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Potency of Plant Ashes as Organic Feretilizers in the Performance and Control of Leaf Spot Disease of *Telfairia occidentalis* in South Eastern Nigeria

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Abstract:

An investigation was conducted in the Research and Training Farm of Michael Okpara University of Agriculture Umudike, Abia State, Nigeria to investigate the effect of plant organic ashes on the control of leaf spot disease of *Telfaria occidentalis* and on its yield performance. The experiment was laid out in a Randomized Complete Block Design (RCBD), with three replicates and six treatments (plantain peel ash, oil palm kernel bunch ash, sawdust, firewood ash mancozeb (synthetic pesticide) and a non treated control. The results showed that all the plant ashes treatments used significantly reduced the leaf spot disease of *Telfaria occidentalis* ($P<0.05$) when compared with the non treated control. Plantain peel ash for instance showed lowest number of mean disease severity (0.25) and all the parameters measured, significantly ($P<0.05$) suppressed leaf spot incidence (20.07%) and also enhanced yield over other treatments including control (4.544). This investigation suggests the practical use of plant waste ashes especially plantain peel (ash) in the control of leaf spot disease and enhancement of the performance of fluted pumpkin (*Telfairia occidentalis*).

Key Words: Plant ashes, organic fertilizer, synthetic pesticides, disease severity.

INTRODUCTION

Telfairia occidentalis commonly known as fluted pumpkin is a leafy vegetable which belongs to the family *Cucurbitaceae*. It is a popular vegetable among the South Eastern Nigeria people (Esiaba, 2000; Akoroda, 2001; Burkul, 2004), where it has the widest diversity and for its edible leaves and seed (Nwufo and Atu, 1987; Badifu and Ogunsina, 1991). The seeds can be eaten by boiling and for egusi soup (Schippers, 2002; Grubben and Denton, 2004).

Leaves are spirally arranged, 3-5.5cm long while female flowers are solitary in leaf axils (Grubben and Denton, 2004). It is an herb climbing by coiled, often branched tendrils to a height of over 20m. The root system ratify the top surface of the soil and stem is angular glabrous and fibrous when old. Nutritionally *Telfairia occidentalis* has been considered an "oil seed" and is high in oil (30%). Shoots of *Telfairia occidentalis* contain high levels of potassium (39%) and iron (35%) while seeds are composed of 27% crude protein and 53% fat and also possesses medicinal values and contain a high amount of antioxidants and hepatic-protective and antimicrobial properties. (Odiaka, 2001; Gruben and Benton, 2004).however, some major fungal diseases of *Telfairia occidentalis* are leaf spot caused by *Phomasorghina* (Nwufo and Atu, 1987) and anthracnose caused by *Colletotrichum* sp. can significantly influence performance. (Udo *et al*., 2008; Wisler and Norris, 2005; McWhorter, 1989; Quénéhervé *et al* 1995 and 1996). Spot disease is a descriptive term applied to a number of diseases affecting different parts of plants, which are one of the most important limiting factors for cultivation of crops in tropical and subtropical areas (Reis and Boiteux, 2010).

Spot diseases are induced by various pathogenic groups of fungi and bacteria (Burrows, 2013).

Telfairia seeds and leaves have lots of nutritive value (Tables 1 and 2). These make the leaves potentially useful as food supplements (Oderinde *et al.,* 1990). The moisture content of the leaves show large variations and is a function of the cultivar plant age, environmental factors, and management practice (Alegbejo, 2012).

Table 2.1: Nutritive value of *Telfairia* seeds and leaves

Content	Seed	Leaves
Water (ml)	6.0	86.0
Calories	543.0	47.0
Protein(g)	20.5	2.9
Fat(g)	45.0	1.8
Carbohydrates(g)	23	7.0
Fibre(g)	2.2	1.7
Calcium(mg)	84.0	0.0
Sodium (Na)	280	0.0

Source: FAO (1988) **:** Akintayo (1997)

The leaves contain adequate vitamins A and C. Mineral content of the seed is fairly high. The seeds are high in essential amino acids (except lysine) and are comparable with that of soybean meal with 95% biological value. The fruit pulp is about 1.0% protein and the seed oil is made up of oleic acid (37%), stearic and palmitic acid (21% each), linoleic acid (15%) (Alegbejo, 2012).

