



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VI Month of publication: June 2021

DOI: <https://doi.org/10.22214/ijraset.2021.34418>

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

Nutrient Composition of Fodder Maize according to Organic Fertilization

Sulafa M. Hassouna¹, Babiker Mohamed El Amin², Abdel Salam Kamel Abdel Salam³, Abdelrahim A. Mohammed⁴
Khalil A. Sabeel⁵, Mahamoud A. Musa⁶, Ali Mohamed Eltayeb⁷

¹Department of Animal Production in Dry Land. Environment, Natural Resources and Desertification Research Institute, National Centre for Research, Sudan

²Department of Environment of Pollution. Environment, Natural Resources and Desertification Research Institute, National Centre for Research

³Department of Agronomy, College of Agriculture, Sudan University of Science and Technology

^{4,5,6}Department of Animal Nutrition, College of Animal Production, University of Bahri.

⁷Department of Biology and Biotechnology, College of Applied and Industrial Sciences, University of Bahri.

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 (*Azadirachta 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 nitrification 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 melon ([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](#)). [Suliman 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 (*Azadirachta indica*), Argel (*Solenostemma 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 15° – 40°N, Longitude 32° 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 (*Azadirachta indica*), (T2): Argel (*Synanchum argel*), (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	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	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 \pm 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.

