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Effect of Maize (*Zea mays* L.) on Human Development and the Future of Man-maize Survival: A Review

M. S. Adiaha[1,]*, O. A. Agba, E. E. Attoe, T. O. Ojikpong, M. A. Kekong, A. Obio, U. L. Undie

[1]Department of Agronomy (Crop and Soil Science), Faculty of Agriculture and Forestry, Cross River University of Technology, Nigeria

*E-mail address: mondaysadiaha@gmail.com

ABSTRACT

From the hands of Olmec, Maya including Inca from whom Corn evolved to all parts of the globe, maize has provided Man with Nutritive, Medical, Pharmaceutical, Industrial, Domestic, Economic including Research values. Corn stands at the center of Mankind, providing Humanity with raw materials for further survival and development. As the need for corn doubles, and as science further widens knowledge on the use/utilization of the crop, creating more avenue and approaches where corn grains, leaves, silk, stem, root and other parts of the plant can be transformed into countless products, then the need to devote more hectares of land to Corn production becomes imperative. Corn has been shown to have the potential to be used in combating global food insecurity, as an indicator-crop for soil fertility assessment and as a commercial cash crop for income generation. Production of Corn has reduce poverty rate and raise standard of living of farmers, especially in the poor/developing countries.

***Keywords*:** Human development; *Zea mays*; uses of Corn; Food security, Man-maize survival

INTRODUCTION

Humanity has always utilized crops for survival and sustenance. From the pre-historic era to the modern times, economic development has been recorded in several developed countries as a result of crop production in large scale, in addition to providing nutritional, medical, pharmaceutical, herbal, economic, industrial including research values.

Wheat, Rice and Maize are the three most explored crops on Earth, providing Man with multi-uses, ranging from nutritional to economic values. Exploration of these three most important food crops has been huge, with Maize been the most explored, owing to the fact that the crop is cultivated in all the Agro-ecological zones of the world. From Central American tropics and Mexico from where the crop (maize) originated (Brewbaker, 2003; Adiaha and Agba, 2016; Adiaha, 2016 a; Adiaha, 2016 b) to all lands of the Earth, were its uses provides humanity with tool for further advancement. Several researches on maize production, biotechnology including maize-fertilizer responds has proofed scientific attention been stressed on the crop, owing to the fact that the crop has end-less uses/utilization. Maize is of the grass family *Poaceae* with it botanical name as *Zea mays* (L.). The trend of maize cultivation has increased in various lands from 2.4 million metric tons in 1961 to 10.6 million metric tons in 2001 (FAO, 2002), indicating scientific and world interest on the crop. Statistical increased have been recorded in the crop been used as an indicator-crop, in other to access the fertility status of soils. A recent survey by Adiaha (2016 a) also confirms this view.

Maize production has been huge in Nigeria, recording increase in the economy of farmers, apart from providing nutrition and raw material for industrial production. The objective of this review is to present the effect (benefit) humanity has derived from maize cultivation, and to present the chance of maize survival.

World Distribution of Maize

Maize is cultivated widely in all Agro-ecological zones of arid, semi-arid, temperate and tropical regions of the world. United States of America produces 177.3 million tons of maize with her yield at 3.6 tons/acre, which recorded the maximum in world production, presenting USA as the largest world corn producer. Closely followed by China, which recorded her world production at 81.8 million tones and 1.9 ton/acre of yield. Brazil recorded 21.8 million tons, 0.8 yield in tons/acre, Mexico recorded 11.8 million tons, 0.8 yield. France recorded her world production at 10.9 million tons with yield at 3.0 tons/acre. Russia produced 10.2 million tons at 1.2 yield in tons/acre. S. Africa recorded world production of 8.8 million tones at 1.2 tons/acre. India produced 8.2 million tones at yield of 0.7 tons/acre.

Yugoslavia recorded 7.7 million tones at 1.6 tons/acre yield. Romania recorded world production of 7.3 million tons with yield of 1.4 tons/acre. Canada recorded 6.4 million tones at 3.0 tones/acre yield. Indonesia recorded 5.9 million tones at 0.9 tones/acre yield. Hungary produced 5.8 million tones, recording her yield at 2.5 tones/acre. Italy produced at 5.5 million tones with yield of 3.4 tones/acre. Argentina recorded 5.5 million tones with 1.5 tones/acre. Philippines produced 4.4 million tones at a yield of 0.6 tones/acre.

