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EVALUATION OF NUTRIENT COMPOSITION OF SOME CEREALS AND LEGUMES CROPS RESIDUES AS COMPOST MATERIALS

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ABSTRACT
The use of compost for horticultural crops production in Nigeria is beginning to gain some attention, since it has been reported to improve plant growth and yield. Some cereals and legumes crops residues with potentials of being used as compost materials such as Sorghum Stovers, Rice Straws, Maize Stovers, Millet Stovers, Groundnut Haulms, Cowpea Stems and Cotton Stalks grown at the Kano University of Science and Technology Research farm were selected and analyzed for nutrient content. Data obtained were subjected to analysis of variance (ANOVA) using F-test. Results obtained indicated that Nitrogen (0.98gkg^{-1}) and Phosphorous (0.31kg^{-1}) were highly significant ($p \leq 0.05$) in rice straws compared to other residues of cereals. Also Groundnut haulms was found to be highest in N(1.10kg^{-1}) and P(0.0597) than other legumes residues. Other essential nutrients like calcium, magnesium and potassium were also determined. Generally, crop residues and their ashes are valuable materials that can be used in making compost fertilizer as they contain high amount of nutrients. However, intensive cultivation and crop residues removal tend to break the natural cycle and prevent the return of nutrient taken up by the crop to the soil.
Keywords: Ashes, crop residues, compost and nutrients.

INTRODUCTION

The demand for compost as an alternative to inorganic fertilizers has increased in order to sustain intensive agriculture. Compost is of more importance than inorganic fertilizer because it consists of the relatively stable decomposed materials resulting from accelerated biological degradation of organic matter under controlled, aerobic conditions (Storey, *et al.,* 1995; Epstein, 1997). Compost fertilizer is therefore made from decomposed plant and animal remains with the respective recycling of such materials for crop production. The decomposition process converts potentially toxic or putrescible organic matter into a stabilized state available for plant uptake. Compost can also serve multiple purposes such as mulch and for weed control.

Crop residues include stems, leaves, roots, chaffs and any other plant part that remain after agricultural crops are grazed or harvested. Balasubrahamanian and Nnadi (1978) referred to crop residues as harvest residues (Straws, Stovers and Haulms) and processed waste (groundnut shells, rice husks, oil cakes etc).

Plant residues and other biomass constitute an important resource, as they have a potential of maintaining soil fertility after decomposition (Aribe, 2003; Udeata, 2008; Nottidge *et al*., 2010). Residue management with respect to the quantity and quality of biomass applied to the soil, has a significant impact on soil quality and resilience as well as agronomic productivity (Udeata, 2008).

Previous studies (Obe, 2009; Gliesman, 2012; Puda, 2012) had demonstrated many residues management techniques on the farm. According to these authors, some of the plant residue management methods include burning in-situ, slashing and incorporation, burnt residue incorporation and slash and pack. The authors reported significant effects of these residue application methods on the nutrient and organic matter status of the soil. The return of crop residues to the soil is the main component of following, which results in accumulation of nutrients, increases in organic matter and improvement of soil structure (Nottidge *et al.,* 2010).

Due to high cost and scarcity of inorganic fertilizers, peasant farmers depend on organic sources of plant nutrients and following practice. Other problems associated with the use of inorganic fertilizers in tropical crop production include physical degradation of the soil increase in soil acidity and nutrient imbalance in the soil (Ojeniyi and Odedina, 2009: Adeniyan and Ojeniyi, 2005). Recently, research attention shifted to the use of plant derived agro industrial wastes such as ash and brewery waste and to the integrated application of organic and inorganic fertilizer in tropical crop production. Despite the potentials of these crop residues as compost materials, this has not been fully exploited in Nigeria. The aim of this study therefore, was to determine the nutrients contents of some cereals and legumes crops residues as compost materials.

MATERIALS AND METHODS

The study was conducted at Kano University of Science and Technology Research Farm, situated within Wudil Local Government Area of Kano State. It is located at latitude $12^0$11N to $12^0$14N and longitude $7^0$38E to $8^0$38E. The area fall within the Sudan Savannah and mean rainfall recorded in 2008 by Kano station of Kano State Agriculture and Rural Development Agency (KNARDA) was 690.2mm.

The crops residues of some cereals and legumes with potentials of being used as compost materials grown in the area were selected.

The materials include; rice straws, millet stovers, sorghum stovers, maize straws, groundnut haulms, cowpea stems and cotton stalks. The plant samples were collected, grounded and separately kept in a labeled polythene bags and used for analysis. All samples were analysed in a laboratory using standard procedures; Nitrogen was determined by the Kjedahl wet distillation method of Bremmer (Udo *et al*, 2009). Phosphorous, calcium, magnesium and potassium by the wet digestion method using the mixture of Nitric (HNO_3), Sulphuric (H_2SO_4) and perchloric acids. Phosphorous was determined using Bausch and Comb Spectrophometer while potassium, calcium and magnesium were determined using flame photometer(Udo *et al*, 2009). All data obtained were subjected to Analysis of Variance (ANOVA) using F-test.

