EFFECT OF MILLED GROUNDNUT SHELL AS A NUTRIENT SOURCE ON THE NUTRITIONAL QUALITY OF PEPPER IN COMPARISON WITH OTHER NUTRIENT SOURCES

*E.A. Asubiaro and O.A. Adesina. Department of Crop Production, Federal University of Technology Minna, Nigeria. *Corresponding author; adolwak@yahoo.com Abstract

Many nutrient sources have been introduced into agriculture such as poultry manure, cow dung, NPK, urea etc. in order to improve vegetable production. Groundnut shell which is known as an agricultural waste has not been explored to see if it could serve any use to the agriculture industry. The aim of this study was to evaluate the potential of milled groundnut shell as a nutrient source on the nutritional quality of pepper fruits, and the nutrient uptake by pepper plants in comparison with other nutrient sources. Five treatments were used in this experiment, namely: control, poultry manure, milled groundnut shell, milled groundnut shell in combination with poultry manure and NPK 15:15:15. Proximate analysis was carried out on the pepper fruits from each treatment to check the nutritional composition and tissue analysis was carried out on the pepper stems from each treatment to check the nutrient uptake by the plant. Post-planting soil analysis was also carried out to determine the nutrient residue in the soil. The results from each analysis was subject to data analysis using Statistical Analysis System (SAS) and the means separated using Duncan Multiple Range Test at 5% level of probability. The results from the proximate analysis showed that pepper fruits treated with Poultry manure had higher nutritional composition followed by pepper fruits treated with poultry manure + groundnut shell. The lowest was observed in fruit from NPK 15:15:15. The results from the tissue analysis showed that the pepper plants treated with poultry manure + groundnut shell had higher nutrient uptake while plants treated with NPK 15:15:15 had the lowest nutrient uptake. The results from the post-planting soil analysis showed that soils treated with milled groundnut shell had higher nutrient residue. While soils treated with NPK 15:15:15 had lower nutrient residue. From this study, it can be concluded that groundnut shell possesses nutritional qualities and it can be considered, as a nutrient source. It is recommended that further research work be conducted on the rate of application of milled groundnut shell as a nutrient source and possibly the addition of organic or inorganic nutrient supplements should be considered. Keywords: Groundnut shell; Organic fertilizer; Inorganic Fertilizer; tissue analysis; nutrient analysis.

INTRODUCTION

Background of the study

Pepper (Capsicum sp) is an economically important crop belonging to the family Solanaceae. It originated from South and Central America where it is still under cultivation (Pickersgill, 1997). Peppers are commonly divided into three groups; bell peppers, sweet peppers and hot pepper

(Grubben, 2004). Most popular pepper varieties are seen belonging to one of these categories or as a cross pollination between them.

Groundnut Arachis hypogaea, is a nutritious leguminous crop grown mainly for oil and seed worldwide. Groundnut shells are the leftover product obtained after the removal of groundnut seed from its pod (Pham Anh Duc, 2019) which are most times burnt, buried or left to litter the environment resulting in environmental contamination. Groundnut shell contains various bioactive and functional components which are beneficial for mankind; commercially it is used in bio-filter carriers etc. (Pham Anh Duc, 2019). However, little is known about its use as organic fertilizer, it is therefore important to ask if this waste can be converted into a form which can add value to the environment and possibly the economy at large.

Aim of the study

The aim of this study is to determine the potential for the utilization of groundnut shell as a nutrient source in the agricultural industry

Objectives of the study

1. To determine the effect of milled groundnut shell in comparison with other nutrient sources on the fruit quality of pepper, and see it's suitability and as the best alternative in curbing agricultural waste problems and reducing waste management costs.

