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BENISEED PRODUCTION AND UTILISATION IN NIGERIA

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Introduction

Sesame (*Sesamum indicum L.*) commonly known as Beniseed is one of the cultivated oil seed crops in the world. Since its introduction to Nigeria after the second world war, it has been regarded as a crop of insignificant importance compared to groundnut and other cash crops. Beniseed is widely grown in the Northern and Central part of the country initially as a minor crop until 1974, when it become one of the major cash earner in many northern states such as Benue, Gombe, Kogi, Jigawa, Kano Nasarawa, Katsina, Plateau, and Yobe states as well as the Federal Capital Territory. The demand for Beniseed and its products is growing both at the National and International levels. Thus huge market potential exists for Beniseed. Owing to its previous status as a minor crop, there has been little research efforts on the crop.

Beniseed is an excellent source of high quality oils. The oil is very stable and free from undesirable nutrition or flavour components. The Beniseed oil has a natural antioxidant such as sesame which prevent aging and vital for production of the liver cells. Also, Beniseed is rich in protein. Its protein has disable amino acid profile and good nutritionally value similar to soybean. It is these sterling attributes that stimulating interest in the production of the crop. The potential for Beniseed production in Nigeria is very high. An estimated 3.5 million hectares of the country's agricultural land are suitable for the production of Beniseed. But the average yield of this crop is bout 300kg/ha which is four times lower than the average yield of other oil seed crops like groundnut and soybeans. He production steadily increased from 15,000 metric tons in 1960 to 50,000 metric tons in 1980 but remained at this level until recently (Annon., 1995). In the major production zones, farmers use Beniseed in traditional food recipes and snacks. In order to increase the production of Beniseed to take advantage of the market potentials, sound agronomic practices need to be implemented by the farmers.

This bulletin therefore aims at presenting the research recommendations for the production of Beniseed in Nigeria. Most of the recommendations have be put forward by the National Cereals Research Institute (NCRI) Badegi, that has the research mandate for genetic improvement of Beniseed in Nigeria.

BENISEED PRODUCTION

The following steps are recommended for Beniseed production based on research and experiences from NCRI and other agricultural research development organizations in Nigeria.

a) **Site selection**

Beniseed is adaptable to many types of soil, it does best on well drained fertile soils of loamy texture. The selected site for Beniseed production should be fairly flat and well drained loamy or loam soil.

b) **Land preparation**

Site clearing

Clear the land immediately at the on set of rainfall. The cut down thrash should be packed to the edge of the farm. Burning should be minimized in order not to destroy some of the essential soil elements and micro-organisms.

Soil Tillage

Plough and harrow one week after clearing. This will loosen the soil lumps into fine texture, easy germination and rooting of seedlings. Hoes can also be used to loosen the soil if the farm is small or tractor services are not available.

c) Planting date

Beniseed is planted at different times in different ecological zone. The presentation below gives a generalized guide. But adjustments

may need to be made depending on when the rains are fully established.

i. Guinea savanna:
- Early planting is by March/April
- Late planting is by mid-July/year August

ii Sudan Savanna
Planting should be conducted as from the last week of June to first week of July

iii. Sahel Savanna
Planting should be conducted by the first rain which usually occurs between June and July.

d) Method of planting

I. Plant on flat with inter-row and intra-row spacing of 60cm x 10 cm
- Planting seed by drilling on flat beds makes the operation very easy.
- The spacing between plants will ensure vigorous growth and high yield. A tractor, where available, can be used to draw the lines for seed drilling for large-scale production

ii. Planting on ridges at an inter-row and intra-row of 75 x 15 cm is also recommend. Planting on ridges is ideal when Beniseed is grown as intercrop with other crops.

iii. Planting by broadcasting is useful where area of cultivation is small.

Seed rate

The recommended seed rates are:

5kg/ha where planting method is by broadcasting;

4kg/ha when planting is by drilling on flat land and 3.5kg/ha when the drilling is an ridges.

