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Nutrient Composition of Fodder Maize according to Organic Fertilization

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Abstract: ***Supplementation of inferior quality roughages with organic fertilizer coming up as a practical approach to increasing crop productivity significantly by way of increasing biological nitrogen fixation, increasing availability or uptake of nutrients through solubilization or increasing absorption stimulation of plant growth through hormonal action or antibiosis or decomposition of organic residues and this reflect to improving roughages utilization and digestibility by animal. This study aimed to evaluate the effect of supplementation of three types of organic fertilizers; Neem cake (Azdirachta indica), Argel (Solennostemma argel/Del. Hayenne) and Field fertilizer on nutritional quality of fodder maize (Zea mays L.). Four treatments were conducted which included Neem cake, Argel , Field Fertilizer and control. The experiment was arranged in a Complete Randomized Block Design, with three replicated. The results showed that no significant differences (P > 0.05) were indicated in all nutrient components of fodder maize except for crude protein (CP). CP increased significantly (P < 0.05) by organic fertilizers comparing with control. Neem cake had the highest value of CP than argel and field fertilizer. No significant differences (P > 0.05) were detected in minerals content measured when used Neem cake, Argel and Field fertilizer as organic fertilizer. It is concluded that organic fertilizers enhanced CP content and quality of fodder maize. As advantages, organic fertilizers is a cheap source of nitrogen that deficient in plant, and is safer than using chemical fertilizers and can avoid any adverse effect on animal health , soil and environmental hazards.***

Keywords: Fodder maize, Nutrient composition, Organic fertilizer, Neem cake, Argel, Field fertilizer

I. INTRODUCTION

Maize is one of the most important food and forage crops contributing to the global food security for human and animals (Ranum *et al*., 2014)**.** Maize has the potential to supply large amounts of energy-rich forages for animal diets, and its fodder can safely be fed at all stages of growth without any danger of oxalic acid, prussic acid as in case of sorghum (Dahmardeh *et al.*, 2009). It can be grown in warm temperate, continental and tropical climatic zones. It has high- energy density. It is a major forage species and can be used as primarily in the production of whole-plant maize silage (Hunter, 1986). Maize green forage is a valuable feed for ruminants in terms of yield and nutritive value (Sarap *et al*., 2015), though supplementation may be needed to compensate for its low protein, mineral and vitamin contents (Bwire *et al.*, 2002).

Much of the world's agricultural land is degrading rapidly, and losing its productivity due to soil erosion and nutrient mining associated with continuous cropping without nutrient inputs and soil conservation. An estimated 24% of the world's land area has been degrading over the past 25 years, directly affecting the livelihoods of 1.5 billion people (Bai *et al.*, 2008).

Conventionally in modern agriculture, increased productivity has been achieved mainly through application of synthetic inorganic fertilizers. However, the increasing price of synthetic fertilizers and the inability of poor farmers to gain access to them pose severe constraints on their widespread use. A recent alternative to the use of synthetic fertilizers has been the application of diverse organic fertilizers that contain a part of N in organic forms, more or less stable, which gets mineralized on a gradual way and become available for the growing plant, for which reason, synthetic fertilizers could be replaced by these materials (Ramos-Agüero and Terry-Alfonso, 2014).

Neem has demonstrated considerable potential as a fertilizer. For this purpose, neem cake and neem leaves are especially promising. Neem cake organic manure is the by-product obtained in the process of cold pressing of neem tree fruits and kernels, and the solvent extraction process for neem oil cake. After processing, neem cake can be used for partial replacement of poultry and cattle feed (Puri, 1999).

Neem cake is rich in plant nutrients and in addition to that it contains alkaloids like imbin and Nimbidin, which have nitification inhibiting properties and release N slowly. The improved yield is due to neem cake application in brinjal. It is gaining popularity because it is environmental friendly and also the compounds found in it help to increase the nitrogen and phosphorous content in the soil. It is rich in sulphur, potassium, calcium, nitrogen, etc. It is used to manufacture high quality organic or natural manure, which does not have any aftermaths on plants, soil and other living organisms. The application of 25% nitrogen through neem cake and 75% through poultry manure was found superior in the enhancement of the growth, yield and quality parameters of bitter gourd (Mulani *et al*., 2007).