REFERENCES

- [1] Abdelwahab, N. 2002. Response of black mustard (*Brassica nigra*) to phosphorous and nitrogen fertilizers. B.Sci. graduation project; Department of Horticulture., Sudan University of Science and Technology, 53 pp.
- [2] Alejandro Moreno-Reséndez ; Jesús Enrique Cantú Brito1 ; José Luis Reyes-Carrillo1, 2, 3; Viridiana Contreras-Villarreal , (2017) . Forage maize nutritional quality according to organic and inorganic fertilization . Scientia Agropecuaria 8(2): 127– 135 .
- [3] A. S. Dhonde1 , M. S. Pilane2 and A. N. Mahatre , 2016. Effect of Intercropping of Maize (*Zea mays* L.) + Cowpea (*Vigna unguiculata*) on Leaf Stem Ratio, Maize-equivalent Yield and Land Equivalent Ratio . Journal of Agroecology and Natural Resource Management , Volume 3, Issue 1; January-March, pp. 27-29 .
- [4] AMAAS, 1996. *Analytical Methods for Atomic Absorption spectroscopy*. Copyright © 1996, the PerkinElmer Inc. USA
- [5] AOAC, 1991. Association of Official Analytical Chemists. Official Methods of analysis. 14th ed., Washington D. C
- [6] Bacilio, M., P. Vazquez, and Y. Bashan, 2003. Alleviation of noxious effects of cattle ranch composts on wheat seed germination by inoculation with *Azospirillum* spp. *Biology and Fertility of Soil*, 38(4): 261-266.
- [7] Bai, Z.G., D. L., Dent, L.Olsson, and M.E. Schaepman, 2008. Proxy global assessment of land degradation. *Soil Use and Management*, 24: 223–234.
- [8] Bwire, J.M, and H. Wiktorsson, 2002. Optimizing the quality and biomass production of the maize stover tops for the stall-fed dual purpose dairy cow in semiarid central Tanzania. *Livestock Production Science*, 77(2-3): 207-215.
- [9] Dahmardeh, M., A. Ghanbari., B. Yasar, and M. Ramroudi, 2009. Effect of intercropping maize (*Zea mays* L.) with cow pea (*Vigna unguiculata* L.) on green forage yield and quality evaluation. *Asian journal of plant sciences.*, 8(3): 235-241.
- [10] Essam E. Kandil , Nader R.Abdelsalam, Mansour A. Mansour, Hayssam M. Ali & Manzer H. Siddiqui (2020) . Potentials of organic manure and potassium forms on maize (*Zea mays* L.) growth and production . w.w.w. nature scientific reports (2020) 10:8752 |
- [11] Gomez, K. A. and A. A. Gomez, 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons, Inc., New York, USA.
- [12] Hamed, A. I. 2001. New steroids from *Solenostemma argel* leaves. *Fitoterapia*, 72(7): 747-755.
- [13] Hanif, N., Q. and Akhtar, N. . (2020). Nutritional Evaluation of Maize Plant Fodder J Biores Manag. 7 (1): 74-93.
- [14] Hunter, R. B. 1986. Selecting hybrids for silage maize production: a Canadian experience. In: 13th Congress of the Maize and Sorghum Section of EUCARPIA (European Association for Research on Plant Breeding). Wageningen (Netherlands), 9-12 Sep 1985.
- [15] Joseph Jjagwe, Keneth Chelimo, Jeninah Karungi , Allan John Komakech and Jakob Lederer ; (2020) . Comparative Performance of Organic Fertilizers in Maize (*Zea mays* L.) Growth, Yield, and Economic Result . *Agronomy* 2020, 10, 69; doi:10.3390/agronomy10010069.
- [16] Kamel, M.S., K. Ohtani., H. A. Hasanain., H. Mohamed., R. Kasai, and K.Yamasaki, 2000. Monoterpene and pregnane glucosides from *Solenostemma argel*. *Phytochemistry*, 53(8): 937-940.
- [17] Marković, J., R. Štrbanović., M. Cvetković., B. Anđelković., and B. Živković, 2009. Effects of growth stage on the mineral concentrations in alfalfa (*Medicago sativa* L.) leaf, stem and the whole plant. *Biotechnology in Animal Husbandry*, 25: 1225-1231.
- [18] Kumar, K.A., G.K. Sagar., G.P. Reddy, and P. M. Reddy, 2008. Effect of integrated nitrogen management on growth, yield and quality of baby corn. *Crop Research*, 36: 60-62.
- [19] MAFF, 1975. Energy allowances and feeding systems for ruminants. Ministry of Agriculture, Fisheries and Food. *Technical Bulletin* No. 33, HMSO, London
- [20] Martin, D. and V. F. Maria, 2008. Field performance of a liquid formulation of *Azospirillum brasilense* on dry land wheat productivity. *European journal of soil Biology*, 45 (1): 3-11.
- [21] Marcos Antônio Leite da Silva , Paulo Sérgio Lima e Silva, Vianney Reinaldo de Oliveira , Roberto Pequeno de Sousa and Jaeverson da Silva, (2020). Intercropping maize and cowpea cultivars: II. Dry grain yield. *Revista Ciência Agronômica*, v. 51, n. 4,
- [22] Mithun Saha and S. S. Mondal, 2006. Influence of integrated plant nutrient supply on growth, productivity and quality of baby corn in Indo-Gangetic Plains. *Indian Journal of Agronomy*, 51:202-205.
- [23] Mulani, T. G., A. M. Musmade., P. P. Kadu, and K. K. Mangave, 2007. Effect of organic manures and biofertilizers on growth, yield and quality of bitter gourd (*Momordica charantia* L.) cv Phule Green Gold. *Journal of Soil Crops*, 17(2): 258-261. [17]
- [24] Nabila, M., M.S. Zaki, and M. G. Karima, 2007. Growth and Yield of Some Wheat Cultivars Irrigated with Saline Water in Newly Cultivated Land as Affected by Bio-fertilization. *Journal of Applied Sciences Research*, 3(10): 1121-1126.
- [25] Naik , P. K ; Karunakaran , M. ; Swain , B.K.; Chakurkar , E.B. and Singh , N. P.(2016) Voluntary Intake and Digestibility of Nutrients in Heifers Fed Hydroponics Maize (*Zea mays* L.) Fodder . *Indian J. Anim. Nutr.* 2016. 33 (2): 233-235 doi: 10.5958/2231-6744.2016.00041.4.
- [26] [26] Orange , R. A. 1982. Ecological and phyto-chemical studies on *Solenostemma argel* growing in Saudi Arabia. *Journal of the College of Science; King Saud University*, 13 (1): 17-24.
- [27] Puri, H.S. 1999. *Neem: The Divine Tree. Azadirachta indica*. Harwood Academic Publishers, Amsterdam. ISBN 90-5702-348-2.
- [28] Ramos-Agüero, D. and E. Terry-Alfonso, 2014. Generalities of the organic manures: Bocashi's importance like nutritional alternative for soil and plants. *Cultivos Tropicales*, 35(4): 52-59.



