Variation of Temperature and Burning Time with Percntage of Potassium and Phosphorus in Rice Husk Ash used for Improving Crop Yields

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***Abstract*--Potassium and phosphorus are among the sixteen macronutrients needed for plant growth and high productivity. The two crop macronutrients are found in rice husk ash in a quantity usable to the crop. It is observed that the amount of potassium and phosphorus contain in rice husk ash varies with burning temperature and burning time. Inorder to investigate this fact, rice husk ash was produced at temperatures of 500^{o}C, 600^{o}C and 700^{o}C at constant burning time of 4hours. In the second case, rice husk ash was produced at a constant temperature of 600^{o}C for three different burning time of 2hours, 4hours and 6hours. The percentage of potassium and phosphorus in each case was determined by X-ray fluorescence analysis. Result shows that, the percentage of potassium and phosphorus in rice husk ash decreases as burning temperature and burning time of the husk increases.**

Key words: Rice husk ash (RHA), potassium, phosphorus,time, temperature

A. INTRODUCTION

Potassium and phosphorus are among the major sixteen essential nutrients needed in the soil for plant growth and high productivity (Marschner, 1995). The source of these nutrients could be organic or inorganic (Priyadharshini and Seran, 2009). Combining both organic and inorganic fertillizer in crop production result to improved soil fertility and high crop yield (Mamaril., 1999).

Researchers have found that rice husk an agricultural organic waste is another source of major soil nutrients. Rice husk generates rice husk ash when burn in an open environment or at controlled temperature. The generated ash contain high grade amorphous silica (Mishra et al., 1986) as the major compoud. The ash also contain trace elements such as potassium and phosphorus.

In Benue state of Nigeria, farmers used rice husk ash for the cultivation of crops inorder to gain high crop yields (Celestine et al., 2013). Rice husk ash contain 0.72-3.84% K_2O (Muthadhi et al., 2007). Bronzeoak Ltd (2003) found the percentage of potassium and phosphorus in rice husk as 0.10-2.54% K_2O and 0.01-2.69% P_2O_5 respectively. However, it was also reported that rice husk ash have 5.4% P_2O_5 and 2.57% K_2O (Onoja et al., 2013). Goncalvesa and Bergmannb (2006) found in their research a value of 3.65 K_2O.

The variation in the percentage values of potassium and phosphorus as observed in the result above could be due to variation in burning temperature, time and fertilizer application. In this research paper, variation of burning temperature and time on percentage of potassium and phosphorus in rice husk ash has been investigated. This research is based on the fact that potassium and phosphorus are macronutrients needed for the improvement of crop yields.

B. MATERIALS AND METHODS

Rice husk ash was collected from Aliade rice milling industry in Benue state Nigeria. The husk was sieved to remove broken particles and other impurities. It was then allowed to dry in an open environment for two days . The husk was then burn in the open environment to produce black ash. Air was blown to help ignite the husk since rice husk is very difficult to ignite. The black ash produced was allowed to cool naturally overnight. 60g of the black ash was produced and divided into 6 clean crucibles each containing 10g of the black ash. The crucibles were labelled A, B, C, D, E, and F. The black ash in A, B and C were burnt at temperatures of 500^o C, 600^{o}C and 700^{o}C respectively for the same burning time of 4hours. The black ash in D, E and F were burn at a temperature of

600°C for 2hours, 4hours and 6hours respectively. In each case cooling was done naturally. Carbolite furnace model GPC12/81+103 with temperature range of 0-1200°C was used to burn the black ash into white ash. The ash chemical composition was determined by using energy dispersive X-ray fluorescence spectrometry minipal 4 model © 2005 paanalytical B.V.

C. RESULT

The percentage of potassium and phosphorus found by XRF measurement of rice husk ash is shown in table 1.1 and 1.2 below. The major compound found in each case was SiO_2 while all other compounds were trace compounds.

Table1.1: Percentage of Potassium and Phosphorus in RHA burn at 500°C, 600°C, 700°C for a constant time of 4hours.

Compound	Temperature 500°C (A)	Temperature 500°C (B)	Temperature 600°C (C)
K_2O	2.58	1.98	1.01
P_2O_5	5.41	4.23	2.82

Table 1.2: Percentage of potassium and phosphorus in RHA burn at 600°C for 2hours, 4hours and 6hours.

Compound	Time 2hours (D)	Time 4hours (E)	Time 6hours (F)
K_2O	2.57	2.00	1.00
P_2O_5	5.47	4.24	2.800

D. DISCUSSIONS

The result of chemical composition of rice husk ash by XRF shows that the ash contain several elements with SiO_2 as the major compound while K_2O and P_2O_5 are among the trace compounds found. However, the result in table 1.1 and table 1.2 shows the values for potassium and phosphorus only because it is where we have our major interest.

The high percentage of K_2O and P_2O_5 in all the samples is due to high fertilizer application and use of herbicides during growth of rice.

In table 1.1, the result shows that the percentage of both potassium and phosphorus in rice husk ash decreases as temperature increases at constant burning time. In table 1.2, the result shows that the percentage of potassium and phosphorus decreases as burning time increases.

E. CONCLUSION

The percentage of potassium and phosphorus in rice husk ash decreases with increase in burning temperature and time. Therefore, low temperature and short burning time are recommended when rice husk ash is to be burn with the aim of obtaining high percentage values of potassium and phosphorus for application to improve crop yield.

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