

USING WOOD ASH TO GROW OKRA BY WOMEN: A STRATEGY FOR ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract

The paper examined using wood ash to grow okra by women for economic development in Nigeria. The efficacy of wood ash in growing vegetables particular reference to okra was discussed. Both micro and macro elements of wood ash were which makes wood ash effective in the vegetative growth of okra and also its fruit formation were also highlighted Okra as a vegetable, its nutritional and economic value were looked at in the paper. The cost effectiveness of female farmers using wood ash to grow okra was discussed.

Key Words: wood ash fertilizer

Introduction

United Nations resolutions in 2016 on sustainable development goals agreed on seven development goals. One of those goals is to ensure that hunger is brought to an end and to achieve food security, improve nutrition, and promote sustainable food production. To achieve sufficient crop production, a number of issues must be addressed among which is the cost of inorganic fertilizers and its availability to farmers, particularly female farmers. Food production is affected in many parts of the world, particularly developing countries like Nigeria, due to inability of farmers in accessing inorganic fertilizers, most especially female farmers. This indeed is a great challenge including the cost.

Farmlands are depleted of nutrients due to over cultivation and absorptions of those nutrients by crops during harvest, which leads to the need for replenishing the soil. Application of fertilizers will always boost the soil nutrients in order to sustain plant growth and yield. For female farmers in Nigeria to use inorganic fertilizers to enhance their okra yield, may not be economically or easy for them to afford, and also inorganic fertilizers cause negative environmental impact; for example, soil acidification and eutrophication. Therefore, it is important to use more affordable and less harmful form of fertilizer as an alternative to produce food crop and for safer environment.

Wood ash as an alternative to inorganic fertilizer, it is the residue left from combustion of wood. Wood ash contain potash and potassium (Fowler, (2020). Wood ash contain elements such as: carbon (C), 5-30%, Calcium (Ca) 7-33%, Potassium(K) 3-10%, Magnesium (mg) 1-2%, Manganese (Mn) 2%, Phosphorus(P) 0.31.3%, and Sodium (Na) 0.2-0.5% (Wikipedia). Wood ash has high P^H of (above 7) and relatively high content of base Cations and phosphorus. Due to the chemical composition of ash, it has been shown that, ash can be used to raise soil P^H and could be used as alternative to fertilizer. Wood ash can supply enough nutrients to meet the growth requirement of okra. The plants foods which is coming from the soil, are taken up by cultivated plants and removed with them from the soil, and which cannot be replaced by any other means except in the application of manorial substances, such as potash and

phosphoric acid. When these two substances are depleted in the soil, crop production almost cease, therefore, re-application will re-established the soil (Greiner, 1894).

Wood ash is cheaper and efficient in crop production due to its macronutrients. Also, plants use large quantities of potassium during their life cycle because potassium is associated with the movement of water, nutrients and carbohydrates in plant tissues. It is involved with enzyme activation within the plant, which affects protein, starch and adenosine triphosphate (ATP) production. The production of ATP can regulate the rate of photosynthesis.

Potassium (K) is one of the components of wood ash, which helps regulate the opening and closing of the stomata, regulates the exchange of water vapour, oxygen and carbon dioxide. If potassium is deficient or not supplied in adequate amounts to the soil, it causes stunted growth in plants and reduces yield. Other roles of potassium in plant growth and yield include: increase in root growth and improves drought resistance, maintains turgor; reduces water loss and wilting, aids photosynthesis and food formation, reduces respiration, preventing energy loss, enhances translocation of sugars and starch, increase plants' protein content, builds cellulose and reduces lodging and helps retard crop diseases. (Daniel, & Carl, 2018).

Okra belongs to the family Malvaceae and genus *Abelmoschus*. The plant is cultivated in tropical, subtropical and warm temperate regions around the world. Okra can be grown on wide range of soils, but well drain fertile soils with adequate organic matter result in high yield. Okra is widely cultivated throughout the year in the tropics especially Nigeria. In 2009-2010 (about 14years ago) the total world area under cultivation of okra was 0.43 million hectares and the production stood at 4.54 million tons. The current production of Okra today in Nigeria is 136 estimated at 1.82 million tonnes per year (FAOSTAT, 2020).The yield is low when compare to the yield of other food crops. India produces 5784 thousand tons of okra. At present, India is the largest producer of okra with 67.1%, followed by Nigeria, (15.4%), and Sudan (9.3%) This production level of production is low to meet the market needs of 230 million people in Nigeria, hence this paper. Okra (*Abelmoschus esculentus* L.) is a vegetable of high nutritional value and with great socio-economic importance worldwide and Nigeria most especially. Okra meets the needs of vegetable, because the immature fruits are a rich source of fibre and minerals (Kamalesh, Subrata, Asraf, Pranabesh, 2018; Maciel, Finzi, Marra, Carvalho, Nogueira, 2018; Petropoulous, 2018).

