SOYBEAN PRODUCTION, PROCESSING AND MARKETING IN NIGERIA

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Abstract

The economic and nutritional importance of soybean informs the need for more studies towards appropriating the all-important crop for improved nutritional status of Nigerians and economic growth of the nation. This paper reviews the origin and historical emergence of this legume crop in the limelight of world agriculture, its production, processing and marketing, its contributions to the economic empowerment and improved nutritional status of rural households, as well as its problems and prospects in Nigeria. In view of its numerous benefits and great potential to occupy a prime position in the

agricultural industry, it was recommended that its mass production be encouraged for the optimum realization of its unlimited potentials.

Introduction

Soybean is a farm crop that belongs to the legume family. It is scientifically called *Glycine Max (L) Merrill.* It was domesticated between the 11th and 17th centuries BC around the north-east China, but was introduced in the Europe only in the 17th century.[1] It has since acquired a world-wide importance as a primary source of vegetable oil and protein.

Benefits of soybean over other grain legumes commonly grown by small-holders, such as groundnut (*Arachis hypogea*), cowpea (*Vigna unguiculata*) and common bean (*Phaseolus vulgaris*) include lower susceptibility to pests and disease, better grains storage quality a large leaf biomass, which gives a soil fertility benefit to subsequent crops, and a secure commercial market for the crop. Nigeria is the largest producer of soybeans for food in West and Central Africa.[1]

Soybeans were first introduced into Nigeria in 1908, but the first successful cultivation was in 1973 with the Malayan variety, which was found suitable for commercial production in Benue State in Central Nigeria.[1] These producing areas of Central Nigeria have been

responsible for a large proportion of the domestic requirement of this cheap source of plant protein.

Following the ban on the importation of soybean and its derivatives in 1984, an increased production of the crop was observed within and outside its traditional producing areas immediately after wards. With the ban, therefore, many growers started putting more land and resources into soybean production.[1]

Though still largely regarded as a relatively new crop, soybean has made a successful incursion into the diet of many Nigerians, particularly children and nursing mothers. Soybean derivatives, such as soy-gari, soy-milk, soy-ogi and soy-lafun, have been developed and found to be good substitutes for more conventional food ingredients like melon, cow milk and cow pea.[2]

Studies have shown that despite the high nutritional value of soybean, relative to other legumes, lack of knowledge of its uses has limited its adoption and production in non-traditional areas of cultivation.[3] Numerous efforts have been put in by research institutes, non-governmental organizations, NGOs, and industry to promote production of the crop in Nigeria in order to bridge the gap of limited adoption and production in non-traditional areas. An appropriate proportion of research was done in the densely populated parts of southwestern Nigeria with the immediate aim of integrating it into the

existing farming system and with the broader aim of seeing how it could alleviate the nutritional status of the people, particularly the women and children.[4,5]

This review paper is aimed at enriching the literature towards appropriating the all-important crop for improved nutritional status of Nigerians and economic growth of the nation.

SOYBEAN PRODUCTION, PROCESSING AND MARKETING

Soybean production

Soybean growth is influenced by climate and soil characteristics. It performs well in the Southern and Northern Guinea Savanna of Nigeria, where rainfall is more than 700 mm. However, short-duration varieties can thrive in the much drier Sudan Savanna when sown early and with an even distribution of rainfall throughout the growing period. The time for planting soybean depends upon temperature and day length. Soybean is a short-day plant and flowers in response to shortening days. It can be grown on a wide range of soils with pH ranging from 4.5 to 8.5. Soybean should not be planted in sandy, gravelly, or shallow soils, to avoid drought stress. It should not be grown in water logged soils or soils with surfaces that can crust, as this will lead to poor seeding emergence.[6]

Soybean matures within 3-4 months after planting and requires timely harvesting to check excessive yield losses. At maturity, the pod is straw colored. It is recommended that soybean be harvested when about 85% of the pods have turned brown for a non-shattering variety, and 80% for shattering varieties.[6]

Nigeria's soybean production increased from about 28 metric tons in 1985 to about 200,000 tons in 1995. The 1995 crop was worth an estimated US $60 million, saving Nigerians an equivalent amount of foreign exchange in just one year.[6]

Total land area under soybean cultivation in the world was 95.2 million ha and total production was 212.6 million metric tonnes. In relation to Africa, soybean was grown on an average of 1.16 million hectares with an average production of 1.26 million metric tonnes in 2005. African countries with the largest area of production were Nigeria (601,000.00 ha), South Africa (150,000 ha), and Uganda (144,000 ha). Soybeans are produced on small holder farms, and as a result, the farming is non-mechanized.[7]