Spot is a common descriptive term applied to a number of diseases affecting plants. The majority of spots are caused by fungi, but some are caused by bacteria. Leaf spot may result in defoliation in some plants (Nix, 2014). Fungi causing spot diseases on different plants include; *Septoria, Alternaria, Cladosporium, Rhizoctonia, Nigrospora, Cercospora, Phyllosticta,* and *Ascochyta*spp. (Singh and Allen, 1979; Allen *et al.*,1996; Howard and David, 2007; Verma and Gupta, 2008). Also *Curvularia* and *Gleosporium* spp. were reported to cause leaf spot (Olson, 1978; Akram *et al.*, 2014).

Spots come in a wide variety of shapes, sizes, and colors. A leaf spot disease creates spots on foliage. The spots will vary in size and color depending on the plant, the organism involved and the stage of the host plant development. Spots are most often brownish, but may be tan or black. Concentric rings or a dark margin around the spot

may be present. Over time the spots may combine to enlarge and form blotches. Spots or blotches that are angular and located around the veins are generally referred to as anthracnose. (Stanley, 2014).

Initial symptoms on the leaves are small circular reddish-brown spots which enlarge, becoming surrounded by irregular shaped water-soaked areas. Under humid conditions the lesions develop rapidly and coalesce (Singh and Allen, 1979; Allen *et al., 1996).* Basidiospore produces distinct small necrotic and circular spots which do not enlarge. Pods and seeds also bear lesions (Verma *et al.,* 2006; Gonzalez *et al.,* 2011).

Cladosporium sp. produces spot on eggplant, pepper and tomato with irregular borders but when infection is severe these spots coalesced and kill large areas of the foliage. The upper surface of affected leaves turn olive green with more intense color near the center of lesions. Leaves eventually curl, wither, and may drop from the plant (Howard and David, 2007). Spots appear purplish-brown on the upper sides of leaves, on the lower side, spots are chestnut brown. Infection is generally more pronounced at margins of leaves (Jauron, 2012).

Nigrospora leaf spot appear in the form of small (2-5mm), circular to irregular red colored spots on leaflets, covering major area of the leaf on turf grass and cotton. Occasionally, the spots are seen delineated by midrib. In advanced stages of the disease, some spots cracked at the center. Eventually leaves dry and the plant defoliates (Nelson, 1992; Verma and Gupta, 2008; Zheng *et al.,* 2012).

Black leaf spot caused by *Diplocarpon rosae* attack fresh leaves of *Telfairia* plant. It can attack any plant with fleshy leaves and stem if the conditions are right. It appears as tiny black spots on leaves no bigger than a pin head. As the fungus develops, those black spots are ringed with yellow. Soon entire leave turn yellow and falls (Rhoades, 2014).

Banana leaf spot (black sigatoa caused by *Mycosphaerella fijiensis var.difformis* have been reported to vary according to location which reflect an important distinction between

disease epidemics in temperate and tropical regions (Chuang and Jeger, 1987; Udugama, 2002; Mcmullen and Adhikari, 2009).

All palms are susceptible to at least one of the pathogens that cause leaf spots and blight. Symptoms reported on palms are usually round to oval in shape and vary in color from yellow to brown to black (Rothrock*et al.*, 1998).

A spot disease causes yield loss of up to 70% to100% respectively, *Alternaria* causes major losses on a wide range of crops (Woundenberg *et al.*, 2013). The losses from the disease may approach 100 % in warm, wet seasons if control measures are not practiced. Harvestable fruits number, size and quality are all reduced by this disease (Neely and Nolte, 1989; Ibrahim, 2008). Indi *et al.*, (1986a and 1986b) reported yield losses to the tune of 10 to 25% and under severe conditions to cause 50% loss in seed yield of safflower. Yield losses of 60% have been attributed to natural infection (Eyal, 1972; Shaner and Finney, 1976; Ibrahim, 2008). Yield losses are often accompanied by corresponding decrease in grain weight (Narvaez and Caldwell, 1957; Shaner and Finney, 1976; Ibrahim, 2008). William, (2003) report 30% yield loss on blue berry in Georgia.

