Efficacy of Wood Ash and Moringa Leaf Powder on the Shelf Life of Fresh Beefsteak Tomato

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ABSTRACT

Background: Major challenges along tomato value chain in Nigeria had been identified to include among others high postharvest losses. However, common materials that can be used by farmers in preserving their grains are wood ash and Moringa leaf powder.

Objective: The study determined the efficacy of Wood ash and Moringa leaf powder on the shelf life of fresh Beefsteak tomato.

Methods: The experiment was conducted at Biochemistry Laboratory section of National Root Crop Research Institute, Umudike; Abia State, Nigeria. The design adopted for the study was complete randomized research design experiment. Beefsteak tomatoes were bought from Dokwa West Local Government Area Market of Delta State, Nigeria using a basket. From the tomatoes gotten, 75 firm Beefsteak tomatoes were selected for the experiment. The treatments used for the study were 600grams of Moringa oleifera leaf powder and Wood ash. The treatment was replicated three times with each replicate containing eight (8) tomatoes that were observed for 24days. However, the data collected were analyzed using mean and percentage with SPSS version 21.0.

Results: The wood ash gave a better preservative effect when compared with Moringa oleifera leaf powder during the experiment. However, the findings further revealed that Moringa oleifera leaf powder preserved tomatoes fresher when compared with the group preserved with wood ash that has shrunk pericarp and other spoilage features

Conclusion: Tomato farmers and other consumers should preserve tomatoes with wood ash and Moringa oleifera leaf powder so as to enhance and promote health and shelf-life of their tomatoes.

Keywords: Beefsteak tomato, *Moringa oleifera*, Wood ash, Preservation

INTRODUCTION

Tomatoes form a necessary piece of cooking styles across the globe, particularly in the Nigeria (1). In this manner, day to day utilization of tomatoes can give an incredible lift to wellbeing, alongside improving the flavor of food. In Nigeria and around Delta state explicitly, Beefsteak species is the most usually developed due to its protection from fusilium and Verticilium wither (2). The beefsteak tomato is one of the hybrid and largest varieties of cultivated tomatoes (3). Generally hybrid and heirloom beefsteak tomatoes are red or pink in variety. In spite of the fact that others can be yellow or even orange. Beefsteaks all contain many little seed locules scattered all

around the fruit. Beefsteaks, as other tomato varieties, like a well-drained soil rich in organic matter. The utilization of fertile loams and clays as your soil for more prominent tomato yields is energized (3).

Tomato is one of the world's most consumed vegetable crops, yet second to potato (4). As indicated by statistics from the food and Agriculture Organization(4), around 340 billion pounds (170 millions tons) of new and handled tomatoes were created universally in 2014. The statistics also attests that the world production of tomatoes has continually expanded starting around 2000, developing over 54% from 2000 to 2014 and around 8% of the tomatoes delivered are consumed fresh (5). The wholesome advantage of tomato to human eating routine and it's medical advantage have been uncovered through different examinations did by (6). Tomato contains huge measure of vitamin C offering 40% of the daily value (DV), 15%DV of vitamin A, 8% DV of potassium and 7% of the recommended dietary allowance (RDA) for men (6). The red pigment in tomato is referred to as the lycopene which act as an antioxidant that can harm cells in the body (9). Tomato is known for its content of sugar, acids, nutrient, mineral, lycopene and carotenoid contents (10). Tomatoes are significant sources of potassium, Phosphorus, magnesium, iron which are vital for the ordinary action of nerves and muscles in people (6) showed eating tomatoes routinely assists with bringing down the risk of certain cancers as well as different circumstances including cardiovascular infections, osteoporosis, bright light prompted skin harm and mental brokenness which is because of the lycopene content. Notwithstanding its medical advantages, tomatoes are utilized in getting ready most food treats in various people homes in Nigeria. It is eaten raw, utilized in salad preparation of stew and sauce.