2. To determine the level of nutrient uptake of the pepper plants in the tissue.

MATERIALS AND METHOD Description of the study site

The research was carried out at the department of Crop Production screen-house and laboratory, Federal University of Technology Minna, Niger state. 2.2 Treatments and Experimental Design

A local variety of pepper called "Dan-Zaria" were obtained from local market. The experiment consisted of five treatments viz: control, NPK 15:15:15, poultry manure, milled groundnut shell, milled groundnut shell + poultry manure. These were replicated five times and arranged in

Completely Randomized Design (CRD). .

Determination of Nutritional Composition

Proximate analysis was carried out on the fruits of the plant. Five samples were used for the analysis by selecting at random replicates from each treatment. Proximate composition (%) of the samples in terms of moisture, ash, fat, crude protein and fibre content were determined using methods described by (Nwinuka N, 2005).

Tissue Analysis

Tissue analysis was carried out on the stems of the plants to determine the nutrient composition in the stem. Five plants were chosen at random from each treatment and replicate for this analysis. The stems of these plants were used to determine the Nitrogen (N), Potassium (K), Phosphorus (P), Calcium (Ca) and Magnesium (Mg) uptake in the plant tissue.

2.5 Post-planting Soil Analysis

Soil analysis was carried out on the soil used to plant the pepper to determine residue of nutrient composition left in the soil. The soil analyzed was taken from all the pots used to plants, 6 weeks after harvest (I.e, from each treatment and replicate).

Data Analysis

The data collected were subjected to Analysis of Variance (ANOVA) using SAS statistical package. The treatments means were separated using Duncan Multiple Range Test at 5% level of probability.

RESULTS Tables 1 –3. 3 shows the result for proximate composition of the pepper fruits, tissue analysis on the stem of the pepper plant and post planting soil analysis respectively.

Table 3.1 shows that there was no significant difference in the moisture content (MC), ash, crude fibre and crude protein content of the different treatments. Milled groundnut shell (MGS) had the higher value of MC while poultry manure + milled groundnut shell (PM+MGS) had a lower MC. A significant difference was noted in the fat content of the pepper fruits. Fruits from PM are

observed having higher fat content, while the lowest was observed in MGS TABLE 1: Proximate Analysis on Pepper fruits as Affected by Different Nutrient Sources

Means with the same letter(s) in the column are not significantly different at 5% level of probability. PM- poultry manure, MGS- milled groundnut shell, PM + MGS- poultry manure + groundnut shell, NPK- Nitrogen, Phosphorus and Potassium, SE- standard error. MC- moisture content, CF- crude fibre, CP- crude protein. In Table 2 the stem nutrient compositions of K and Ca were significantly influenced by the applied treatments. While, TON and P were significantly improved by control, PM, MGS and PM + MGS compared to NPK: 15:15:15 Table 2: Tissue Analysis carried out on the stem of Pepper Plant, as Affected by Different Nutrient Source.

Treatment	TON	K	P	Ca	Mg
Control (T1)	1.15ab	268.80a	112.40ab	189.20ab	111.20a
PM (T2)	1.39ab	269.00a	122.60ab	136.80ab	94.00a
MGS (T3)	1.35ab	260.60a	134.80a	180.60ab	105.40a
PM + MGS (T4)	1.61a	303.60a	137.40a	212.20a	117.40a
NPK :15:15:15 (T5)	0.95b	192.80a	84.00b	116.80a	50.80b
SE ±	0.17	35.58	15.48	23.79	10.24

Means with the same letter(s) in the column are not significantly different at 5% level of probability.

Treatment	MC%	ASH%	FAT%	CF%	CP%
Control (T1)	3.08a	2.29a	1.46cd	8.05a	5.83a
PM (T2)	3.29a	2.49a	4.00a	7.23a	6.16a
MGS (T3)	3.37a	2.37a	1.03d	7.88a	5.32a
PM + MGS (T4)	2.29a	1.59a	2.90b	8.10a	5.69a
NPK :15:15:15 (T5)	2.46a	2.04a	2.13bc	7.93a	5.83a
SE ±	0.42	0.26	0.32	0.90	0.37