Losses due to *Cercospora* leaf spot disease on sugar beets can approach 40%, and are represented by both root tonnage and sugar percentage in roots. Beets with low sugar level do not store well and losses in storage result from increased storage decay. Profitable yields are additionally reduced due to greater levels of impurities in roots and increased sugar loss to molasses during processing (Harveson, 2013). *Ascochyta* leaf blight yield losses in commercial pea fields were estimated from 10 to 20% but in some trials losses were over 50% (Xue*et al.*, 1997; Xue and Warkentin, 2001; Boros and Wawer, 2007). Based on the assessment of nursery-wide annual losses due to *Rhizoctonia* web blight, about 0.5% of the plants are killed and 3 to 8% are unsalable during part of the year and experience reduced growth the following year (Copes, 2005).

MATERIALS AND METHODS

The study was conducted in Michael Okpara University of Agriculture Umudike, Eastern farm. Umudike is located on latitude 5^{o} 28^{o} N and longitude 7^{o} 32^{o} E, with an elevation of 122m above sea level. The area is characterized by uniform mean temperature ranging from 27^{o}C to 30^{0}C all through the year, with annual rainfall of 2200 mm per annum. The rainfall pattern is bimodal; a long wet season from April to July is interrupted by a short "August brake". This is followed by another short rainy season from September to October or early November, dry season stretches from early November to March, (NRCRI, 2015). The *Telfairia occidentalis* seed was procured from the Agricultural Development program (ADP) Umuahia, Abia State. About 1.0Kg of each fresh plant materials that will be use as plant ashes were sourced from the local environment and National Root Crop Resesarch Institute (NRCRI), Umudike.

Soil samples was collected from a depth (0-15cm), sieved through a 2mm mesh sieve and weighed out into perforated containers and Soil physiochemical properties were analyzed at the laboratory of National Root Crop Research Institute (NRCRI), Umudike. The experiment was layout in a Randomized Complete Block Design (RCBD) with six treatments which are: plantain leaves palm oil bunch, sawdust, kitchen wood ash, inorganic pesticide and a control, replicated three times.

Preparation of Plant Ashes: Four plant ashes which used in this study are: plantain leave (*Musa spp*), palm oil bunch, sawdust, kitchen wood ash, and inorganic pesticide (mancozeb) and control. About 1.0kg of each fresh plant material was sun-dried before grinding into powder; about 50g powder of each plant material (ashes) will be used. (Stoll 1998, 2000, anonymous, 2000, Opara and Obani, 2010).

Disease Assessment and Data Collection

Maduewesi (1977), Onuegbu and Dimkpa, (2010) described the following ratings for leaf spots of *Telfairia occidentalis*

1- no symptoms on leaf

2-one or two spot on leaf

3-morethan 2 or few spot on leaf

4-50% or half of leaf is covered with spots

5-Almoast all the leaf surface covered with spots

6-leaf yellow or dead

Disease incidence $\frac{\text{No.of leaves affected}}{\text{total no.of leaf sampled}} \text{ x } \frac{100}{1}$

Data on growth and yield parameters were collected every two weeks interval after planting (2WAD) based on: Plant height (cm), number of branches, number leaves and leaves weight (g). The disease severity assessment in the field was based on the first four leaves starting from the youngest open foliage of each plant.

All the data collected were subjected to analysis of variance (ANOVA) and the significant differences between the means were separated by Least Significant Difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

Results on table 2 show the effect of treatments on vine length, number of leaves and number of branches. On vine length there is no significantly different between the plantain peel (ash) and kitchen wood ash while sawdust and fire wood ash show no significantly different. There was significantly different between pesticides and palm oil bunch (ash).

Table 2: Effect of treatments on vine length, number of leaves and number of branches

Treatment	Vine length (cm)	No of leaf	No of Branches
Plantain peel (Ash)	106.767	76.356	2.333
Kitchen wood ash	102.411	68.833	2.111
Pesticides	92.711	60.522	2.000
Palm oil bunch (Ash)	83.289	60.144	1.888
Saw dust	71.311	57.111	1.666
Control	68.678	52.522	1.222
LSD ($p < 0.05$)	19.01	15.92	0.813

On the number of leaves there was no significantly different between the palm kernel bunch (ash) and sawdust while there was significantly different among other treatments.

