Rapid Advancement on Integrated Application of Sawdust Ash Manure and Urea Fertilizer on Soil Chemical Properties and Sesame (Sesamum Indicum L.) Performance

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Abstract. One of the solutions to food insecurity and malnutrition in Sub-Saharan Africa is to promote local crops, encourage the use of locally source materials as amendment, improve their traditional system of production, and so diversify subsistence crop. Despite the increasing demand and price of sesame in the world market, its productivity is declining from 8 to 3q/ha in most part of the planting region of Africa. The major reasons are the lack of knowledge and skill in land preparation and agronomic practices, weather uncertainties, pest outbreak and above all the use of fertilizer. Integrated application of organic and inorganic nutrients sources rather than total dependence on any of the sources is expected to ensure reduction in expenditure on chemical fertilizers, a more balanced plant nutrition and control of soil acidity. Due to increasing number of saw milling industries, sawdust is being daily generated and burnt. There is urgent need to study the use of sawdust ash waste for soil improvement and as fertilizer and liming material. Hence, the objective of this review tend to evaluate the effect of combined application of Sawdust ash and its combined application with Urea fertilizer on the growth and yield of sesame plant nutrients composition and sesame nutritional quality. Crops have become so expensive to grow that nutrient deficiencies should not be allowed to limit the yields. With management practices such as continuous cropping and reduce fallow periods, the soil can hardly support cropping. The need therefore, arises for production practices that will ensure high yield. The integrated application of organic and inorganic nutrient sources rather than total dependence on any of the sources is expected to ensure reduction in expenditure on chemical fertilizers, a more balanced plant nutrition and control of soil acidity. Since sawdust ash is a waste which poses environmental concern, its combined use with chemical fertilizer in crop production will assist in environmental sanitation.

Key words: sesame, sawdust ash manure, urea, performance, soil chemical properties.

Introduction

Sesame or benniseed (Sesamum indicum L) is cultivated in most tropical and subtropical Asian and African countries for its highly nutritious and edible seeds. The seed function ingredient in soup and a source of oil (43%) (Iwo et al. 2002: 76-82). Sesame (Sesamum indicum L) is widely naturalized in tropical regions of the planet. The oil crop originates from dry savanna of tropical Africa. Though numerous wild relatives of the crop occur in Africa and fewer number in India, it seems to possess been first brought into domestication and enormous scale cultivation in India.

Sesame (Sesamum indicum L) otherwise referred to as bennin seed, is an annual plant belonging to the family 'Pedialaceae'. It's long history of cultivation mostly for its oil yield and typically considered together of the world's oldest spice and oil seed crop containing up to 50% oil and 25% protein. The first area of domestication of the crop appears obscure but seems to possess been first brought into large-scale cultivation in India. The plant is deep-rooting and well adapted to face up to dry conditions. Hence, it's a drought tolerant crop (Jefferson, 2003: 41-58). It can grow on relatively poor soils in climates generally unsuitable for other crops, thereby being widely valued for its nutritional and economic yield from inclement (mild/low rainfall) areas. Its life cycle ranges from 90 – 140 days. The fruit of sesame may be a dehiscent capsule usually held on the brink of the stem when ripe. Its capsule shatters to release variety of small seeds which are normally protected by fibrous white or brown or black skin (hull) counting on variety. One thousand seeds are found to weigh 4 to 8g.

A number of products are often obtained from sesame. The leaves are cooked and eaten in stews as 'morogbo' and 'miyar taushe' in some parts of southwestern and northern Nigeria respectively. Its seeds are used as source of oil for cooking or might be roasted as confectionary. Besides these, the seeds might be baked into biscuits. In northern Europe, hulled seeds are incorporated into breads as decorative toppings. Dried stem of the plant are often burnt as fuel with the ash used for creating local soap. additionally, sesame meal (obtained after oil extraction) are often wont to feed cattle thanks to its appreciable content of methionine and tryptophan (Sharma et al., 2007: 554-559). Aside from using the oil for cooking, it are often used for treatment of ulcers, making of margarine and as aerosol to synergies pyrethrum insecticide, among others.