PM- poultry manure, MGS- milled groundnut shell, PM + MGS- poultry manure + groundnut shell, NPK- Nitrogen, Phosphorus and Potassium, SE- standard error. TON- total nitrogen, K- potassium, P- phosphorus, Ca- calcium, Mg- magnesium. In Table 3, the soil's pH level was significant in Control, Poultry Manure (PM), MGS and PM+ MGS. Although the highest value was recorded at control but there was no significant difference between them. The lowest value was observed in NPK: 15:15:15 treated soil. The soil's Electrical Conductivity (EC) and Exchangeable Cation (Exc) parameter increased in MGS and PM respectively while a decrease of these parameters was observed in NPK: 15:15:15. The Ca content of the soil was higher in control but lower in NPK 15:15:15. The OC and OM contents of the soil were improved by MGS and PM + MGS, although the highest values were observed in NPK 15:15:15. The highest TN content in the soil was determined with the application of PM +MGS. However, there was no significant difference between all of the treatments. Soil treated with MGS had the highest Na content. It is also observed that the application of NPK 15:15:15 to the soil, only exerted significant effects on the concentration of Mg and PO4 Table 3: Post-planting Soil Analysis as Affected by Different nutrient Sources

PM- poultry manure, MGS- milled groundnut shell, PM + MGS- poultry manure + groundnut shell, NPK- Nitrogen, Phosphorus and Potassium, SE- standard error. Ec - electrical conductivity, Ca- calcium, Mg- magnesium, OC- organic carbon, OM- organic matter, TN- total nitrogen, Na- sodium, K- potassium, PO4- phosphorus, Exc.- Exchangeable cations. DISCUSSION In this study we observed that an optimum amount of organic manure is advantageous for higher nutritional content. The results from this research indicates that there was significant amount of ash from all the treatments however, the application of PM gave a higher composition of ash in

Treatment	Ph	EC	Ca	Mg	OC	OM	TN	Na	K	PO4	Exc
cat Control (T1)	7.25a	253.20b	3.52a	0.69a	0.87b	1.53b	0.58a	1.37b	0.29a	10.54a	0.02a
PM (T2)	7.07a	271.20b	2.44bc	1.53a	0.93b	1.60b	0.18a	0.67b	0.29a	11.16a	0.03a
MGS (T3)	6.97a	363.60a	2.82ab	1.44a	1.34a	2.31a	0.20a	3.29a	0.39a	8.27a	0.02a
PM + MGS (T4)	7.03a	242.00b	1.80cd	2.51a	1.36a	2.35a	0.21a	0.66b	0.22a	12.85a	0.02a
NPK :15:15:15 (T5)	4.29b	112.20c	1.30d	36.92a	0.59b	1.02b	0.13a	0.60b	0.21a	16.00a	0.01a
SE ±	0.78	30.58	0.29	15.99	0.13	0.22	0.16	0.45	0.07	3.35	0.00

the peppers. The ash content is an indication of the level of minerals present in the peppers. Consumption of foods rich in minerals helps the human body in maintaining water balance as well as play some useful role in the bone and body (Akintola et al., 2015). The mineral elements present (Ca, P, Mg, Na etc.) in ash were analyzed in the stems of the plants; PM + MGS had the highest composition. From the proximate analysis, it is noted that pepper fruits from plants treated with PM contained higher fat content. According to (Akintola et al., 2015), fat content in the food is important because it's serves as means of storage and transport of metabolic fuel in the human body. It also serves as electrical insulators for subcutaneous tissues and emulsifier for drug preparations. The results clearly shows that all the treatments supplied rich amounts of crude fibre to the peppers with the highest composition coming from plants treated with PM + MGS. Fibre is considered an essential nutrient for humans because of its role in lowering constipation, diabetes and high blood pressure as well as reduces the risks of developing cardiovascular disease and cancer (Akintola et al., 2015). There was a significant amount of crude protein in pepper fruits from all the treatments, with plants from PM treatment having a higher concentration than the others. Protein have amino acid as its building blocks and it is the only macronutrient in food that contains nitrogen. The results revealed that the moisture content of the peppers from all the treatments are low with NPK 15:15:15 having the lowest moisture content. Generally, the moisture content of food gives an indication of its susceptibility to microbial spoilage (Effiong et al., 2018). The low moisture content of the peppers from the treatments in this study suggests that they are not easily degraded by microorganisms thereby extending the shelf life of the fruits. According to Botir (2018), organically amended soil is generally reflected in the enhanced nutrient content of the plant vegetative parts. The results from the proximate, tissue and soil analysis from this study agrees with the above statement. In this study, it shows that an increment in the fruit nutrient values were in response to the improved soil quality by the input