Thailand recorded 3.6 million tones at 1.1 yield in tons/acre. Spain recorded 2.9 million tones with her yield at 2.9 tones/acre. Kenya world production recoded 2.4 million tones at 0.8 in tons/acre yield. Tanzania recorded 2.4 million tons with 0.6 yield in tons/acre. Nigeria recorded 1.8 million tones with her yield at 0.6 tons/acre. Zimbabwe recorded 1.6 million tones of production, with her yield at 0.7 tons/acre (Brewbaker, 2003).

Figure 1. Maize plant still growing in the field

Figure 2. Maize plant at full maturity

A report by FAO (2002) present an increased from 3.2 million in 1961 to 9 million in 2001, presenting a phenomenal expansion in land area devoted to maize cultivation. Further increased was recorded by FAO (2002), where they recorded an increased from initial production of 2.4 million metric tons in 1961 to 10.6 million in 2002.

Nigeria has been recorded as the largest African producer of maize with about 8 million tons of production (IITA, 2014). Findings of Smith *et al*. (1997) revealed that about 40% of the land area in Guinea Savanna been cultivated to maize, presenting maize as important food crop for Human nutrition and development. Maize production in the recent years has spread massively into all corners of the Savanna, replacing Sorghum and millet (Smith *et al*., 1999). FAD (1990) reported rapid increased observed in maize production, stating an increased in 1960 at a world maize production reaching a level of 224, 200, 000 metric tons, presenting the increased in land area globally utilized for maize cultivation.

Effect of Maize (*Zea mays* L.) on Human/Animal Nutrition

The positive effect of maize to Human/animal nutrition over the years has been huge. Report by IFBC (1990) shown maize to contain Calcium 6.0%, Phosphorus 30%, Iron 2.5%, Carotene (iv) vita 0.015%, Ascorbic acid 11.40%, thiamine 0.5%, Riboflavin 0.08%, also stating: that there is no significant toxins associated with the genus *Zea*. Maize can be processed into any of the following products: livestock feed, corn flasks, pap, corn meal, beer, baking flour. It is eaten as a vegetable when harvested green soon after the silk from the cob dries up. Where maize is to be used for silage; it is harvested when is bloom just before tasselling . Most of the maize usually harvested dry are used either for human consumption or for making livestock feed. Maize is an important source of carbohydrate (CHO). The bulk of the concentrates fed to farm animal consists of grains especially maize. Maize grains can be milled, some ingredient added to formulate mash which vary in composition used for feeding different classes of livestock. 40-75% of livestock feed is made-up of maize, resulting in conversion of maize grain into meat, eggs and dairy products, providing livestock with energy in addition to some other essential nutrient for survival.

Several beverages including alcoholic drinks have been obtained from maize both locally and industrially. Maize grains a times can be steeped in water for 2-3 days, and then left to germinate, on germination, the seeds are then exposed to sunlight which stops the germination, then the grains are pounded, the mash is cooked for some hours, then the liquid portion is drained off and cooled rapidly, it could be drank as a mild beverage. A times the mixture can be allow to ferment naturally from moulds present in the air. If observable covering of the surface by mould is noted, then the liquid is seated for some days for "beer". The beer can be further distilled in rudimentary stills for formulation of alcohol, several modifications has been applied over the years depending on the taste, purpose and locality (IITA, 1982).

Fasasi (2008) report indicates improvement in human nutrition from consumption of maize especially in carbohydrate (CHO), fats and some enzymes. Osundahunsi and Aworh (2000) report also confirms the findings of IFBC (1990) where they stated that maize contains calcium, iron, carotene, thiamine, riboflavin and macin among other nutrients. Maize is a good source of energy, with its oil containing a high level of natural antioxidants resulting in a stable oil with good flavor. Edible oils obtained from maize seeds are useful in salad preparation and for domestic food cooking, supplying nutrients which feeds and nourish the

human body. Roasted seeds are used as coffee substitute. A report by Nweke (2004) indicated about 43% of calorie intake been attributed to maize consumption as food in Nigeria.

