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Food and Agriculture
Organization of the
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STANDARDS and TRADE
DEVELOPMENT FACILITY



Promoting Good Practices in the Sesame Value Chain for Improved Quality and Enhanced Market Access



Republic of Sudan
جمهورية السودان
Ministry of Trade
وزارة التجارة



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Objectives and Usage

The objective of the guides is to disseminate and promote best practices into each stage of the sesame value chain, to support various value chain actors in Sudan in their efforts to improve quality of their products and compliance with international market requirements which will contribute to increased value addition along the sesame value chain in Sudan.

The guides cover various topics on Good Agricultural Practice (GAP)– Integrated Pest Management (IPM), post-harvest, transportation, shed/storage facilities, oil extraction, traceability, market compliance and Business to Business (B2B) linkages, which are relevant to production, processing, storage and transportation and marketing activities along the value chain. The guides were developed based on in-depth scrutiny of existing and traditional practices, consolidation of international good practices, extensive research, technical meetings and workshops organized by the two project implementing agencies, the United Nations Industrial Development Organization (UNIDO) and the Food and Agriculture Organization of the United Nations (FAO). Valuable inputs were also collected from national counterparts under the leadership of the Ministry of Agriculture and Forestry of Sudan to identify where improvement is needed with regard to quality and standards compliance.

The guides will be used by a wide range of stakeholders in the sesame sector, including farmers, post-harvest handlers, exporters, importers, academics, quality institutions, chambers, ministries and international organizations. They could serve as a consolidation of training materials for trainings organized by extension service providers, and national and local governments which aim to improve quality and trade compliance of sesame products. The guides also could be used as reference by standards bodies, policy makers and market surveillance authorities to improve quality control and supervision system.

The guides were prepared in English and Arabic and include pictorial animation so that all users can easily understand the concepts and contents. It is expected that the contents of the guides will be maintained and updated by the Government of Sudan or its extension service after certain period of time when needs arise.

Preface

The agricultural sector has an important role to play in achieving food security by increasing food production and providing employment opportunities in Sudan. Sesame seeds is one of the most important agricultural export products of Sudan as it is considered a highly demanded commodity in global markets. Sudan has great capacities in sesame seeds production. Its total production volume reached 1.21M metric tons in 2019, while the global production in the same year was 6.55M metric tons.

The Sudanese Government, together with international organizations aims at assisting farmers and other value chain actors to produce and process safe and quality sesame seeds for promoting exports to international market. The Government at the same time seeks to improve the policy framework and quality control system that are consistent with international standards and good practices, rehabilitate the infrastructure and support the small farmers who constitute the majority in the agricultural sector.

In this regard, we acknowledge the valuable support provided through the project “Upgrading the Sudanese Sesame seeds value chain” which is funded by the Standards and Trade Development Facility (STDF) and implemented jointly by the United Nations Industrial Development Organization (UNIDO), and the Food and Agriculture Organization of the United Nations (FAO). We appreciate the efforts of the three international development partners in assisting the Government to achieve its development strategies and policy objectives.

The guides are a set of good practices but also consider fully the local conditions, needs and current practices of the local actors along the sesame value chain in Sudan. They will serve as valuable technical guides for various value chain actors, to improve their activities starting from cultivation to exportation, help improve quality of sesame products and support them in meeting standards and requirements in the international markets.

We appreciate the coordination and guidance of the UNIDO core team in preparing these guides: the project managers Mr. Cong Wu and Mr. Toshiyuki Miyake, project associate Ms. Suvdaa Dukhumbayar, as well as UNIDO’s international experts Mr. Ali Qazilbash (PhD), Mr. Thomas Gude (PhD) and national project coordinator Ms. Ula Abdelaziz Makkawi Abdelrhman.

We also extend our appreciation for the cooperation extended by FAO’s team in Sudan, project manager, Mr. Elwathig Mukhtar Hamid, regional plant protection officer based in Egypt, Mr. Thaer Yaseen (PhD), as well as IPM and FFS expert and Deputy Director, General Directorate of Technology Transfer and Knowledge Management of ARC, Dr. Amir Abdullahi Yousif Malik.

Mr. Abdelrahman Abdulrahim Hutr
Undersecretary
Ministry of Agriculture and Forestry



UNIDO and FAO

The United Nations Industrial Development Organization (UNIDO) and the Food and Agriculture Organization of the United Nations (FAO) have decided to join efforts and put their respective expertise together to contribute to the efforts of the government of Sudan in strengthening the sesame value chain in productivity and compliance with international standards and technical regulations.