RESULTS AND DISCUSSION

Table 1 shows the content of Nitrogen and Phosphorous in some cereals crops both in residues and ash. Rice straws had the highest Nitrogen (N) content of 0.98% and 0.77% in both residue and ash followed by millet stovers with 0.50 and 0.56gkg^{-1} N. Phosphorous was highest (0.82gkg^{-1}) in sorghum stovers (ash) followed by millet stovers ash (0.53gkg^{-1}).

The trend in the nitrogen content for the stalks stems and straws contain an approximately same amount of nitrogen in both the residues and the ash. In general both cereals residues and ash contain lesser amount of nitrogen. It was observed that the amount of Nitrogen in the residues was markedly significantly higher ($P<0.05$) than their ash for all the samples. The Nitrogen content of the crop residues varies according to the nature of uptake by plants. The result also showed that rice straws have the lowest level of P(0.34gkg^{1}) among the crop residues in both the residues and their ash.

The content of Nitrogen shows in Table 1 of some legumes crops indicated that for groundnut haulms contain a significantly higher($P<0.05$) amount of Nitrogen (1.10 and 0.66gkg^{1} in both the residues and the ash than the cotton stalks (0.98 and 0.25gkg^{1}). The P content also was more in cowpea stems (2.25gkg^{1}) than the cotton stalks in the ash with low content of Ca and K than sorghum, maize and millet stoves' in the ash.

Table 2 shows the content of Ca, K and Mg of some cereals and legumes crops both in the residues and ash. The results indicated that the Groundnut haulms contain more Ca, K and Mg than the cotton stalks and cowpea stems in the residues.

From the results, Nitrogen is found in all crops residues. It could be observed that generally, the amount of Nitrogen in the residues was mostly higher than their ash. This could be due to the loss of Nitrogen through volatilization during the burning process. Organic materials contain high levels of essentials nutrients required for vegetables production (Moritsuka *et al*., 2001). In addition wood ash is an affordable material which has been effectively used to ameliorate soil acidity and as a local alternative to commercial liming materials (Onwuka *et al*., 2009). The greater availability of P in the ash as against the residues may not be unconnected with the fact that P is more extractible in its inorganic form than in its organic complexes and burning changes the organic P into inorganic P; it could be observed that most of the ground residues are deficient in P while levels are optimum in their ash. This could be due to the deficiency of P in the soils of this sub-region and this could account for this deficiency in the residues.

The crop residues analysed are not deficient in Mg as values below 0.05% are considered deficiency levels and above 0.36% as luxury consumption levels. The general conclusion to be reached as regards to the level of Mg is that it is stored in the stovers than in the straws/haulms/stalks. Also ashes analyzed contained more Mg levels than their respective residues. The result also shows that the K is stored in the stovers/stalks/straws than in the haulms. The high amount of K in sorghum Stover could be due to the characteristics of the crop Cowpea stems and maize stovers contain more calcium than the stalks, haulms and stems in both ground residues and the ash. This is because Ca which is important in cell formation is found more in the growing cells of the stovers than in any other part. From the results, it can be observed that all of the crop residues sampled are deficient in Ca. This may be due to the low CEC and Ca content of the savannah soils (Nottidge, 2010).

Table 1: Proximate content of Nitrogen and Phosphorus of Some Cereals and Legumes crops residues

Plant Samples	N(gkg^{-1})		P(mgkg^{-1})	
	Residue	Ash	Residue	Ash
Rice Straws	0.98a	0.77a	0.305a	0.341b
Sorghum Stovers	0.30b	0.03c	0.171a	0.815a
Maize Stovers	0.20b	0.18b	0.035b	0.452b
Millet Stovers	0.50a	0.56a	0.026b	0.532a
Groundnut Haulms	1.10a	0.66a	0.0597a	0.307b
Cowpea Stems	0.78b	0.88a	0.0171b	2.250a
Cotton Stalks	0.98b	0.25b	0.0454a	0.396b

Table 2: Proximate content of Ca, K and Mg content of some Cereals and legumes crops residues

Plant Samples	Ca		K		Mg	
	(Cmol kg-^{1})					
	Ground	Ash	Ground	Ash	Ground	Ash
Rice straws	0.011b	0.69c	0.61b	24.0b	0.051a	1.26b
Sorghum stovers	0.016a	1.00b	2.77a	26.0a	0.036b	1.35b
Maize stovers	0.015a	1.13b	0.68b	29.0b	0.088a	1.60a
Millet stovers	0.003a	1.88a	0.96b	23.0b	0.080a	1.70a
Groundnut Haulms	0.013b	0.81b	0.54b	18.0b	0.046b	3.666a
Cowpea stems	0.018a	1.13a	0.46b	23.0a	0.075a	4.07a
Cotton stalks	0.011b	0.69b	0.88a	14.0c	0.050a	2.31b

CONCLUSION

The study concludes that composts produced from readily available cereals and legumes crops residues contained nutrients that will enhance growth, increase yield and can be used successfully as a soil amendment to improve soil's condition therefore, it can be said that the most efficient and cheapest method to cut down the cost of fertilizer is the use of crop residues.

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