The utilization/uses of maize may vary according to different countries. Various reports by Morris (1998); Galinat (1988); Shaw (1988) and Mexico (1994) maintained that maize is used mostly as the first source of animal feed, where the grains or its mash are used to feed animals directly or sold to feed industries, and as raw material for human food extractive/fermentation formulations. AICRP (2007) reported bulk of maize been used as human food in Latin America and Africa, while in Asia, it is increasingly been used for food and animal feeding. Further, reporting; that in India, about 28% of maize produced is used as food, about 11% - 48% been used as livestock feed, especially poultry feed, with 12% used in wet milling industries for production of edible starch and oil, aside from other products, with 1% maize produced been used as planting seeds.

Contribution of Maize (*Zea mays* L.) to Human Health Development

Maize has always played a crucial role in human health care, with several success been recorded in many lands after using one part or the other from corn or its extract for either herbal or orthodox medication. A survey by Dilip and Aditya (2013); Lans (2006) confirms this view, where they reported corn silk been used to tract urinary tract infections and kidney stones, their research further affirms maize silk been used by the traditional Chines in treating cases of fluid retention and jaundice. Their report further stated corn silk been used in the improvement of blood pressure and support of liver functioning including bile production. Corn roots, leaves and silk can be boiled and its decoction used for bladder treatment, which is a common practice in herbal home treatment.

Over the years, different tea has been developed in other to support proper functioning of the body system/treatment of human diseases, apart from *Moringa oleifera* tea, Corn tea has also grown to be one of the leading tea drinks, where the tea is taken for stomach upset and stomach related abnormalities. Findings of British Herbal Medical Association (BHMA, 1989) also agrees with this report, where her report proves that corn contains phytochemical secondary metabolites, hordenine and polyphenols which are found in leaves, seed and silk, are been utilized for human health development , been usable for treatment of various kinds of disorder in human and animal.

Over the years, across the globe, various ground-breaking researches has proved corn extract and decocte been used as emollient for ulcer treatment. A review by Dilip and Aditya (2013) also agrees with the view of this research, were they reported corn extract and decocte been used as emollient for ulcer, wound, swelling, vomiting, nausea and other related health cases, presenting corn as one of the crops playing a crucial role in human health development, hence it cultivation in large scale should be encourage and more research into quality/quantity improvement should be encourage, as Man healthcare and food always stands superior in safeguarding Humanity survival and future sustenance.

Figure 3. Corn cob

Figure 4. Corn silk

Economic Importance/Benefit of Maize (*Zea mays* L.) Cultivation to Humanity

From time immemorial, maize has equipped Man with raw materials and opportunity for further development. Providing edible oil which is widely used for cooking and manufacturing of soaps. Corn provides materials used for production f sticky gum which contains dextrin used for sealing envelopes and tabels. Corn starch is well recognized for its uses in cosmetics and pharmaceutical industries as diluents. Corn seeds are functional in making alcohol and stem fibres for manufacture of paper.

Different types of maize are classified on the basis of protein content and the hardness of the kernel. These include; pop, flint including flour corn (FAO, 1999). Popcorn, a product of whole maize grain is one of the best all-round foods made from a special kind of flint corn with popping characteristics originally selected by Indians in early Western civilization (Carter *et al*., 1989). Waxy maize is used by wet-maize millers to produce waxy starch which is utilized by food industries as a stabilizer and in paper industries as an adhesive (Ptaszek *et al*., 2009). Since the early 1980's a significant amount of maize grain has been used for fuel and ethanol production, and the by-products from these processes are often used in animal feeds.

A survey by Watson (1988) indicates that sweet corn including super-sweet corn are eaten as vegetables, popcorn, dent and flint corns are utilize massively in animal feeding. Corn is an energy crop, providing energy for both biological, domestic and industrial uses, inform of ethanol, providing burning materials which serves as fuel-wood material for domestic cooking, including provision of nutritional carbohydrate (CHO) that drives all living cells in terms of energy production for daily biological activities. Watson (1988) stated, that corn products occur in about one of every five item s in a supermarket, ranging from

soda-pop to plastics, indicating the point that, the need for corn will continue to increase as human population increases, hence, strongly stressing the need for massive corn production.

The industrial uses of maize has been stressed over the years, ranging from mixed feed manufacture, dry milling, wet milling, distillation and fermentation. The principal food outlets of the dry milling industries are maize meal, maize flour, grits and breakfast cereals. Grits consist of the coarsely ground endosperm of the kernel from which most of the bran and germ have been separated. Maize flakes are made by rolling grits after they have been flavoured.