Economic Value of okra Production

National economic as described in literature is the production, distribution, trade, consumption of goods and services by different agents of a nation. It is about macroeconomics and also is characterized by efficiency, equity, economic freedom, economic growth and price stability. Nigeria is an open economic where buying and selling of goods and services and distribution are determined by supply and demand with little government intervention. Citizens are free to run private businesses or engage in production, distribution or rendering services and farming okra by female farmers in Nigeria is a form of production or trade which leads to income generation.

Research reports in Nigeria have shown women economic benefits in growing Okra. For example, studies done by Ewunwe, Alufobai, and Adolue (2018) in Delta state, revealed the cost ratio of okra yield by female farmers which stands at 2.99 and a return on their investment was 2.03, indicating that okra production is viable and profitable and is cultivated mostly by

women. The authors concluded that okra farming is profitable and female farmers should be encouraged by government to invest more in okra production.

Okra plant takes about 40 days to mature from planting (i.e., to flowering and fruiting), it is a vegetable that is always sort for; it can be processed by drying and preserved. The leaves are sold for use in some parts of Nigeria, therefore, farming okra by women using wood ash is a veritable business for the women. Okra is multipurpose and economic crop for farmers and marketers in Nigeria because of the income generated from the sale of immature fresh leaves, fresh and dried fruits which are made into diverse soup products (Ibitoye & Kolawole, 2022).

Nutritional Quality and Health benefits of Okra

Okra is a nutritious vegetable with many health benefits. It is rich in dietary fiber, minerals (Sodium, Calcium, Potassium, Zinc, and iron), Vitamins (A, B and C), antioxidants, and folate. Okra seed is rich in proteins (15-26%), the seed oil is edible (20-40%), and rich in unsaturated fatty acids like the linoleic acid essential for human nutrition (Olsen, 2019). The mature fruit and stems are used in the paper industry. Okra mucilage can be used as food additives (NRCNAs, 2006; Bnchasri, 2012. Kumar, Kumar & Nadendla, 2013), 2017; Gemedede, Ratta, Haki, Woldegiosgis, Beyene, 2015; Dubey & Mishra, 2017).

Okra leaves are excellent source of fiber and also contain vitamin A and C, Calcium, protein and iron. Okra leaves are also used to balanced digestion and internal health (Olsen, 2019). Okra is used to control cholesterol level, stabilize blood sugar by regulating the rate at which sugar is absorbed from the intestinal tract. It is good for people who feel weak or exhausted, including people suffering from depression. It is also used in treating ulcers, lung inflammation, sore throat, as well as irritable bowel. Okra is good for asthma patient (Sengkhampam, Verhoef, Schols, Sajjaanatakul & Voragen, 2009).

Effects of Wood Ash on growth and Yield of Okra

Wood ash majorly contains potassium is absorbed by plants in the form of the potassium ion (K⁺). Potassium exist in solution and in exchangeable and non-exchangeable forms which are in dynamic equilibrium with each other (Cox & Singh 1999). Solution potassium and exchangeable potassium are replenished by non-exchangeable potassium when they are depleted by plant removal or leaching (Gardner & Miller, 2004). A study reported a two years trial of N.P.K. on okra. The application was: N=60; P=30 and K=30Kg/ha. (Bid, Days, & Dhua, 1971). The best growth was obtained when the three elements were applied, the two nutrient combinations, NK was the most effective, followed by NP and PK. in trials with okra cultivas, *Pusa sawani*, N and K₂O were each applied at 0-120kg/ha (Mishra & Pandey, 1987) Nat 80 kg/ha and K at 40 kg/ha significantly increased the number of fruits per plants, 1000 seed weight and seed yield. Application of K above 40 kg/ha adversely affected seed yield. Potassium is essential in photosynthesis, sugar translocation, nitrogen metabolism, enzyme activation, stomata functioning, water relations and growth of meristematic tissues (Mitchel 1970). However, excess K causes plants to be deficient in magnesium and Calcium due to induced nutrient imbalances which upset the K: Mg and K: Ca ratios.

Potassium in the Soil

The total potassium content of soils always exceeds 20,000 ppm (parts per million) (Kaiser & Rosen, 2018). While the supply of total K in soils is quite large, relatively small amounts are available for plant growth at any given time. That is because nearly all this K is in the structural component of soil minerals and is not available for plant growth. The amount of K supplied by

soils varies due to large differences in soil parent materials and the effect weathering has on these materials. Therefore, the need for K in a fertilizer programme varies across soil types.