Note that drilling on flat land or on ridges makes it easy to conduct some other farm operations such as weeding and fertilizer application. Plan the variety that has the characteristics that you desire. However, table 1 show the various recommended Beniseed varieties and their charactistics. You can as the ADP nearest to you to assist you to get the seeds of any of the recommended varieties from NCRI or National Seed Services (NSS).

Table 1: Basic Agronomic Characteristic Recommendation Beniseed varieties

Variety	Days to maturity	Seed colour	Seed size	Oil content %	Potential yield (ka/ha)
NCRIBEN O1m (530-6-10)	102-115 (medium)	White	3mm	45	1000
NCRIBEN-02M TYPE 4	102-115 (medium)	Light brown	3mm	45	750
NCRIBEN O -3l (Goza-25	125-140 (Late)	White	2mm	40	600
E-8	90 (early)	Light-brown	3.6mm	50	1000
Yandev -55	125 (late)	Light brown	2.5mm	4.5	600

Thinning

When your plants have fully germinated, thin the plants at three weeks after planting (WAP) to about 2 plants per stand along the row. This permits maintenance of appropriate plant density and also alleviates the attendant problems associated with high-density. Leaving too many plants per stand will make the plants grow tall excessively and induce lodging.

Fertilizer application

- Beniseed does not required much fertilizer except where the soil is very poor.
- NPK fertilizer is required where the soil fertility is low. /two baga of NPK fertilizer (15:15:15) is enough to fertilize one hectare.
- The recommend rate are:
  Nitrogen (N) 20-50kg/ha
  Phosphorous (P) 30 – 60kg/ha
  Potassium (K) 30 35kg/ha.

CROP PROTECTION

Pest and Diseases

Sesame like other crops is susceptible to pests and diseases some of which are of economic importance. Every aspect of Beniseed production from seedling to matured plant has one form of the other types of pests and diseases. Important pests of Beniseed could be classified under the following.

* Insect pest
* Fungi
* Bacterial
* Nematodes
* Weeds

Insect pests

Most of these field problems including insects, causes drastic reduction in the yield of Beniseed. Depending on the weather and time of the year the Beniseed plant is constantly attacked by a wide range of insect pests. These pests range from species that defoliate the plant to those attacking flower heads and young fruits. However, not all the insects found on the plants are of economic importance. All stages of Beniseed plant are attacked on the field and the pests responsible are discussed as they rate to the growth stages on the crop. See table 2.

The insect pests associated with the flowering phase usually inflicts very severe damage to the crop. The physical damage may be less than those of foliage pests, yet their impact on final yield is colossal.
Antigstra catalaunalis Dup (Phyrilidae), a leaf feeding moth, Asphondylia sesame Felt (*Cecicomyyiidea*) a gall midge and Bemisia tabaci Gen. (Aieyrodidate), a white fly that transmits the leaf curl virus are the major insect pest of sesame. Neem seed as a protectant at 8% concentration reduced the midge population significantly.

Research by NCRI has shown that in most Beniseed production zones, pod sucking buds causes severe damages to the crop. Spraying against insects is necessary especially if serious damage is noticed at flowering and capsule formation stages.

For effective control of insect pest, in Beniseed fields, the extent of the damage should be verified before application of insecticide. If the extent of damage is of no significance, there should be no insecticide spray, but if the damage is extensive and will cause significant yield loss, then chemical control may be considered. Insecticides that are readily available are:

*	Decis 2.5Ec at	50ml1/25 liter	Systemic
*	Monochrotophos	40ml1/15 litre	Systemic
*	Super plus	40ml1/15 litre	Contact/systemic
*	Karate E.C.	25ml1/15 litre	Contact
*	Perfeckthion E.C	40ml1/15 litre	Contact