Wet milling industries utilizes different varieties of corn for manufacture of starch, feed, syrup, sugar, oil and dextrines. The distillation and fermentation industries manufacture ethyl alcohol, butyl alcohol, propyl alcohol, acetaldehyde, acetic acid, acetone, lactic acid, citric acid, glycerol, whisky including other relevant products flooding the industrial and domestic market, this findings confirms the work of IITA (1982), who investigated the use of maize in the industrial market.

The cultivation of maize has improved the standard of living of farmers, providing income, food and raw material for production of local and international products. Maize now serves as a "cash crop" for the local farmers. Global food shortages (food insecurity) is globally been fight using massive maize cultivation as one the remedy procedures. Hunger in many poor/developing countries is gradually been reduced as maize production is been increased, this view confirms the work of Ayeni (1991); Degrande and Duguma (2000), whose report indicated that human hunger can be reduced by cropping and utilization of crops. The increasing human population, incessant changing of climate, and the ever increasing products from corn should be considered, and included as factors necessitating massive global maize cultivation in other to seek possible solutions to these problems.

Effect of Maize (*Zea mays* L.) as an indicator-crop for soil fertility Assessment

Over the years, maize has served humanity in various ways. Soil fertility assessment is one of the ways in which maize has helped Mankind. Different activities takes place in the soil, ranging from nutrient imbalance, nutrient depletion, leaching, salinization, alkalinization and other related activities.

These problems can detected using various approaches, one of the well-known and documented method used over the ages is; the use of an indicator crop like maize. Several researches have recorded success after fertilizer application, using the growth and yield parameters of maize to conclude on the fertility status of soils, this view is confirmed by the experiment of Adiaha (2016 b), where the researcher recorded increased in soil nutrient after observing and recording a significant ($p < 0.05$) increase in maize growth parameters as shown in figure 5 and 6, presenting maize as an important crop for assessing soil nutrient performance.

A survey by Adediran and Banjoko (1995); Adiaha (2016 a) also utilized maize in accessing the nutrient status of soil, recording increased in soil-nutrient status, as observed by vigorous increased in maize plant growth/yield, which proves the applied fertilizer as positively influencing the soil chemical composition, which was physically observable by tall maize plants, including higher number of maize leaves over the control. Pointing to the fact that maize stands superior in the list of nutrient indicator-crops.

Observable Maize plant height indicating soil-nutrient status

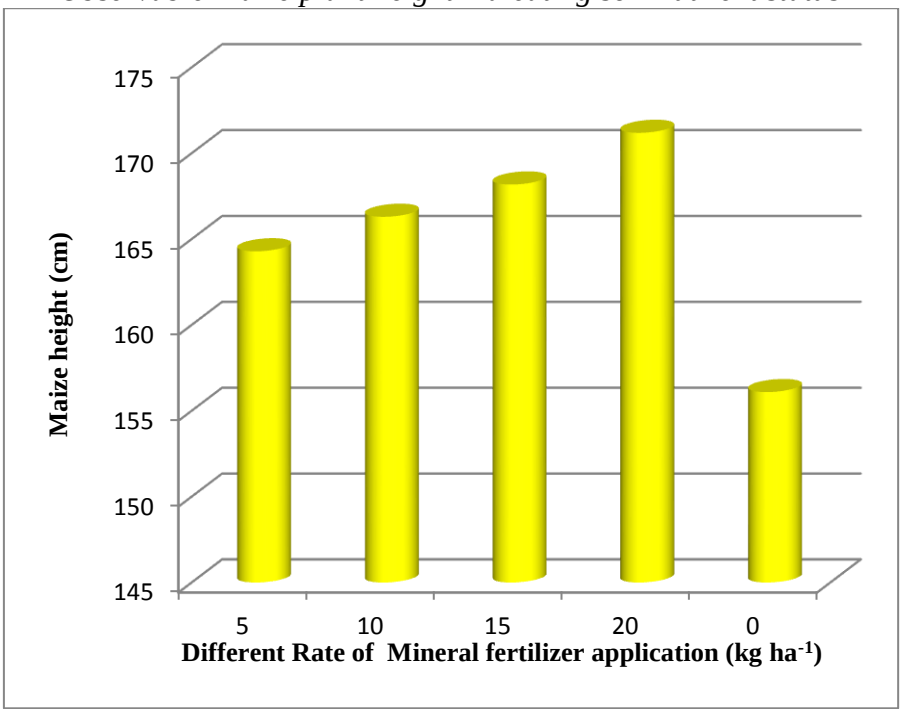

Fig. 5. Responds of maize to soil nutrient status of at 8 Weeks After Planting
Source: Adiaha (2016 b)