Nigeria's soybean output is forecast to increase to 500,000 metric tonnes in 2008/2009 up from 450,000 metric tonnes in 2007/2008. The increase in output is attributed to favourable weather and the attractive grower prices. Compared to the erratic pattern in 2007, rainfall was favourable both in terms of volume and distribution in 2008. Benue

state is the dominant soybean producing area, but several other states are also increasing production.[7]

Soybean processing

Soybean can be processed into different products, such as soymilk, soybean fortified gari and tapioca, cereal-based traditional weaning food, etc. Variations in processing methods also yield a host of co-products. Soybean processing involves a series of steps to produce commodities for food, industrial and animal feed uses. The processes include threshing, transport, drying, cleaning, packaging and storage. In addition to these soybean foods, soymilk has been identified as one of the promising products. Soymilk is made by soaking soybean in water before grinding and straining. The milk is a white or creamy emulsion which resembles cow milk (conventional milk) in both appearance and consistency.[8] The increasing popularity of soymilk as a beverage worldwide is credited to health benefits, example low cholesterol and lactose, its ability to reduce bone loss, menopausal symptoms prevention, and reduction of heart disease and certain cancers.[8]

Acceptability of soybean products has been enhanced by modification of processing methods. Some of the modified soymilk extraction method includes application of heat, soaking of soybean in ethanol or alkali and acid grinding.[9] There are reports on the use of

natural flavourants to improve soymilk production.[9] In Nigeria and other countries in Africa, maize grains is fermented to give "Ogi".[9] Maize protein is deficient in lysine and tryptophan but has fair amounts of sulphur-containing amino-acids.[10] Improvement of the qualities of tortilla (Maize product) through soybean fortification has been reported.[11] Fortification of soybean product with maize has the potential of creating a valuable food product. Soybean can be processed and incorporated into many other products.

Soybean-based products have become a common market commodity in some areas of Nigeria, where retail sales of soybeans were once virtually non-existent. In Ibadan, for example, retailers selling soybean products increased in number from only 4 in January 1987 to 824 in January 1993. In addition, soybean crushers in the country are operating below capacity and are unable to satisfy the growing demand for vegetable oil.[11]

There is a domestic supply short fall of all vegetable oil estimated at about 300,000 metric tonnes annually, and over the past few years the local price of vegetable oil has been more than double the international price. In September 2008, the Government of Nigeria removed its import ban on crude vegetable oil. Nigeria offers growing market opportunity to US exporters of soybeans, soybean meal, crude soybean oil and value-added soy products, and soy-based ingredients

market opportunity of about 100,000 metric tones of soybean meal exist for US exporters. Additionally, importers and vegetable oil refining companies are anxious to take advantage of the removal of import ban on crude vegetable oil to increase capacity utilization, and opportunity exists for US exporters of crude soybean oil. US soybeans, soybean meal and crude vegetable oil exporters are encouraged to explore these growing market opportunities in Nigeria. The Office of Agricultural Affairs is collaborating with the poultry association of Nigeria to encourage group purchases of US soybeans and products, utilizing USDA export credit facilities.[11]

Recent market development activities in Nigeria by the American Soybean Association World's Initiative for Soy in Human Health (WISHH) programme have generated enormous interest in the value-added soy products and soy-based food ingredients.[11]

ECONOMIC AND NUTRITIONAL IMPORTANCE OF SOYBEAN

Soybeans have been used as food for centuries and its exceptionally good nutritional value is well known. Soybean has been variously described as a "miracle bean" or a "golden bean" because it is a cheap, protein-rich grain. It contains 40% high quality protein, 20% edible vegetable oil and a good balance of amino acid[11] and has, therefore, tremendous potential

to improve nutritional status and welfare of the families of resource-poor farmers.

Mature soybean seed also contains thiamine, niacin, riboflavin, cholin, vitamin E and vitamin K. Theses vitamins are necessary for normal body growth and development. Soybean products serve as essential raw material for vegetable oil industries. An earlier report reveals that soybean ranks the highest among leguminous crops in terms of protein utilization and efficient ratio, compared with other plant sources. The report also reveals that soybean has a high total digestible nutrient percentage of 91.99%, compared to cowpea with 79.52%. Soybean consumption helps in solving nutrition protein-intake problem among the poor people.[11]

Soybean is currently cultivated in all the major agro-ecological zones of Nigeria due to its nutritive value. In the early 1990s, the International Institute of Tropical Agriculture (IITA) promoted the use of protein-rich soybeans in everyday food to curb malnutrition. For many years, soy proteins have found favour in baking industries. Low levels of full-fat soy flour added to wheat flour at levels of 0.5% of the wheat flour allows the production of bread which has increased crumb softness and keeping quality. Soybean can also contribute to the enhanced sustainability of intensified cropping system by improving soil fertility through nitrogen fixation, permitting a longer duration of ground cover

in the cropping sequence and providing useful crops residues for animal feed.[11]