As indicated by (1), most tomato farmers in Nigeria are limited scale farmers in the country regions and need admittance to present day storerooms and power, and further expressed that, capacity, handling and additive strategy are essentially nonexistent or past the method for little farmers in emerging nations. These moves lead to absolute losses in tomato production and thusly influence the monetary improvement of the farmers. Major challenges along tomato value chain in Nigeria had been identified to include deficiency in critical inputs such as lack of improved technology, low yield and productivity, high postharvest losses, lack of processing and marketing infrastructure (7). The most serious of these challenges is high post-harvest losses. To this end, farmers and consumers are in constant demand for safe and eco-friendly method of extending shelf life thereby reducing post-harvest losses of tomatoes. However, common materials that can be used by farmers in preserving their grains are wood ash and Moringa leaf powder. Wood ash is a non-dangerous agricultural waste which is produced as a result of oxidation process during burning of wood (8). It comes about because the trees have retained over their lifetime aside from carbon, hydrogen and nitrogen which dissipate during the firing of wood (9). Previous study (8) affirmed in their investigations the presence of a few significant translucent stages with the prevalent one being calcite-CaCO3, with more modest amounts of quartz-SiO2, K and fairdice-K2Ca (CO3) and it has been utilized to kill acidic soils because of its capacity to frame antacid concentrates when broken down in water. The concentrate additionally expressed that the substance and versatility of harmful components in the wood ash is in full consistence with the administrative prerequisites to safeguard soil quality and agrarian productions (9). In most cases, ash from the combustion of plant wastes does not contain heavy metals and other toxic elements in concentration that could lead to secondary contamination of soil and agricultural products for recycling as a soil improver (10).

Apart from the abundant dietary value, Moringa plant has a panacea of medicinal and preventive properties, many research publications have revealed that hydro alcohol, aqueous, or alcohol extracts of *Moringa oleifera* leaves contain multiple biological properties such as antimicrobial, antioxidant, anti-inflammatory, vital organs protective, pain-relieving, anti-peptic ulcer, antihypertensive, anticancer, anaphylactic, and other immune boosting actions (11). Additionally, the use of *Moringa oleifera* species was recommended by Daba as a substitute to feed source in the management of malnutrition (12). Multiple researches conducted have also demonstrated that the leaf extracts from Moringa trees have antimicrobial activities over some disease-causing microbes that cause water associated morbidities like Staphylococcus aureus, E. coli, Salmonella typhi, Shigella species

in humans (2, 5 and 12). This capability linked to the benzyl isothiocyanate compound that is an active bactericide and fungicide properties. The leaf extracts of *Moringa stenopetala* exhibit considerable antimicrobial and antifungal action, has shown to treat leaf blight in sunflower plants. Such kind of evidence based information suggests that *Moringa oleifera* and *Moringa stenopetala* possibly possess a potential for formulation of antibiotic preparations (13). Moringa leaf has also been proven to have preservative properties on food, it was observed that dehydrated Moringa leaf powder have some effects on increasing the shelf life of selected food products such as Dhal curry, soya meat curry and cooked rice. They accordingly presumed that Moringa leaf powder can be utilized as food additive.

However there is a low level of information on the use of cultural measures such as the preservative effects of wood Ash and Moringa leaf powder which is affordable by small holder farmers to extend the shelf life of tomatoes. Hence, the primary target of this study was to determine the efficacy of Wood ash and Moringa leaf powder on the shelf life of fresh Beefsteak tomato.

MATERIALS AND METHODS

• Sources of materials

Small basket of Beefsteak tomatoes transported from Dokwa West *Local Government* Area Market of *Delta* State, Nigeria using a basket. Dokwa West Local Government is one of the 25 LGAs in Delta state with its administrative seat located in located in Kwale (Utagba-Ogbe) with other districts & towns like Abbi, Ogume, Onicha-Ukwuani, Utagba, Utagbe-Uno, Ijeze, Imam-Abbi, Emu-Uno & more. Its headquarters are in the town of Kwale (Utagba-Ogbe). It has an area of 816 km^2 and a population of 149,325 at the 2006 census. 75 healthy tomatoes were selected based on absence of defect, uniformity in size and colour. Six (6kg) of wood ash were collected from a local kitchen in Ubakala village, Umuahia South Local government area, Abia state. The wood ash was sieved with a 150mm mesh size sieve to remove stones and wood remains and poured into a cleaned container. However, fresh Moringa leaves were gotten from Obuohia Ibere in Ikwuano Local Government Area of Abia state and air dried for fifteen days at room temperature. After the green dried after the days at room temperature, it was grinded into powdery form and 4000 of Moringa leave powder was obtained and kept in a cleaned container, thereafter.

• Experimental procedure

The experiment was carried out at the Biochemistry Laboratory section of National Root Crop Research Institute, Umudike; Abia State, Nigeria. It is located in the South-East geopolitical zone of Nigeria, bordered to the north and northeast by the states of Anambra, Enugu, and Ebonyi, Imo State to the west, Cross River State to the east, Akwa Ibom State to the southeast, and Rivers State to the south. Economically, Abia State is based around the production of crude oil and natural gas along with agriculture, mainly of yams, maize, taro, oil palm, and cassava. The experiment was conducted for 24 days between February and March, 2022, using a complete randomized experimental design replicated into three units. Three treatments of wood ash and moringa leaf powder were applied on the Beefsteak tomato in a brownish cartoon used as the storage platform. The replications includes;

i. controls (RcT1, RcT2 & RcT3)
ii. wood ash (RaT1, RaT2, & RaT3)
iii. Moringa leaf powder (RmT1, RmT2 & RmT).