Observable Maize Number of Leaves indicating soil-nutrient status

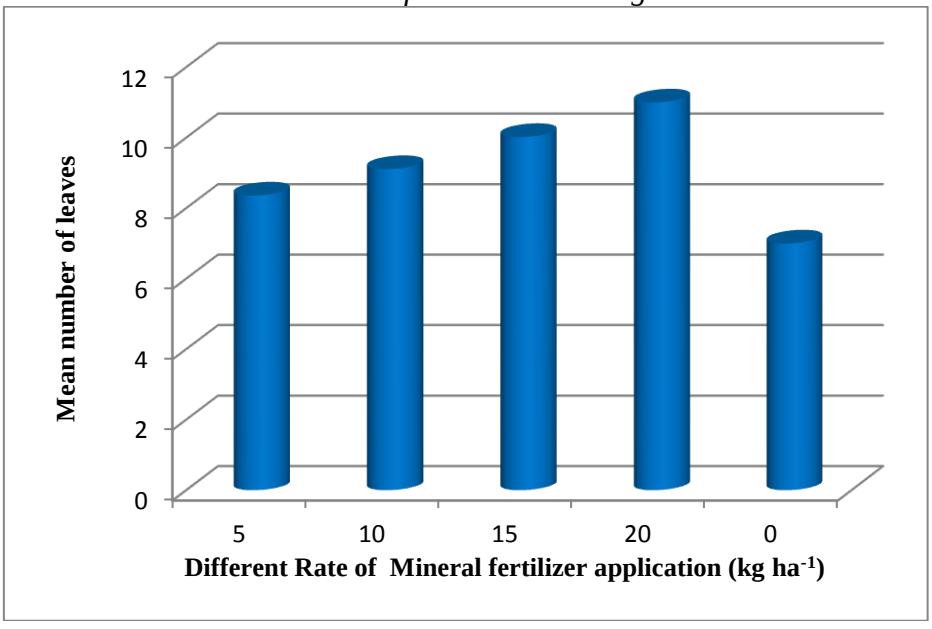

Fig. 6. Responds of maize to soil nutrient status of at 8 Weeks After Planting
Source: Adiaha (2016 b)

The Future of Man-maize Survival

From the history of the early users of corn; the native Americans, to the global users; all nations, corn stands high in demand than most of the food crops. It must be kept in mind that corn never grow wild, but survive only through Man's care (Brewbaker, 1979; Mangelsdorf, 1974). Corn history is interwoven with the histories of Olmec, Maya, Teotihuacan including Inca under whose guidance it evolved (Brewbaker, 1979). Pointing to the fact that, as human further in advancement, corn may also be developed/improve, but this is only possible if more scientific attention is focus on the crop.

Across the globe, Biotechnological approaches has been geared towards improving the threat, genes including the behavour of crops, seeking ways humanity can produce more desirable food crops in large quantity and at the shortage possible time, hence, providing a good avenue for more improvement on maize. Various researches on Biotechnological maize improvement has produced positive result, as humanity now have hope that quality seeds are safeguarded by qualified research institutions, seed production and certifying bodies including seed banks for future uses, and maize stands a chance of existing as long as humanity exist, owing to the fact that the crop had been useful in all aspect of Human survival apart from serving as food, which is the first basic necessity for Man and animal survival.

CONCLUSION

From the hands of the Olmec, Maya, Teotihuacan including Inca, from which maize evolved to all lands of the Earth, maize has played a crucial role, serving: Nutritional, Herbal, Medical, Pharmaceutical, Economic, Industrial including Research values, hence, its multi-purpose nature has been helpful in advancing human development and survival. From the various literature studied, it is thus concluded that maize is the most important food crop, ranking third after Wheat and Rice, providing Humanity with end-less raw materials for further survival and development. And for Human survival and development to be effective then it is imperative to double hectares of land devoted to maize production globally. Production of maize has created more avenues where all parts of the crop have been turned in countless products for Humanity consumption/sustenance. Maize has been shown to have the potential to be used in fighting global hunger, raise standard of living, as a local cash crop, as a leading soil-nutrient indicator crop among other end-less uses/utilization.

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