On the number of branches plantain peel (ash) shows the highest number of mean but it was not significantly different from kitchen wood ash but was significantly different from other treatments while there was no significantly different between chemical (ash), palm oil bunch (ash) and sawdust. Control shows lowest number of mean and significantly different from other treatments.

Results on table 3 show the effect of treatments on leaf spot severity, disease incidence and leave weight. On the leaf spot severity plantain peel (ash) recorded the lowest number of mean number of leafspot and was significantly different from other treatments while kitchen wood ash, pesticide, palm kernel bunch (ash) and sawdust shows no significantly different ($p>0.005$) and the control recorded highest number of mean number of leafspot and shows significantly different among other treatments.

Table 3: Effect of treatments on spot severity, disease incidence and leaf weight

Treatment	LeafSpot severity	%Disease Incidence	Leaf Wt (kg)
Plantain peel (Ash)	0.25	20.07	5.266
kitchen wood ash	0.55	53.67	3.633
Pesticide	0.93	53.43	3.600
Palm oil bunch (Ash)	0.78	37.36	2.700
Saw dust	0.66	32.40	2.700
Control	4.54	75.79	2.000
LSD ($p<0.05$)	0.78	31.44	0.774

On the disease incidence plantain peel (ash) recorded the lowest number of mean and significantly different from other treatments while kitchen wood ash, pesticide, palm oil bunch (ash) and sawdust shows no significantly different ($p>0.05$) and the control

recorded highest number of mean and was significantly different ($p>0.05$) among other treatments.

Plantain peel (ash) recorded the highest number where on the leave weight and was significantly different among other treatments while there was no significantly different between pesticide and kitchen wood ash. There was no significantly different among the palm oil bunch (ash), sawdust and control which recorded the lowest number of mean.

The results revealed that all treatments significantly reduced leaf spot incidence and severity. But plantain peel (ash) effectively reduced the incidence of leaf sot disease of *Telfairia occidentlis.* This finding agrees with Osai *et al.,* (2013) who reported that plantain ash reduces the effect of leaf spot disease. The fungicidal properties of this ash may be traced to its high alkalinity (pH 9.26–9.95).

Eze Maduekwesi (1990) and Obgeni (1995) had earlier linked ash efficiency with alkalinity. The fungicidal properties of the ash observed during this study also agrees with that of Osai *et al.,* (2013) who reported on the efficacy of plantain inflorescence ash in the control of translucent leaf spot disease of *T. occidentalis*. The presence of phenol and other elements in ash may also explain its phytotoxicity. Asuquo *et al.,* (2002) reported that the fungitoxic superiority of *Elaeis guineenses* ash over other plant extracts in their study was due to higher phenol, sodium and phosphate levels.

The result shows that plantain peel (ash) significantly increased the number of leaves, number of branches, vine length and leave weight. Plantain peel (ash) suppress leaf spot and subsequently increase yield this study agrees with that of Osai *et al.,* (2013) who reported that plantain inflorescence ash reduces leaf spot disease incidence and enhanced leaf yield. *Telfairia occidentalis* is widely consumed in South-Eastern Nigeria where it is grown for its young vines, leaves and its oil–rich seeds. Its production is often threatened by insect pests and diseases especially leaf spot which reduces the quality, market value leaf and pod yields of the crop. Due to their scarcity, high cost

and environmental hazard, the use of synthetic pesticides for its control is not widely practiced. The use of ashes from readily available agricultural by-products was investigated as a potential control measure for this disease. Among all the ashes used plantain peel (ash) significantly suppressed leaf spot and also enhanced leave weight.

The ashes used in this investigation especially plantain peel (ash) which gave the highest suppressing effect and also increased yield could possibly be the best alternative for synthetic pesticides for the control of leaf spot disease of *Telfairia occidentalis.* Recommendably, farmers should embrace it, considering their efficacy, environmental friendliness and local availability which will help to enhance fluted pumpkin production and at the same time reduced leaf spot disease. Therefore, there is a need to explore the potential usage of these fungicidal properties of the ash observed to control the leaf spot disease of *Telfairia occidentalis.*

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