Argel (*Solenostemma argel*) is a desert plant of traditional medical uses. Sudan is regarded as the richest source of this plant (Orange, 1982). Phyto-chemicals of medicinal properties from argel shoots had been reported by many workers (Roos *et al*., 1980; Kamel *et al*., 2000*; Hamed*, 2001). Sulieman *et al*. (2009) reported that the aqueous extracts of argel have antifungal and antibacterial properties. Upon treatment with argel as a soil additive, or a spray of shoot water extract or a combination of soil additive and spray, the vegetative growth was restored in all plots after pest disappearance and the plants flowered within 10-15 days after treatments. The inflorescence was abnormally thick and profusely branched in plants that received the combined treatment suggesting a growth-regulator-like effect and indicating the efficiency of argel as a pesticide (Abdelwahab, 2002).

The main objective of this study was to determine the effect of supplementation of three types of organic fertilizers; Neem cake (*Azdirachta indica*), Argel (*Solennostemma argel*/Del. Hayenne) and Field fertilizer on nutritional quality of fodder maize (*Zea mays*).

II. MATERIALS AND METHODS

A. *Study Area*

Field experiment was conducted during winter season at the experimental farm at College of Agriculture, Sudan university of Science and Technology, Shambat north Khartoum city. The located is (Latitudes 15º – 40´N, Longitude 32º 32´E. and 380 meters above the sea level). Shambat climate is tropical, usually hot and humid in summer and cold and dry in winter. Maximum temperature values (45.9°C) are obtained in June and minimum values (22°C) in January. The chemical analysis was conducted at laboratory of Animal Production in Dry Land Department, National Center for Research (NCR) at Khartoum state.

B. *Treatments and Samples*

The experiment was conducted with four treatments and three replicates in a randomized complete block design. The treatments were: Treatment (T1): Neem cake (*Azadirachtaindica*), (T2): Argel (*Synanchumargel*), (T3): Field fertilizer and (T4): Control. Samples of fodder maize were taken from the experimental farm at the milk stage before the maturity of grains. The samples were chopped at farm and then preparing at the laboratory, drying and grinding for determination of various nutrients. The Parameters investigation was Dry matter (DM), Organic matter (OM), Crude Ash, Crude protein (CP), Crude fat /Ether extract (EE), Crude fiber (CF), Nitrogen free extract (NFE) and Minerals content (Ca, Cu, Fe, K, Mg, Mn and Zn).

C. *Chemical Analysis*

Samples were analysis for their proximate chemical components as described by AOAC (1991).
Minerals content measured by Atomic Absorption as described by AMAAS (1996).

D. *Statistical Analysis*

The collected data were analyzed using Microsoft Office Excel Program. the studied variables was done using analysis of variance (ANOVA).The mean separation by the least significant difference test (LSD) at ($P<0.05$) as described by (Gomez and Gomez, 1984).

III. RESULTS AND DISCUSSION

A. *Effect of Organic Fertilizers on Chemical Composition of Fodder Maize*

Table (1) showed that no significant difference ($P>0.05$) between neem cake, argel, field fertilizer and control in DM, OM, CF, Ash, EE, NFE and ME. CP showed a significant difference ($P < 0.05$) between treatments .Neem cake was significantly higher than other treatments of CP content, while, argel and field fertilizer were similarly ($P>0.05$) in the value of CP content and significantly ($P < 0.05$) better than control.

Table (1): Effect of organic fertilizer on Chemical Composition of fodder Maize.

