267'

El-Sheikh, F. T. (1998). Effect of soil application of nitrogen and foliar application with manganese on grain yield and quality of maize (Zea mays L). Proc. 8th Conf. Agron., Suez Canal Univ., Ismailia, Egypt, 28-29 Nov., pp. 182-189

Frova C, Krajewski P, Fonzo ND, Villa M, Sari-Gorla M (1999) Genetic analysis of drought tolerance in maize by molecular markers. Theory Appl. Genet. 99: 280–288.

Gao Y, Duan AW, Qiu XQ, Sun JS, Zhang JP, Liu H, Wang HZ (2010) Distribution and use efficiency of photo synthetically active radiation in strip intercropping of maize and soybean. Agro J. 102: 1149–115

Sanjeev, K.A., S. Bangarwa and S. Kumar. 1997. Yield and yield components of wi nter maize as influenced by plant density and N levels. Agriculture Science 17: 181-184.

Sarir, M. S., Sharif., M., Zeb, A., & Akhlaq, M. (2005). Influence of different levels of humic acid application by various methods on the yield and yield components of maize. Sarhad. J. Agric., 21(1), 75-81

Sharif, M., Khattak, R. A., & Sarrir, M. S. (2002). Effect of different levels of lignitic coal derived HA on growth of maize plants. Commun. in Soil Sci. and Plants Anal (pp. 19-20).

Zeidan, M. S., Amany, M. F., & El Kramany, B. (2006). Effect of N-Fertilizer and Plant Density on Yield and Quality of Maize in Sandy Soil. Res. J. Agric. Biol. Sci., 2(4), 156-16