Studies of wood ash fertilization and plant density in okra production are necessary given that an adequate plant density associated with K fertilization provides a greater yield (Straussburger 2010; Meena, 2016). The interaction of the traits studied was reported only for broccoli by Hashem, Al- Abbas and Mohammed (2018) with significant total yield effect. Reports of wood ash fertilization and planting density on okra productivity are scarce. Potassium is an essential nutrient for plant metabolism that increase crop yield and fruit quality due to its enzyme activity increase, which metabolizes carbohydrates to synthesize amino-acids and proteins (Zahedi, 2016; Chrysargyris, Drausa, & Tzortzakis, 2017). This nutrient is essential in plants production especially in semi-arid regions, due to stomata regulation to avoid water loss through transpiration and increase the accumulation of osmoprotectants for osmoregulation during water scarcity (Meena, Bahadur, Maurya & Kumar, 2016; Jha & Subramanian, 2017).

Ideal planting density can improve the plant yield because it can reduce and suppress weed infestation when plants are closely spaced (Omouvbude & Odensi, 2018). It can also ensure the balance between vegetative growth and fruit development due to better use of nutrients and solar radiation (Straussburger 2010). However, there are fundamental factors that affects the uptake of K by plants that must be taking into consideration, they include: soil moisture, soil aeration and oxygen level and tillage system.

Sources of Potassium

Common potassium fertilizer sources are: Potassium chloride (KCL) 60-62%, Potassium sulfate (K_2SO_4) 50%, Potassium magnesium sulfate ($K_2SO_4 \cdot 2Mg SO_4$) 20%, Potassium thiosulfate ($K_2S_2O_3$) 17%, and Potassium nitrate (KNO_3) 44%

Methods of application

It does not make much difference whether we apply the manorial substances to the land before plowing or after plowing, above the seed or below the seed, stir them in with the harrow or with the cultivator or with any other tool, and often whether we put them on the soil or in the soil, so long as we apply sufficient quantities, and apply them at an opportune time-namely, somewhat ahead of the moment that the plants will want to take hold of these foods. Select the manure in accordance with the requirements of soil and crop. Therefore, what is the method of applying wood ash? Use plenty of them. However, here are some ways of application:

1. For improvement of soil apply one to two ton per acre in early spring
2. For maintenance of soil fertility, apply annually from 500-1000 pounds of ashes per acre in fall winter and early spring.
3. For the more valuable farm crops, apply two –three ton per acre at winter.
4. Make large applications sometime ahead of planting (Greiner, 1894).

Symptoms of K deficiency in Okra

Before symptoms of K deficiency become visible in okra, there are losses that occur in both crop yield and crop quality. Disease incidences increases and crop production is severely reduced. The number of leaves are low; Leaf margins are brown yellow; brown or scorched;

abscission of scorched leaves; plants are stunted; leaves are dark green; roots are poorly developed and often affected by rot., decreased drought resistant, appearance of white, yellow or orange chlorotic spots or stripes on older leaves, chlorotic areas becomes necrotic, the tissue dies and leaves dry up. The symptoms spread to younger leaves and finally, and the entire plant in some case (Tiwari, & Gavin, 2014.) Potassium deficiency symptoms in vegetables crops. Potassium-de

References

- Benchasri, S. (2012). Okra (*Albemoschus esculentus* L. Moench) as a valuable vegetable of the world. *Rataestvo Povtarstvo* (49), 105-112. Crossref/Google Scholar.
- Bid, N. N, Days, P. K. & Dhua, S. P. (1971). Efficacy of nitrogenous and phosphatic fertilizers on growth and yield of Bhindi, *Tectonology India*. 8(2), 145-148.
- Cox, K. I. & Singh, A. K. (1999). Effect of different levels of phosphorus, GA3 and pickings on seed production of okra. *Environment, and Ecology*. 16(2), 350-352
- Chrysargyris, A., Drouza, C. Tzortzaks, N. (2017). Optimization of potassium fertilization nutrition for growth, physiological development, essential oil composition and antioxidant activity of *Lavandula angustifolia* Mill. *Journal of soil Science and Plant Nutrition* 17, 291-306.
- Daniel, E. Kaiser, B. & Carl, J. Rosen (2018). *Nutrient Management specialist*. extension.umn.edu.
- Dubey, P., Mishra, S. (2017). A review on: Diabetes and okra (*Albemoschus esculentus* L.). *J.Med. plants Stud.* (5), 23-26 Google Scholar
- Ewunwe P.A., Alufobai, G. & Adolue C.F. (2018). Economic Viability of okra production in Ika South and North East Local Government Areas of Delta State, Nigeria. *Journal of Tropical Agriculture, Food Environment and extension* (17), 1, 57-62.
- Fowler, A. (2020). How to use wood ash as fertilizer for your garden. The guardian.com.
- Gardner, D. T. & Miller, R. W. (2004). *Soils in our environment*. 126-165
- Gemed, H. F., Ratta, N., Haki, G. D., Woldegiosgis, A.Z., Beyene, F. (2015). Nutritional quality and health benefits of okra (*Albemoschus esculentus*): A review. *J. Food process Technol.* (6), 2. 10.4172/2157-7110.1000458. Crossref/Google Scholar.
- Hashem, A. L., Al Abbas, N. M. H., Mohammed, B. N. J. (2018). Effect of cultivation distances. and potassium fertilization on the growth and yield of broccoli (*broccoli brassica oleracea var. italic plenck*). *Euphrates Journal of Agriculture Science* (10)163-174.
- Jha, Y., Subramanian, R. B. (2016). Physiology and antioxidant enzymes for alleviating salinity stress by potassium-mobilizing bacteria. In: Meena, B. R., Verma, J. P. Meena R. S. (ed *Potassium Solubilizing Micro-organisms for Sustainable Agriculture* 149-162. Springer, New Delhi, India.
- Ibitoye, D.O. & Kolawale, A.O. (2022). Farmers' Appraisal on Okra (*Albemoschus esculentus* L.) Production and Phenotypic Characterization: Asynergistic Approach for Improvement. 10.3389/fpls/787577. ncbi.nlm.nih.gov
- Kamalesh, P., Sabrata, D. Asraf, A. K. Pranabesh, C. (2016). Phytochemical investigation and hypoglycemic effect of okra (*Abelmoschus esculentus*). *Research Journal of Pharmacy and Technology* (9), 162-164).