Treatments / Parameters	T1 Neem cake	T2 Argel	T3 Field fertilizer	T4 Control	Sig.
DM%	95.11±0.57	94.81±0.24	94.90±0.32	94.94±0.45	ns
OM%	92.47±0.3	91.82±0.24	93.01±1.47	93.23±1.40	ns
CP%	7.82±1.33^{a}	6.08±0.72^{b}	6.53±0.52^{ab}	4.09±0.51^{c}	s
CF%	22.83±3.40	21.23±3.13	22.31±2.80	23.24±1.29	ns
Ash%	7.53±0.30	8.18±1.77	6.99±1.47	6.77±1.40	ns
EE%	1.55±0.32	1.61±0.38	2.11±0.43	1.75±0.21	ns
NFE%	57.27±4.50	62.90±4.57	62.06±1.37	64.16±1.32	ns
ME(MJ/Kg DM)	10.73±0.26	10.93±0.28	11.25±0.21	11.18±0.17	ns

Values are mean ±SD of three replicates.

^{a}, ^{b} and ^{c} with same row , mean with different superscript different significantly at P<0.05.

s= significant Different

ns = non Significant

ME (MJ/KG DM) Calculated after MAFF (1975).

The results obtained from this study indicate that there were no differences between the treatments in nutritional quality of fodder maize except for CP which increased significantly by treatments comparing with the control. Many investigators found that organic fertilizer significantly increased the growth of plant, yield and its components and nitrogen content, (Bacilio *et al*., 2003; Nabila *et al*., 2007; Martin and Maria, 2008). Reséndez., *et al* (2017) study the effect of two fertilization sources – organic and inorganic, upon the nutritional quality of forage maize. They concluded that organic fertilizer applied to forage maize increased both nutritional quality of forage maize and milk yield per ton of dry matter and per hectare of this forage.
In our result CP content was higher with neem cake treatment than argel and field fertilizer. This result was similar to the result obtained by Srinivasan *et al*., (2014) with baby corn treated with organic fertilizer (poultry manure and *neem* cake), they recorded higher protein (15.68%) content over other manure combinations or fertilizers. Mithun Saha and Mondal (2006), and Kumar *et al*., (2008) stated that application of organic manures at regular intervals has been shown to have a capacity to improve protein content of crops.

B. Effect of Organic Fertilizer on Minerals Content of Fodder Maize

Table (2) showed the effect of Organic Fertilizer on Minerals Content of Fodder Maize. The results obtained from this study showed that the Minerals content was measured (Ca, Cu, Fe, K, Mg, Mn and Zn) were not differ significantly (P>0.05) when used neem cake, argal, field fertilizers and control as organic fertilizer. Ca, K and Mg had higher values content (mg/kg) among treatments compared with other minerals investigated. K was in-significantly higher with neem cake compared with other treatments.

Table (2): Effect of Organic Fertilizer on Minerals Content of Fodder Maize.

Treatment / Parameter	T1 Neem Cake	T2 Argel	T3 Field Fertilizers	T4 Control	Sig.
Ca	36.85±8.62	37.38±16.75	35.26±10.46	39.66±17.61	ns
Cu	0.18± 0.10	0.25±0.07	0.31±0.14	0.28±0.15	ns
Fe	18.04±1.34	13.87±8.60	10.54±6.65	19.07±1.97	ns
K	45.49±3.95	36.82±10.17	33.17±7.95	27.7±5.3	ns
Mg	328.20±0.90	329.65±1.12	332.86±3.07	329.1±7.96	ns
Mn	0.29±0.02	0.44±0.29	0.4±0.13	0.29±0.04	ns
Zn	4.13±1.40	3.28±0.58	2.53±0.08	3.31±0.74	ns

Units of Mineral content Measurements: ppm
Values are mean ±SD of three replicates
ns = non Significant

The variability of the content of individual elements in plants is largely determined by soil parameters (Soetan *et al.* 2010). Marković *et al.*, (2009) demonstrated that the concentration of elements depends also on the phase of plant development. They concluded that concentrations of P and Ca in whole plant increase in the course of plant growth and development, while the concentrations of N, K, Mg, Fe, Cu, Zn and Mn are closely linked with growth stage. However, many researchers indicated that application of recommended dose of fertilizers significantly increased plant growth, uptake of N, P and K, and yield in maize (Upperi *et al*, 2011; Sunil Kumar and Dhar Rai, 2005). In their study of using organic manures and fertilizers to baby corn crop, Srinivasan *et al*., (2014) found that poultry manure + *neem* cake recorded higher N and K uptake and this was on par with farm-yard manure and *neem* cake combination. Similarly, Sangeeta Mohanty and Lenka (2007) reported significant increase in residual effect of the organic manures on a subsequent crop than did inorganic fertilizers.