Table 2 Insect Pest of Beniseed in Nigeria

i. Seedling Stage

Species	Order	Family
Cyrtacanthacris tatarica L.	*Orthoptera*	*Acriidadae*
**Zonocerus variegates L*	"	*Tygomorpiphidae*
Apthona ssp	*Coleoptera*	*Chrysomelidae (Flea beetle*
**Ootheca mutabilis Sahib*	"	"
Lema tibialis Cast	"	"
Hyperancontha senegaliensis Lab	"	"

ii Vegetative Stage

Species	Order	Family
Bemisia tabaci Gehn	*Hemptera*	-
**Aphis gassypii Glov*	"	*Aleyrodidae*
Mtzus persicae Sulz	"	*Aphididae*
Agonoscelis versicolor F	"	"
Adelphocoris	"	*Lygaeidae*
Cyrtopeltis tenuis Ruet	«	*Mirridae*
Taylorilygus vosseleri Popp	«	«
Spodoptera spp	«	*Flatidae*
**Antigastia catalaunalis Dup*	«	*Noctvidae (Leaf roller)*

iii. **Flowering Stage**

Species	Order	Family
Platypternodes granulate	*Orthopotera*	*Acriididae*
Acrotypus patruelis H – S	"	"
Pyrogomorpha vignaudiGuar	"	"
**Callosobruchus maculates Fab*	*Coleophera*	*Bruchidae*
**Nezara viridula L*	-	"
Agonoscelis pubescens Thumb	*Hemptara*	*Pentatomidae*
Lygaeus rivularis Germ	«	«
Locris rubens Eric	«	«
Asphondylia saseme Felt	"	*Aphrophoridae (Gall midg*

iv **Store Pest**

*Tribolium	Coleopthera	Tenebrionidae

DISEASES

Fungal Diseases

Beniseed plant is a host to many fungi pathogen on the field but not all of them cause severe damage to the crop. There are four important fungi pathogen that causes damage to Beniseed in Nigeria. These are as listed in the table below.

Table 3 Fungal Pathogens of Beniseed

Species	Family	Status	Area of
Cercospora sesame	Fungi imperfecta	Major	Causese severe leaf spot in beniseed
Fusarium sp	"	"	Causes collar and root rot of beniseed plant resulting in sudden death of infected plants
Pythium sp	"	Major/Minor	Causes damping off resulting in sudden death of young plants.
Selerotium sp	"	Minor	This Fungus affects the bases of their stems producing a fan of silky white aeration and large round sclerotia. Infected plant wilt and die. Common in area where beniseed on the same land for several years.

Diseases of sesame include the Cercospora leafspot that is caused by cercopora sesame, leaf curl virus caused by Xanthosomonas compsetris pr. Sesame

* Early planting especially with the onset of the rain gives a healthy crop. A delay in planting usually increases the change of disease attacks on Beniseed. However, varieties that are pubescent (hairy) usually prevents white flies from feeding on the plant. Glaborous varieits are more susceptible.

Control of Fungal Diseases

The following fungicides are readily available and effective against most fungi, diseases of Beniseed.

1.	Benomyl at	2kg/ha
2.	Chorothalonil	1.2kg/ha
3.	Moncozeb	2.kg/ha and
4.	Thiram	2kg/ha

* To ensure that your Beniseed plant are not seriously infected by disease, use disease free seeds and or treat your seeds with seed dressing chemicals (Fungicides).
* Cerospora leaf spot can be controlled with the use of benomyl or thiram or Difolatan or other suitable fungicides. These fungicides can also control most fungus diseases or Beniseed. Application of insecticides and fungicides at about 4-5 weeks after planting are recommended as preventive measures especially if Beniseed is to be grown in moist ecologies.

Bacterial disease

Bacterial blight of Beniseed is caused by xanthomonas sp. The initial symptoms of the blight are spots on the leaves resulting in the drying of the growing trips. The spot remain small and the surrounding tissue dies. On heavy infestation, leafspots merge resulting in larger areas of leaves

heavily infected. The pathogen also infect the terminal buds from where the pathogen enters the seeds This disease is however not very serious in Nigeria hence routine cultural practices are sufficient to control it.

Viral Diseases

The only viral diseases in Beniseed is Leafcurl disease caused by Tobacco curl that is transmitted by Beniseed tabaci Gen. This disease is however not very serious in Nigeria at the moment.