Both agencies are implementing jointly the project titled “Upgrading the Sudanese Sesame seeds value chain” through their innovative cooperation which is funded by the Standards and Trade Development Facility (STDF). The project's main interventions are enhancing the competitiveness of sesame seeds by improving the capacity of value chain stakeholders, including small-scale farmers and exporters for the production of quality sesame and by supporting quality infrastructure institutions in assessing and certifying the conformity of the seeds with international market requirements, which in the end will maintain and increase access to international markets.

As part of the project interventions, the good practice guides were one of the results achieved through the collaboration between UNIDO and FAO to jointly conceptualize and codify their knowledge and experiences in the areas of agricultural value chain development, trade-related standards compliance, quality infrastructure development and B2B linkage promotion.

We expect the guides to positively contribute towards the efforts of the Sudanese government, public and private sector actors, and other stakeholders aiming to improve productivity and increase value addition through complying with sanitary and phyto-sanitary requirements, as well as increasing their export opportunities in high-end markets.



Mr. Mohamed Elsayed Adam Ali Abdelmomen
UNIDO Country Representative in Sudan



Mr. Babagana Ahmadu
FAO Representative in Sudan



Messages

Standards and Trade Development Facility (STDF)



STANDARDS and TRADE
DEVELOPMENT FACILITY

The STDF is a global partnership that helps developing countries improve their sanitary and phytosanitary (SPS) capacity to meet international standards. The STDF funded the Sudan sesame project in support to the government's efforts to promote good practices and to enhance the global competitiveness of Sudan's sesame value chain. These guides are an important contribution by the project and will help support farmers, processors, traders, competent authorities, and other supply chain actors to better comply with SPS and quality requirements in order to maintain and gain market access.

STDF would like to extend its appreciation to the collaborative efforts of UNIDO and FAO for diligently putting together their joint expertise in the development of these guides and in jointly implementing this project. Special thanks are extended to UNIDO's international expert Mr. Ali Qazilbash (PhD) for leading the preparation of the guides.

Mr. Pablo Jenkins
STDF Project Coordinator

Ministry of Industry



Sesame seeds are one of the major export commodities of Sudan, but often face challenges in complying with standards and technical regulations of destination markets. We strongly believe that the good practices outlined in the guides prepared under the project "Upgrading the Sudanese sesame seeds value chain" will greatly contribute to strengthening the capacities of the sesame seeds value chain stakeholders through the introduction of good agricultural practices, as well as an understanding on testing and the market requirements of sesame seeds.

Sincere appreciation for the two implementing agencies (UNIDO & FAO) for their joint efforts and the STDF for providing the opportunity to implement this project through its funding. Particular thanks are extended to the UNIDO experts, Mr. Ali Qazilbash and Mr. Thomas Gude, as well as the national project coordinator, Ms. Ula Abdelaziz Makkawi Abdelrhman, in developing the B2B linkages for the producers and exporters of sesame in Sudan.

Mr. Shamas Eldien Alshaf
Undersecretary

Ministry of Trade



The Ministry of Trade would like to express sincere appreciation to the project funded by STDF and implemented jointly by UNIDO and FAO for consolidating the knowledge and developing the guides. The set of guides has become the first systematic technical guides for the sesame value chain in Sudan, which could be used and replicated by national stakeholders in their efforts to strengthen capacity of the supply chain for quality trade of sesame products and greater access to the international market.

Mr. Nadar Alrayeh
Undersecretary

Agriculture Research Corporation (ARC)



The Agriculture Research Corporation (ARC) aims to contribute to the achievement of food security, alleviation of poverty, generation of income, promotion of agricultural export and conservation of natural resources of Sudan. In this regard, the good practice guides will provide aid on preparing the farmers with relevant compacted guidance to support them on cultivation and post-harvest handling practices of sesame seeds, and this along with illustrations to better promote the direction of the process and avoid the unnecessary sesame losses, which will definitely point to achieve our goals. Taking this opportunity, I would like to express my appreciation to UNIDO and FAO for implementing and the STDF for funding this project.

Particular appreciation is extended by ARC to the national project coordinator, Ms. Ula Abdelaziz Makkawi Abdelrhman, in the training of extension officers from North Kordofan and Al Qadarif on these guides.