Sesame productivity is restricted by low soil fertility, hence its yield is increased by application of inorganic and organic fertilizers (Akinola and Ojeniyi, 2000: 20-23). However, use of inorganic fertilizers is restricted by its cost and scarcity, also it increases soil acidity which adversely affects nutrients uptake (Abdulraheem, et al., 2012: 38-41; Aduayi, 1980: 16-34).

The integrated application of organic and inorganic nutrient sources rather than total dependence on any of the sources is expected to ensure reduction in expenditure on chemical fertilizers, a more balanced plant nutrition and control of soil acidity. Since sawdust ash is a waste which poses environmental concern, its combined use with chemical fertilizer in crop production will assist in environmental sanitation (Abdulraheem, 2020: 61-66).

Sawdust is derived from wood processing industries and it is often disposed off by incineration to ash. Studies have established ash as a fertilizing and liming materials. It has been found to improve soil and plant nutrients and yield of crops (Abdulhamid and Mustapha, 2000: 84-88; Abdulraheem et al., 2015: 38-41; Abdulraheem and Ojeniyi, 2015: 146-154; Abdulraheem, et al. 2017: 333-339; Abdulraheem, 2018: 8-13; Odedina, et al. 2003: 61-67). However, its combined with the use of chemical fertilizer has not received research attention. This research work therefore investigates the effect of combined application of sawdust ash manure and urea on soil and plant nutrients composition and yield of sesame.

Rationale of the Study

One of the answers for nourishment weakness and lack of healthy sustenance in Sub-Saharan Africa is to advance nearby yields, energize the utilization of locally source materials as change, improve their customary arrangement of creation, thus broaden subsistence crop. The yield broadening towards specific high worth harvests including foods grown from the ground, perfect with the similar bit of leeway of the locale, is suggested as a successful technique in raising livelihoods, creating business openings and easing destitution among little and minor families. Therefore, the central explanation behind this proposition is that significant difficulties with the considerable ramifications for the prosperity of a nation (Nigeria and South Africa) are going up against the countries agrarian, nourishment, soil and natural framework. A more noteworthy research limit is expected to fuel the vital advances in the science and innovation to address these difficulties. Henceforth the investigation of the impacts of the utilization of sawdust debris compost and urea manure on soil substance properties and sesame execution is unavoidable.

Notwithstanding the expanding request and cost of sesame on the planet advertise, its efficiency is declining from 8 to 3q/ha in most piece of the planting locale of Africa. The significant reasons are the absence of information and ability in land planning and agronomic practices, climate vulnerabilities, bother episode or more all the utilization of compost. It will be difficult to confront uncertainty and unhealthiness in Sub-saharan Africa without suitable utilization of compost chiefly natural manure.

Proper compost application is a significant administration practice to improve soil richness and yield creation. The examination indicated the benefic impacts of the natural and inorganic composts (sawdust debris excrement and urea manure) by means of various rates and mixes on soil compound properties, development and yield of sesame.

Sesame is a financially significant harvest broadly developed in a few nations. In West Africa, it is notable in Nigeria, Mali, Senegal and Burkina-Faso. While it is characterized ignored harvest in Ivory Coast, because of its nonappearance in national agronomic research program. The non-use of compost is the most significant components liable for this low efficiency. So as to augment the creation of sesame and the earnings of ranchers, it has gotten important to search for other elective techniques of creation innovation, basically the appropriation of legitimate preparation. Substance manures have been utilized for a considerable length of time to build crop yield. In any case, because of various socio-natural requirements comparative with substance manures utilizes, current patterns in practical agribusiness are centered around.