of poultry manure and Milled groundnut shell to the soil as a nutrient source to pepper. These results show that incorporating organic manure in the soil improves the growth and nutrient attributes of the plants. Conclusion This research has shown that milled groundnut shell which is considered an agricultural waste possesses nutritional quality and can serve as a nutrient source in the fertilization of pepper. The milled groundnut shell on pepper exhibited a significant response in the nutritional composition of

pepper. Among the five (5) treatments, milled groundnut shell, poultry manure and the combination of poultry manure and milled groundnut shell (PM+ MGS) were observed to have significant impact on the proximate composition of the pepper fruits, nutritional status of the pepper stems lastly, the soil's nutritional composition as compared to NPK:15:15:15.

Recommendation.

Based on this research, it is observed that the addition of milled groundnut shell as a nutrient source could improve the nutritional value in foods. Although the use of milled groundnut shell as a nutrient source has not yet been fully exploited, therefore the following recommendations are suggested; ➢ Different application rates of milled groundnut shell should be considered for further research. ➢ Nutrient supplements either organic or inorganic should be added to milled groundnut shell for further research.

References

Akintola O O Bodede A L, Ogunbanjo O R. Nutrional and medicinal importance of Tetrapleura tetraptera fruits (Adrian). [Journal] // J. Sci. Research. - [s.l.] : Afri.J. Sci. Research, 2015. - pp. 33-38.

Botir Khaitov Hye Jin Yun, Yejin Lee, Farrukh Ruziev, Thi Hien Le, Mirjalol Umurzokov, Aung Bo Bo, Kwang Cho, Kee Woong Park Impact of organic manure on growth, nutrient content and yield of chili pepper under various temperature environment [Journal] // Int. J. Environ. Res. Public Health . - 2019.

Effiong B.N., Udofia U. S., Maduka N Studies on Nutritional Composition and Efficacy of Selected Spices in Southern Nigeria against Some Food Spoilage Fungi [Journal] // Journal of Advances in Microbiology . - 2018. - p. 9.

Gradawa M.M Characterisation of Physio-Chemical Properties of Arachis Hypogeal L. Shells (Groundnut) as Environmental Remidation [Conference] // Int'l Conference on Chemical Biological, and Environmental Sciences (ICCBES'14). - Kuala Lumpur (Malaysia) : [s.n.], 2014. - pp. 1-4.

Grubben G. J., & El Tahir, I. M. Capsicum annuum L. In: Grubben, G. J. H., and Denton O.A. (Eds.). PROTA 2: Vegetables/ Legumes. [CD-Rom]. [Journal] // PROTA, Wageningen. The Netherlands.. - 2004.

Nwinuka N, I. G. (2005). Proximate Composition and Levels of Some Toxicants in Four Commonly Consumed Spices. J. Appl. Sci. Environ. Mgt., 150-155.

Pham Anh Duc P. Dharanipriya, Bharath Kumar Velmurugan Groundnut shell - a beneficial biowaste [Journal] // Bicatalysis and Agricultural Biotechnology. - 2019. - p. 1. Pickersgill B. Genetic resources and breeding of Capsicum spp. [Journal] // Euphytica 96:. - 1997. - pp. 129- 133.