Nematodes

Nematodes usually attack the root of crops. But in Beniseed grown in Nigeria this problem is not common. However, application of Furadan at the rate of 10-15kg/ha will suppress nematodes activities in the soil.

Weeds

Weeds are very serious problem in Beniseed production because they often cause drastic-reduction in yields. For optium yield the crop must be kept weed free from planting to harvesting as much as possible. Weed in Beniseed may be congrol through any of the following.

a. Hand weeding
   Hand weeding should begins as soon as weeds appear
   Hoe weeding at 3 and 9 weeks after planting is recommended.

b. Chemical weed control
   Scepter (Imazaquim) at the rate of 0.18 and 20kg al/ha
   1. Pre-emergence herbicides: Galax 2.5ft/ha.
   ii. Post-emergence herbicides: FUSILADE: 21t/ha

Rodents/Birds attack

Rodent and bird should be scares away within the first ten days after planting in order to prevent picking up of sown seeds by these pest before germinating. To enhance the effectiveness of pests control it is important to consider adopting an integrated pest management approach to alimate the problem posed by pests. Emphasis should be placed on cultural control methods along with biological control such as the use of *Bacillus sp* and where feasible combined with chemical control as last resort. Cultural control methods such as planting at high seed rate, use of branching varieties, early plantings, light ploughing varieties, early plantings, light ploughing, crop rotating, field sanitation and avoidance of alternative host sites have been found to be effective. Pesticides are also effective but not very economic where the farm size is small. Where necessary, the application of Karate EC at the rate of 1 litre per hectare of Perfekthion EC 11/ha at fortnight intervals can keep the insect pests under check.

Beniseed 'based' Cropping systems

Beniseed can be grown on its own as sole crop. Yields are however affected by length of growing season rainfall, weather, and plant density among other factors. Beniseed based-cropping system may comprise of either of both principles of growing crops simultaneously in mixture (i.e. intercropping and growing crops in sequence) (sequential cropping).

Beniseed based cropping system and pest

Several pests attack Beniseed with potential to reduce the yield of the crop. Some of these caused moderates to serve yield losses as a result of foliar feeding or damage to seed or other harvestable portions of the plant. However, adopting appropriate cropping system that may help circumvent problems can check some of these pests. For instance, inter cropping with the incidence of leaf bugs in Beniseed.

Beniseed base cropping system and nematodes.

Sesame has deep taproot, which produces a natural biocide that suppressed most nematodes. Growers have noted suppression of nematode populations in rotational crops such as cotton. Peanuts and other crops. Researchers have documented the suppression of several genera of root knob nematodes in soil where sesame was grown. This natural suppression may offer some practical biological control of nematodes in order crops when planted in rotation or as intercrop or any other appropriate cropping system with Beniseed.

Beniseed base cropping system and weed control

Weed control is essential to obtain good stands, reduce competition, and avoid quality/contamination problems/ Culture controls should be utilized to a maximum extent. Another cultural practice is to prepare land for planting, allow weeds germinate after a rain, and then apply 'glyphosate' to kill weeds that may emerge before planting sesame in relay cropping or in rotation.

Harvesting

- Beniseed should be harvested when about 50% of the capsules turns yellow in colour from green.
- Harvesting should not be delayed in order to prevent seed loss through shattering. Harvesting should be done by cutting the stems with sickles. Harvesting by pulling the plants from the root should be avoided in order to prevent contamination of seeds with sand. After harvesting, the plants should be ties with a rope into bundles and positioned in an erect form on tarpaulin or mat for the capsules to be fully dried. This prevents wastage of seeds and contamination by impurities compared with when the capsules are allowed to shatter on bare ground.