However, three cartoons were used for each treatment making it a total of 9 cartoons for the study. 600g of wood ash and Moringa leaf powder were divided into three which resulted in 200g for each replicate. The factor tested is Beefsteak tomato and two (2) plants extracts. Beefsteak tomatoes is one of most widely cultivated tomato in Delta for commercial purpose and the most available and consumed in Nigeria. Eight (8) healthy tomatoes weighing 1333g were preserved using 200g of wood –ash and Moringa leaf powder respectively. Two hundred gram (200g) of wood ash were poured evenly on the bottom part of the carton, Eight(8) healthy tomatoes were randomly laid on top and covered with the remaining of wood ash. The same process was repeated three times except for the control group where eight (8) healthy tomatoes were laid in cartoon triplicates. Thus, in total, 25 healthy tomatoes were preserved in each treatment. The total population of the experimental Beefsteak tomato was 75. The cartoons containing the treatment were kept in place where rat are absent and other pests and observed for 28 days. The parameter to be observed include, percentage rate of tomato

spoilage and preservative rate of each treatment. A correct visual observation was made on the colour and smoothness of the Beefsteak tomato skin. The data collected were analyzed using mean and percentage with SPSS version 21.0

From the findings as shown in result 1 above, there is a significant difference in the mean preservative rating of the treatment on Beefsteak tomatoes. The wood ash preservative was observed to have a maximum preserved effect on the 12th day as shown in Figure 1 above. It is slightly higher than Moringa leaf powder as against the control with very low preservative effect. The experiment further showed that the Beefsteak tomatoes treated with wood ash and moringa leaf powder had an extended shelf life for 24days. However, in the wood ash treatment, the longest shelf life was 24 days with a decrease in mean preservation rate from the 15th day.

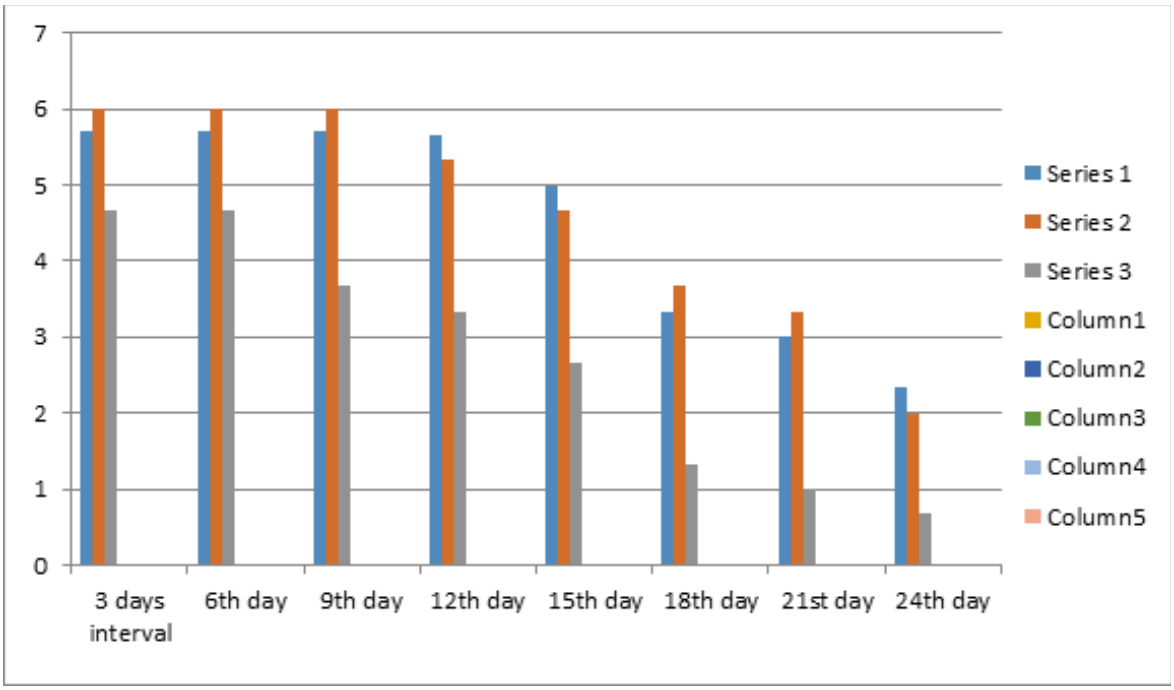
From the findings in result 2, the spoilage of tomatoes was recorded in all the treatment groups. The group with the highest mean value of spoils tomatoes fruits was observed in the control treatment. Thus, the result showed that from the third day, 2.33 numbers were rotten, but was observed to be higher from the 18th day as shown in result 2. The treatment with wood ash was observed to have decreased numbers of rotten tomatoes from the 6th day to 24th day followed by Moringa leaf powder and control.