- Kant, K., Singh, J.P. (2020). Resources use efficiency in okrs in Meerut district of Western Uttar Pradesh. *Journal of Pharmacognosy and Phytochemistry* (9), 2114-2116
- Maciel, G. M. Finzi, R. R., Marra, A. W. C., Carvalha, F. J., Nogueira, A. P. O. (2018). Agronomic potential and selection of okra hybrids to obtain potential genitors. *Horticultura Brasileira* (36), 112-117.
- Meena, V. S., Bahadur, I. Maurya, B. R., Kumar, A., Meena, R. K., Meena, S. K. & Verma, J.P. (2016). Potassium solubilizing microorganism in evergreen agriculture: An Meena, B. R., Verma, J. P. Meena R. S. (ed) *Potassium Solubilizing Micro organisms for Sustainable Agriculture* 120. Springer, New Delhi, India.
- Mishra, H. P. & Pandey, R. G. (1987). Effect of N and K on the seed production of okra (*Abelmoschus esculentus* L.) Mill, J in calcareous soil. *Indian Journal of Agronomy*, 32(4), 425-427.
- Mitchel, J. D. D. (1970). Potassium uptake by potatoes. *Journal of Agricultural Science* 74 (3) 495-500.
- Narayanamoorthy, A., Davika, N. (2018) Economic and resource impacts of drip method of irrigation on okra cultivation: An analysis of field survey data. *Journal of Land and Rural Studies* (6),15-33
- NRCNAS, (2000). “Okra” *Lost crops of Africa: Vol II: Vegetables. Lost Crops of Africa. 2.* Washington, D.C.: National Academics Press Google Scholar
- Omorbude, S. & Udensi, E. A. (2018). Response of okra (*Abelmoschus esculentus* (L.). Moench) and weeds to plant spacing and weeding regime in a humid forest agro-ecology of South-Eastern Nigeria. *Journal of Applied Science International* 18; 1-13.
- Olsen, N. (2019). Benefits and uses of Okra). <https://www.medicalnewstoday.com>
- Petropoulos, S. Fernandes, A., Barros, L., Ferrera, I. C. (2018). Chemical composition, nutritional value and antioxidant properties of Mediterranean okra genotypes in relation to harvest stage. *Food Chemistry* 242: 466-474.
- Sengkhampam, N., Verhoef, R., Schols, H. A., Sajjanatakul, T., & Voragen, A. G. J. (2009). Characterization of cell wall polysaccharides from okra (*Abelmoschus esculentus* (L.) Moench) *Carbohydrates Research* 344, 1824-1832.
- Strassburger, A. S., Peil, R. M. N., Schwengber, J.E., Medeiros, C. A. B., Martins, D. D. S Silva, J. E. (2010). Crescimento e produtividade de cultivares de melão-de-são-paulo em diferentes densidades de plantio em Sistema de cultivo orgânico, *Bragantia* (69), 623-630.
- Greiner, T. (1894). *Value of wood ashes and their uses.*
- Tiwari, K. N. & Gavin S. (2014.) Potassium deficiency symptoms in vegetables crops. Potassium-de Wikipedia <https://en.wikipedia.org>
- Zahedi, H. (2016). Growth promoting effect of potassium, solubilizing microorganism on some crops species. In: Meena, B. R., Verma, J. P. Meena R. S. (ed) *Potassium Solubilizing Micro-organisms for Sustainable Agriculture* 31-32. Springer, New Delhi, India.