Aside from the standard limits of composts on soil physical, concoction and natural properties, natural fertilizer has additionally been accounted for to significantly improve water holding limit, supplement maintenance cations trade limit and microbial action (Bolan et al., 2010: 673-698; Duncan, 1955: 1-42; Pornparu, 2009: 197-204; Scotti et al., 2015: 334; Shaikh, 2004: 425; Tilman, 2002: 671). Natural composts, for example, sawdust debris fertilizer are effectively accessible for ranchers in agro-environmental zone of sesame creation. The capacity of sawdust manures to advance yield creation has been appeared in Nigeria and in China. The improving impact of fertilizer is ascribed to a progressive and all the more enduring arrival of a wide scope of supplement components (N, P, K, micronutrients, and so on.) to the dirt. Sawdust debris compost makes a positive situation for root advancement and furthermore those huge populaces of microorganisms are acquainted with the dirt through natural fertilizer, which advanced N obsession and P solubilization. Moreover, the blend sawdust and urea added to decrease the number of inhabitants in growths in the dirt. It will be difficult to confront instability and lack of healthy sustenance in Sub-saharan Africa without suitable use of manure primarily natural compost.

Role of Micronutrients in Sesame production

Micronutrients have been applied in form of foliar spray where micronutrient deficiency is observed. Abass et al. (2010: 250-257) repoted the applications of Fe, Zn, and Mn at respective rates of 450, 225, 225 $mgkg^{-1}$ as well as 900, 450, 450 $mgkg^{-1}$. Elemental sulphur and amno-acids were included in the experimental fertilizer treatments both in their sole and combined forms with amino acid. The result obtained showed that application of micronutrients and amino acid significantly influenced height, biomass yield, seed weight and seed qualities (oil, protein, K and P contents) as much as 48% and 89.8% respectively for height and seed yield over that of control. Sigaravel et al. (2002) reported a significant influence of micronutrient application (both in soil and foliar forms) on sesame height in pot experiment using a vertisol. Combined soil application of zinc and manganese recorded highest growth characters such as plant height (105cm), and dry matter production (2805 kg ha^{-1}).Yield components were also influenced by combined application of zinc and manganese producing highest number of capsules(59) and highest number of seeds per capsule(57).

Role of Organic Manure in Sesame Production

Organic fertilizers are many wastes materials and residues of plant or animal life added to the soil to supply the essential plant growth, development and enhance optimum productivity (Amanullah et al., 2010: 172-184; Amanullah et al., 2007: 216-222; Ayeni, 2008: 323-326). The sustainability of soil tropics lies in the adequate and contestant maintenance of soil organic matter because most tropical soils are highly weathered and infertile. Continuous cropping on these soils reduces organic matter during the first few years of cultivation and also causes a significant decline in soil pH and exchangeable cation. Organic fertilizers are very active and important component of soil, it is the nitrogen reservoirs, it furnishes large portion of the soil phosphorous and sulphur, it protects soil against erosion, it supplies the cementing substance for desirable aggregate soil formation and it loosen the soil from all available organic fertilizer. Narkhede et al. (2001: 57-59) reported that the application of castor seed cake at 1.0 tha^{-1} produced significantly higher grain yield in all the seasons and when the data were pooled over the seasons .The application of FYM (5.0 tha^{-1}) also produced significantly higher grain yield of sesame than the control in all the seasons and when the data were pooled over the seasons. On pooled mean basis, application of castor cake and FYM produced significantly (78.6 and 39.6%, respectively) produced more grain yield than the control. These results are in conformity with the results obtained in Mandore, Rajasthan. The application of castor cake gave significantly more gross monetary returns/ha than the control and the application of FYM in all the seasons and when the data were pooled over the seasons. The highest benefit cost ratio (4.34) was also obtained with the application of castor cake followed by the application of FYM (3.42) and the control (2.97) in 2006, 2007 and 2008, respectively. Soil microbial biomass carbon and chemical properties of the experimental plots were improved after 3 years of organic fertilizer application in both paddy and upland conditions.