Discussion of the findings

The result 1 revealed a significant difference in the mean preservative rating of the treatment on

RESULTS

Result 1: Mean preservative efficacy of wood ash and Moringa leaf powder on the shelf life of the tomatoes



Number of days

Result 1: Mean preservative Effect of Wood ash and Moringa Leaf Powder on Roma VF Tomatoes

Keys:

Blue: Woodash

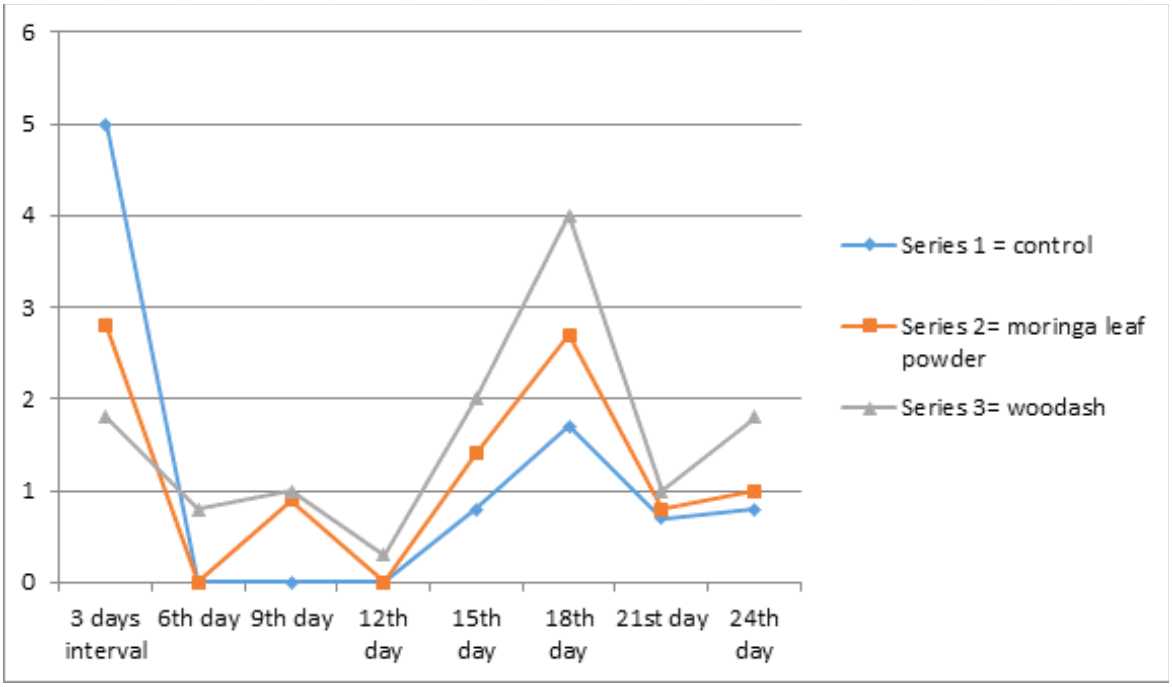
Red: Moringa leaf powder

Green: Control

Horizontal Line: Number of days

Vertical Line: Mean number of tomatoes

Result 2: Efficacy of Wood Ash and Moringa Leaf on Mean Spoilage level of Beefsteak tomatoes



Result 2: Mean Rate of Spoilage on the Effect of Wood ash and Moringa Leaf Powder on Beefsteak tomatoes

Keys:

Series 1: Control

Series 2: Moringa leaf powder

Series 3: woodash

Horizontal Line: Number of days

Vertical Line: Mean number of tomatoes

Beefsteak tomatoes. The wood ash preservative was observed to have a maximum preserved effect on the 12th day as shown in Figure 1 above. It is slightly higher than Moringa leaf powder as against the control with very low preservative effect. The experiment further showed that the Beefsteak tomatoes treated with wood ash and moringa leaf powder had an extended shelf life for 24days. However, in the wood ash treatment, the longest shelf life was 24 days with a decrease in mean preservation rate from the 15th day. This may be as a result of the components of wood ash. The findings is in agreement with (14) who suggested utilization of *Moringa oleifera* leaf extract as additives in human and livestock feeding materials. Also, in same line with results of (15) who reported that calcium inhibits senescence of fruits, reduction in respiration prevention of fruits, ripening, promote firmer fruits and physiology disorders. The presence of calcium in wood ash invariably added to its preservative effect of Beefsteak tomatoes. This results however is proof that wood ash can be used in preservation of agricultural produce. The preservative ability of Moringa leaf powder was also recorded. The tomatoes treated with Moringa leaf powder kept a shelf of 12 days at most extreme number, the mean additive rate was seen to decrease from the fifteenth day. Meanwhile, the treatment was completed at room temperature which undeniably intruded on the outcome while the control group was seen to have a diminishing additive impact as the day goes by. Thus, among all the treatments, wood ash was the

best as it had a higher number of healthy fruits after 24days. However in comparing the effect of wood ash and moringa leaf powder on the shelf life of Beefsteak tomatoes, the observations showed a slightly different effect from the two methods The immovability and redness of the tomatoes were kept up with till the last day of the examination however the thing that matters was found in the perfection of the skin. The tomatoes protected in wood debris were seen to have a slight contracted skin dissimilar to the ones safeguarded with Moringa leaf powder that kept up with its perfection till the last day. The contracted skin of tomatoes preserved in wood ash is reported to occur as a result of loss in moisture content of the tomato which is an effect from the chemical constituents of wood ash. This was in line with the study of (16) who reported that potassium presence in ash led to absorption of moisture from the storage environment. This is because, the potassium found in ash is always in the hydroxide state hence water soluble. More so, according to (17), wood ash and Moringa leaf powder can be used in reducing the spoilage level of tomatoes and extend the shelf life. Since the primary aim of preservation is to extend the shelf life of the produce.

Result 2 showed that the spoilage of tomatoes was recorded in all the treatment groups. However, the group with the highest mean value of spoils tomatoes fruits was observed in the control treatment. Thus, the findings revealed that from the 3rd day, 2.33 numbers were rotten, but was observed to be higher from the 18th day as shown in result 2. The treatment with wood ash was observed to have decreased numbers of rotten tomatoes from the 6th day to 24th day followed by Moringa leaf powder and control. This findings concurred with (3) that tomatoes bought from retail outlets hold best eating characteristics for 2 to 3 days when put away at room temperature while under ready tomatoes, it can stay up to 5 - 7 days. More so, the low rate of spoilage in wood ash and moringa leaf powder was seen as result of antimicrobial effect in the two plant extracts. Wood extracts has been accorded as a native technique for preserving seeds from organisms. This was recorded in the study of (18), that the various experiment conducted in the work showed that wood ash have fungicidal effects which probably explains why ashes were able to prevent the invasion if pests and microbial grow more viably. As indicated by (19), the presence of zinc in chemical creation influences the starch digestion and helps tomato plant impervious to growths and bacterial sicknesses ominous circumstances like hot and dry spheres. Likewise the presence of protease inhibitor in Moringa Leaf powder makes it a viable way in broadening the time frame of realistic usability of tomatoes. It was stated that *Moringa oleifera* contains useful compounds such as saponins, cardiac glycosides, terpanoids, steroids and alkaloids that are known to possess many therapeutic antimicrobial properties (20). However, *moringa oleifera* was recorded to have a reduction in bioactivity when stored for a long time. Hence; the longer the storage, the lesser the bioactivity.

CONCLUSION

Tomato species treated with wood ash extracts produced lower rot values than the ones treated with Moringa extracts. Nonetheless, wood ash and Moringa leaf powder are better choices in expanding the time span of usability of tomatoes despite the fact that wood debris showed a marginally higher impact on the quantity of tomatoes stored. Therefore, wood ash and Moringa leaf are better options for farmers and customers to store their tomatoes for 12 days with next to no deterioration. Subsequently, the preservation and storage of tomatoes using extracts from wood ash and the leaves of *Moringa oleifera*, which requires no type of refrigeration or extra use of synthetic compounds makes its use for tomato preservation exceptionally advantageous for low pay workers and rural farmers, either for market or for personal consumption.

RECOMMENDATIONS

In view of the discoveries of the study, the accompanying recommendations are put forward;

1. Tomato farmers and consumers should preserve tomato fruits with wood ash and moringa leaf powder
2. Extension workers should help in teaching tomato consumers and farmers on the best way of utilizing wood-debris and moringa leaf powder in preservation
3. Curriculum planners should integrate wood-ash and moringa leaf powder as post-production and preservative

techniques in the existing curriculum

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