PROCESSING UTILIZATION AND POST-HARVEST TECHNOLOGIES

In quality, the best brands of sesame oil are close to olive oil. Sesame oil has no odour after refining. It is straw-like to colour and has excellent taste. Sesame oil is widely employed for production of margarine, canned sardine and beef, as well as in the soap and confectionary industries. After burning, sesame oil yield top quality ink. In Nigeria, substantial research effort had been given to Beniseed dehulling, development of suitable oil extraction methods, protein enrichment of food using the press cake (in infant weaning foods) and on the design/fabrication of processing machines at the Federal Institute of industrial Research (FIRO), Oshodi. The development of appropriate processing and utilization technologies had also received some research attention at NCRI. For example, it had been demonstrated that dehulling of Beniseed becomes easier with the use of 0,1N or 0.01N sodium hydroxide solution compared to dry, cold or hot water method. A prototype 10kg/batch Beniseed oil-extractor has also been designed and fabricated. Several Beniseed recipes and snacks have been developed in line with local food habits and preferences.

PROCESSING

1. Cleaning

* Pour Beniseed grains in water enough to cover the grains.
* Drain off floating seeds.
* Thoroughly wash the sedimented grains.
* Then dry the grains for about 3-4 hours in sunlight (34-37°c).

During cleaning, the immature grains and other impurities that float are removed. Sand and other extraneous matter on the grains which affect the quality of the end production are removed by sedimentation and the microbial load on the grains are drastically reduced. The drying tempers the grains ready for further processing.

2. DEHULLING

a) Soaking

- v Beniseed for processing should be dehulled. His is followed by soaking grains in salt solution (3% Naci) for night (17-18hours). Dehulling of Beniseed using this method have several advantages such as the free fatty acid (FFA) are greatly reduced. The removal of the hulls is complete, and there may be no need for winnowing after drying.
- v The grains are therefore cleaner and whiter than the traditional process.

b) Washing

- v Pre-soaked Beniseed is rubbed in a mortar pestle to loosen the pericarp (seed coat)
- v The coat (hulls) is separated from the kernel by sedimentation washing (removing the hulls by floatation)

c) Drying

The dehulled grains and the corresponding hulls are dried separately for 3-4 hours in sunlight (34-37°c). However, depending on the end in view, the grain should be dried to the point when it is milliable.

Dehulling is very important because Beniseed contains tannins which are located in the hulls. Tannis mixes with several valuable nutrients to form a complex that may make such nutrients unavailable to the body.

OIL EXTRACTION

For local or medium scale extraction of Beniseed oil; the following steps are recommended.

a) ROASTING

Roast Beniseed (1kg) for 5-10mins at (180-210°c)

b) MILLING

Roasted Beniseed should be milled in a clean attrition mill or any other available mill.

c) PRESSING OUT THE OIL

1. Hot water (70 -85°c) should be added to the milled Beniseed flour
2. About 15-20mls of hot water should be added to about 200g of Beniseed flour in an appropriate container, and continue working on the meal, till the oil begin to come out.
3. The meal can be tied at the point in a muslin cloth in other to be able to express more oil.
4. Small screw press can be used to press out the oil.

DRYING THE CAKE

The cake should be broken into small particles and spread evenly on a clean surface and sundry for 3-4 hours at 34-37oc)

FLOUR PREPARATION

The defatted sun dried Beniseed cake should be milled in a clean attrition mill. The resultant flour should be milled with commercial sieve and package in air tight container for use in further processing. The milling should be done such that particle size of the flour will not be too far from wheat flour. This is in order to ensure easy incorporation into food recipes.

1. PREPARATION OF SNACKS

a) BENISEED SNACKS

For the preparation of Beniseed snacks adequate quantity of dehulled Beniseed is soaked in salt or sugar solution.