Global Review of Sesame Production and Markets

World production of sesame is estimated to be 3.66million tonnes with Asia and Africa producing respective values of 2.55 and 0.95million tonnes. FAO (2002) put world production at 3.15million tonnes in 2001 having risen from 1.4m tonnes in early 1960's. According to FAO (2002), World's average yield of sesame is low (0.46 t ha^{-1}). The low yield had been attributed to cultivation of low yielding dehiscent varieties with low harvest index values, significant yield loss during threshing and inadequacy of agricultural inputs such as improved varieties, fertilizers and other agro-chemicals (Ashri, 1994: 25-39; 1998: 179-228; Weiss, 2000; Uzun and Cagirgan, 2006: 13-18). Non-dehiscent sesame varieties with yield potential of at least 1ton/ha have been developed by sesame coordinators- SESACO in the USA (SESACO, 2007).

The largest producers of sesame are China and India with annual harvest around 750,000 tonnes followed by Myanmar 425, 000 tonnes and Sudan 300, 000 tonnes (FAO, 2002). Nigeria is the world's sixth producer in 2001 (FAO, 2002). The largest exporter of the crop is India with export of 180,000 tonnes followed by Sudan 138, 00 tonnes. In the case of importation, Japan is the largest importer with the highest supply coming from Nigeria in 2001. Egypt is the second largest importer in 2000. Imports of sesame into Egypt have been growing strongly since 2000.

A rapid rise in sesame imports has been seen in South Korea, where the inability of local production to meet demand has allowed trade to expand. Korean sesame market like the Japanese market mainly imports sesame for oil extraction.

The USA is the fifth largest importer of the crop. In the US, virtually all uses of crops are found most especially its use in garnishing bakery products such as hamburger buns.

Industrial processing and utilization of sesame has not been fully developed in Nigeria. However, the product is locally processed and utilized in various forms in different areas of production. For instance, oil is extracted from seed and the cake is made into 'Kulikuli'. The 'Kulikuli' together with leaves are used to prepare a local soup known as ' Miyar Taushe' in northern part of Nigeria whereas fresh leaves are cooked as 'Morogbo' soup in some parts of south-western Nigeria. It has been observed that women are more involved in processing of sesame seed in Nigeria. A convenient dehulling technique has been developed via the addition of 3% sodium chloride (common salt) and soaking overnight. NCRI has also developed a 10kg hydraulic hand press for household and small-scale sesame handlers to ease the extraction process.

Conclusion

It is clear that the prospect of obtaining enough chemical fertilizer to meet the requirement of the teaming farming population in the tropic is remote. The current price of fertilizer calls for its economic utilization to meet specific requirements of crops. This research work address the current world-wide shortage of fertilizer and its anticipated adverse effect on food production and would encourage many countries to explore the manorial value of organic manure to reduce pressure on the demand for mineral fertilizer as complementary use.

The use of organic with inorganic fertilizer is employed so as to sustain soil fertility management strategy for sesame production to curb the problems of the increasing demand for food due to population, high cost and scarcity of inorganic fertilizer due to government deregulation policy, and unavailability of high yielding crop varieties as planting materials; total reliance on inorganic fertilizer or organic materials alone as fertilizer may not be realistic. Unlike inorganic fertilizer, sawdust ash manure are cheap, easy to come-by, always safe to use, not poisonous or kill crop and are environmentally friendly, but must be applied in large quantity to the crop because the nutrient concentration is very low compared with inorganic fertilizer.

Hence, this review work is carried out to encourage use of inorganic fertilizer in combination with organic materials to be able to give the desired higher and sustainable crop yields than the sole use of inorganic fertilizer or animal manure. It is thus anticipated that availing information on the improved agronomic practices, sawdust ash uses, weed and pest management will undoubtedly increase sesame production and productivity. It will also equip grower with the state of art production techniques, knowledge, skill and information on using sawdust ash and its combination with urea at reducing rate.

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