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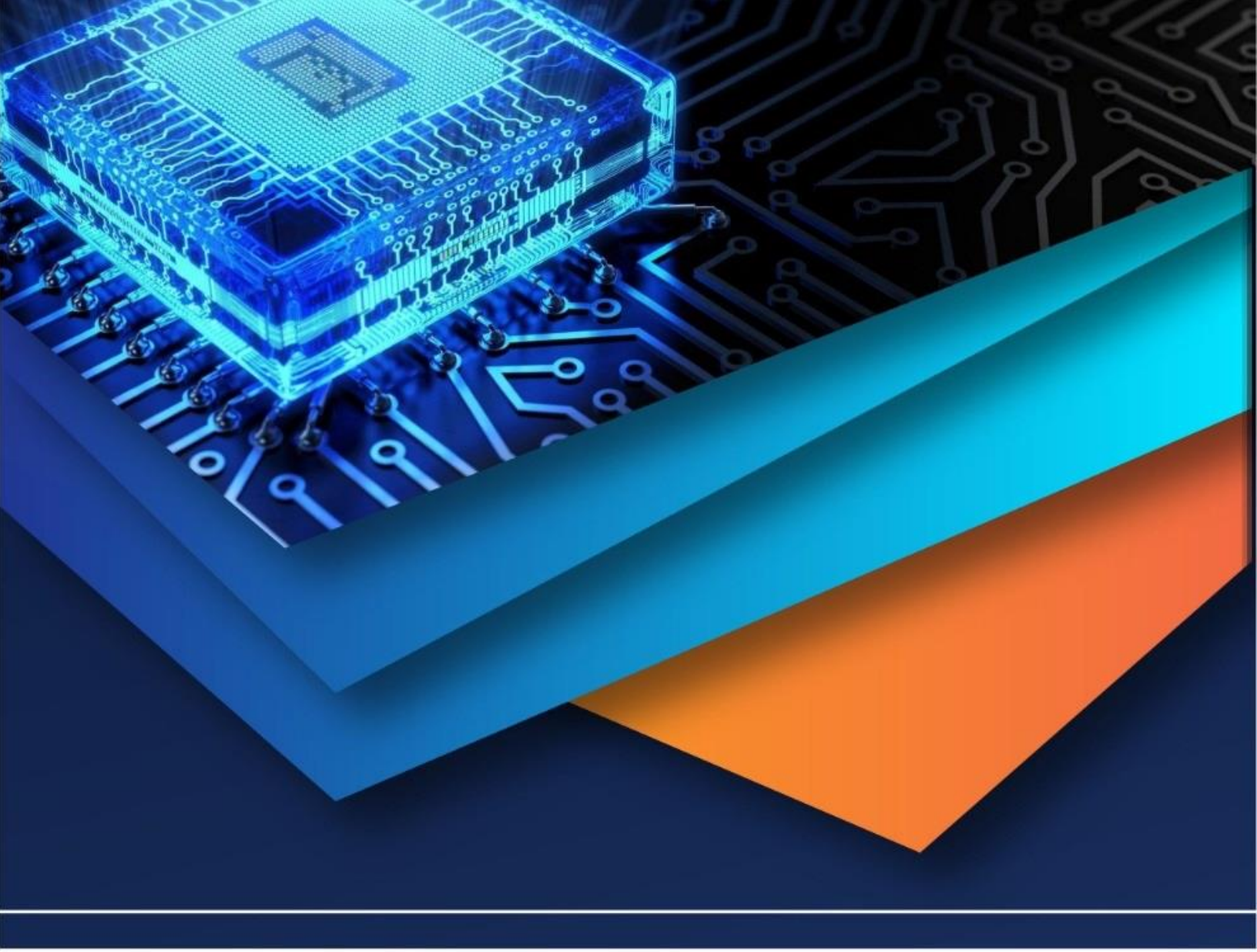

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