1. Toast or roast over low heat to avoid burning.
2. Roast should be continued till the Beniseed begins to turn brown.

Beniseed snack can be consumed whole as a dessert or with banana and some fruits drink for refreshment at social gatherings. It can also mixed with groundnuts and taken together for relaxations and for entertainments.

b. Beniseed candies

Beniseed is friend in sugar syrup over low heat in adequate oil until the Beniseed turns golden brown due to sugar caramilzation. This is then spread on a clean surface and cut into desired shapes and size. This can also be used to make Beniseed pyramids for displays. In the preparation of Beniseed candies, excessive heat should be avoided so as not burn the sugar caramel which imparts bitter taste to the product.

c. BENISEE/GNUT BISCUITS

- v Beniseed and groundnut cakes should be mixed in a 1:2 ratio and fried in oil to make biscuits. The resulting biscuit have more nutrients than g/nut biscuit.

ii. WEANING FOOD

a) maize Beniseed/soybean meal

Maize starch is mixed with Beniseed flour and soyabean flour at a ratio of 3:1:1. The mixture is prepared as pap. This preparation supplied type child with nearly all required nutrients especially essential amino acid for good health and body building.

b. BENISEED/TIGGER NUT MEAL

Beniseed and tiger nuts (whole) should be mixed and then milled and can be given to infants of weaningage and even adults. This combination of Beniseed and tiger nuts gives a balance meal such as obtained from breast milk.

iii. SOUPS AND SPREADS/DESERTS

a) BENISEED SOUP

v Whole dehulled Beniseed should be blended and cooked with adequate ingredient as in Egusi melon soup preparation. Vegetable could be added as desired. The soup may however, have a bitter taste but normally not strong enough to cause rejection.

b) BENISEED/EGUSI SOUP

Beniseed and melon should be mixed at a ratio of 1:1 or 1:2 and preparation with desired ingredients and cook as for normal egusi soup. This soup is richer in nutrients and more balance nutritionally, hence good for weaning infants. It is also cheaper to cook and therefore more economic to prepare

c) BENISEED LEAF SOUP

Young and succulent Beniseed leaves are chopped into pieces and added as vegetable as in okro soup preparation. This preparation serves as a substitute for okro or ewedu leaves especially during scarcity of fresh okro.

BENISEED SPREAD.

1. Dehulled but roasted Beniseed is blended
2. Sugar is melted in oil and cocoa powder is added
3. This is made into butter with the Beniseed four and,
4. Then heat and stir to a smooth consistency.

This can serve as spread for bread, cakes etc. it can also be moulded into bars and filled with coconut candies.

IV baked products

a. BREAD
   * Defatted Beniseed flour is mixed with flour at a ratio of 1:2 (of Beniseed flour to wheat).
   * Bread can be prepared from the mixture by kneadling the dough with yeast dissolved in warm water.
   * The kneadled dough should be proofed for 15-30 min
   * Knead and shape the dough again for between 10-20min
   * The dough should then be placed in appropriate oiled in baking pans and
   * Bake at 300oc for 15-20mins

Milling of the defatted Beniseed cake should be finely done. The use of harmmer mills is recommended because it gives better result. The milled flour should be sieve with either a commercial sieves or laboratory sieves before mixing. Sieving is to ensure that flour have uniform consistency so as to give a bread of acceptance crust and crumb texture.

b. CAKE
   * The better is mixed as for bread but instead of yeast, baking powder is added.
   * The better is placed in appropriate baking pans and baked at 150-180oc for 10-20mins. This will enhance better floss and shine.
   * Then the surface of the cakes is washed with egg solution. The batter may require more water than conventional wheat flour due to changes inrheological properties caused by the addition of Beniseed flour.

c. BUNS DOUGH HUTS AND CHIN-CHIN
   * Defatted Beniseed should be mixed with wheat flour at a ratio of 1:3
   * This can be used to prepared buns, doughnut and chin-chin as in traditional flour method.

* These products are far richer in nutrients because of the availability of essential amino acids than obtained from sole wheat products.

d. PREPARATION OF FEED AND FARM MANURE

Beniseed cake especially when produced from undehulled kernel can be an important component for making poultry and livestock feeds. It may thus be added to soy cake or groundnut cake to make feeds that has balanced amino acid, carbohydrate and fat components. Beniseed cake dropped around growing plants have been shown to serve as good source of farm manure. The major use of Beniseed cake is in livestock feed formulations. Poultry, fed on Beniseed meal have more lean meat with characteristic taste and flovour than those of from others meals.

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