- [29] Ranum, P., J. P. Pena-Rosas, and M. N. Garcia-Casal, 2014. Global maize production, utilization, and consumption. *Annals of the New York Academy of Sciences*, 1312: 105–112.
- [30] Reséndez, A. M., J. E. C. Brito., J. L. R. Carrillo, and V. C. Villarreal, 2017. Forage maize nutritional quality according to organic and inorganic fertilization. *Scientia Agropecuaria*, 8(2): 127– 135.
- [31] Roos, S. A., S. E. Medgalla., D.W. Dishay, and A.H. Awad, 1980. Studies for determining antibiotic substances in some Egyptian plants: Screening for antimicrobial activities. *Fitoterapia*, 5: 303-308.
- [32] Sabry , Heba and Salama , Attia , (2019) . Yield and nutritive value of maize (*Zea mays* L.) forage as affected by plant density, sowing date and age at harvest . *Italian Journal of Agronomy* 2019; 14:1383 .
- [33] Sangeeta Mohanty, A. R. and N. K. Lenka, 2007. Effect of organic manures on micronutrient uptake and residual soil fertility in groundnut (*Arachis hypogea* L.) – corn (*Zea mays* L.) sequence. *Environment and Ecology*, 25:1180-1184.
- [34] Sarap, K. and S. D. Chavan, 2015. Nutritive value of green maize (*Zeamays* L.) leaves for crossbred heifers. *Research Journal of Animal Husbandry and Dairy Science*, 6 (1): 85-86
- [35] Sulieman, A. E., W. M. Elzobair, and A. M. Abdelrahim, 2009. Antimicrobial activity of the extract of *Solenostemma argel* plant. *Journal of Science & Technology*, 10(3):104- 115.
- [36] Srinivasan, R., K. Jeevan Rao., V. Sailaja, and D. Kalaivanan, 2014. Influence of organic manures and fertilizers on nutrient uptake, yield and quality in cabbage-baby corn cropping sequence. *Journal of Horticultural Science*, 9 (1):48-54.
- [37] Soetan, K. O., C. O. Olaiya, and O. E. Oyewole, 2010. The importance of mineral elements for humans, domestic animals and plants: A review. *African Journal of Food Science*, 4: 200-222.
- [38] Sunil Kumar, C. R. and S. K. Dhar Rai, 2005. Dry-matter accumulation, nutrient uptake and changes in soil fertility status as influenced by different organic and inorganic sources of nutrients to forage sorghum (*Sorghum bicolor*). *Indian Journal of Agricultural Sciences*, 75:340-342.
- [39] Upperi, S. N., S. R. Anand., P. Ashoka., M. T. Sanjey., P. Priya, and N. H. Sunitha, 2011. Long-term effect of organic and inorganic sources of nutrients on soil properties and uptake of nutrients in green gram (*Vigna radiata* Wilzeck.). *Environment and Ecology*, 29: 428-431.
- [40] Waqas Ali , Muhammad Nadeem , Waqar Ashiq , Muhammad Zaeem , Raymond Thomas , Vanessa Kavanagh and Mumtaz Cheema, (2019) . Forage Yield and Quality Indices of Silage-Corn Following Organic and Inorganic Phosphorus Amendments in Podzol Soil under Boreal Climate . *Agronomy* 2019, 9, 489; doi:10.3390/agronomy 9090489 .



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)