Soybean can be used for industrial processing and for livestock feed. It is highly digestible and has a high degree of unsaturation, containing about 85% unsaturated and 15% saturated fatty acid, making it especially suitable for people who have a level of blood cholesterol and are, therefore, highly susceptible to cardiovascular disease. Consumption of soybean oil is one way of preventing cholesterol accumulation in the blood.[11]

Soybean meal is being used in the manufacture of many chemical products, from paints to fire-extinguisher fluids, making of paper coatings, adhesives, fertilizer, insects sprays and dozens of other products. Soybean is used for various cheap recipes in Nigeria. It oil stands first in the world as edible oil and occupies important place in the economy.[11]

Soybean de-oiled cake is exported and foreign exchange is being earned to the farmers. From soybean whole seed, soymilk is obtained and considered to be the best health drink for infants and adults, and soy-dadawa is considered to be a healthy food. It also improves soil fertility and controls the parasitic weed - (*Striga hermonthica*) when in rotation with maize. It is the source of an excellent vegetable oil. Soybean meal is also recommended as animal feed.[11]

PROBLEMS AND PROSPECTS OF SOYBEAN PRODUCTION, PROCESSING AND MARKETING IN NIGERIA

Average grain yields of soybean is low (<1t/ha) in Tropical Nigeria. Dual-purpose improved varieties of soybean have not reached many soybean growers to increase production, and distribution is also major impediment in soy bean growing. Pod shattering, especially in the hot dry Savanna environments, reduces seed longevity, and lodging is still constraints in soybean production.[12]

Diseases, such as rust, red-leaf blotch, frog-eye leaf, spot bacterial pustule, bacterial blight and soybean mosaic virus, are problems affecting soybean production.[12]

Lack of varieties tolerant to mid season moisture stress and high yielding varieties tolerant to low phosphorus are among the biotic constraints. In Nigeria, farmers lack interest in the production of soybean because there is no huge market for the grain and many people do not know how to prepare the crop for home/domestic consumption.[12]

A key problem associated with utilization of soybean is the presence of certain anti-nutritional factors, which may inhibit the availability of the desirable nutrients, such as proteins and minerals. Some of the prominent anti-nutritional factors in soybean include typsin inhibitors, hemaglutinin, phytic acid, goitrogen, urease activity and

flatulence causing factors (starchyose and raffinose).[12] The significance of soybean trypsin inhibitors (TI) lies in their implication in inhibiting the pancreatic enzymes (trypsin and chymotrypsin), resulting in reduction in protein digestibility both in humans and animals. It causes hypertrophy of the pancreas in smaller animals like cats and chicks.[12]

Efforts have been made to inactivate or remove trypsin inhibitors from soybean.[12] Many approaches had been based largely on heat treatment. Most commercially available soybean production intended for human, such as tofu, soybean milk, soybean-based infant formula, soybean protein, isolates and concentrates, and textured meat analogues have received sufficient heat treatment to cause inactivation of at least 80% of the TIA present in raw soybeans.[13,14] This level of TIA destruction is well above the threshold of 45-50% inactivation found to be necessary for eliminating significant growth inhibition and pancreatic hypertrophy in rats.[14]

Protein solubility is an important target parameter and in the animal and feed industry, the protein dispersibility index is often used to characterize the protein quality of raw material. PDI could be used as a chemical indicator for inactivation of anti-nutritional factors and effect of functional properties.[15]

Though soybean is used in quite a number of African countries as weaning food, there are still problems, such as lack of technical know-

how for its processing into infant foods. Cultural practices favour the use of cereal rather than legumes for weaning infants and the look cooking time.[15]

CONCLUSION AND RECOMMENDATIONS

Considerable efforts had been devoted to the study and production of soybean in Nigeria. These efforts have prompted a great number of people into accepting and consuming soybean and its products due to its high nutritive value. Increased consumption has helped to curb malnutrition, reduction of cholesterol in the blood and also boost energy.

Finally, soybean production has continued to attract families into its cultivation, compared to earlier public or government sponsored programmes to improve agriculture.

The following recommendations are proffered for increased production, processing and marketing of soybean in Nigeria in order to maximize the benefits of soybean products to the teeming population.

1. The agricultural extension system should have increased number of food specialist extension workers in all the states of Nigeria to continue with the education of people on how to produce, process and market soybean products, such as soybean meal and soybean oil.

2. Government should support farmers with facilities, such as processing machines and farm inputs (eg. fertilizer and other agro-chemicals) in order to encourage the cultivation of soybean and improve yields.
3. The marketing system should be developed for soybean products to encourage large scale domestic and export of soybean products in Nigeria.

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