Mr. Abdelmoneim Taha Ahmed Elsiwailih (PhD)
Director General

Sudanese Standards and Metrology Organization (SSMO)



The Sudanese Standards and Metrology Organization (SSMO) aims to upgrade the quality of local products like sesame seeds and increase their regional and global competitiveness. The good practice guides will facilitate the advancement of SSMO's objectives by disseminating knowledge and providing guidance for compliance to requirements. We would like to thank the STDF for funding the project which will help enhance productivity of sesame products, as well as the two implementing agencies UNIDO and FAO.

SSMO would like to extend its appreciation to UNIDO's international expert, Thomas Gude (PhD) in identifying the market requirements for sesame and strengthening the services of SSMO that would allow Sudan to access high-end export destinations.

Mrs. Sana Elzain Abdelmoniem Alshafaie
Director

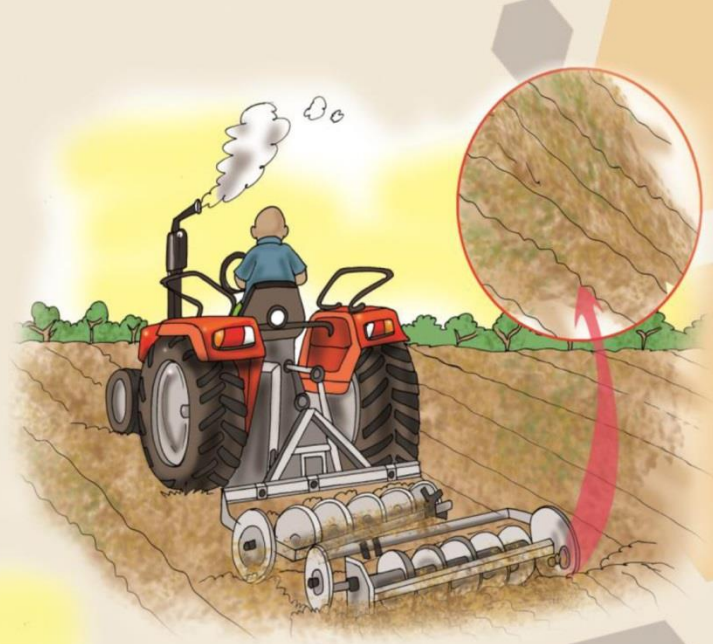
Chamber of Commerce



The Sudan Chamber of Commerce representing the sesame seeds exporters would like to express its appreciation to the project implementing agencies, UNIDO and FAO, as well as STDF for funding the project. We are pleased to see the good practice guides, which included all the important guidance for facilitating the export of sesame seeds, contributing to market access of the sesame products and improvement of exports and trade balance of the country.

Particular appreciation is extended to UNIDO and its international experts for working closely with the processors and exporters of sesame in Sudan to help establish B2B linkages with key international markets.

Mr. Omer Bashier Alkalifa
President



Good Agricultural Practice (GAP)



Current Practices

- Poor field sanitation and preparation
- Most of the work is done through traditional or semi-mechanized techniques
- Lack of coherent pest management; farmers use incorrect pesticides purchased in local market
- Poor application of pesticide; spraying techniques
- Farmers use uncertified seeds from previous season's crop, or purchase from local market from uncertified dealers – this is driven by low cost and accessibility
- Sowing of seeds is done manually
- Lack of irrigation system and water management is poor
- Lack of latrines near the fields for farmers to use; no wash basins for farmers to clean their hands
- Harvesting done manually and all post-harvest procedures carried out in the field (drying, threshing, seed extraction and packing)
- Storage facilities on farm are inadequate and poorly maintained – lack of hygiene, pest control and poor ventilation

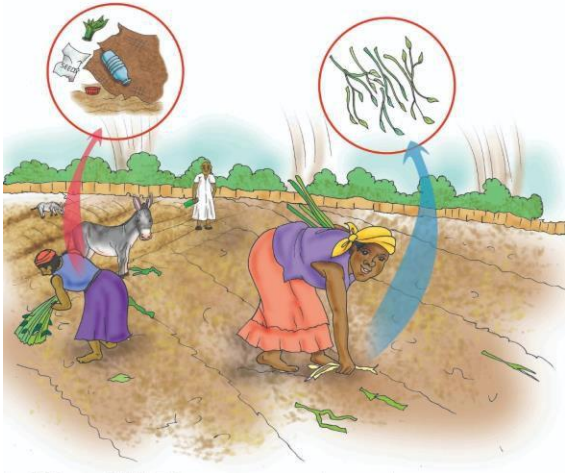
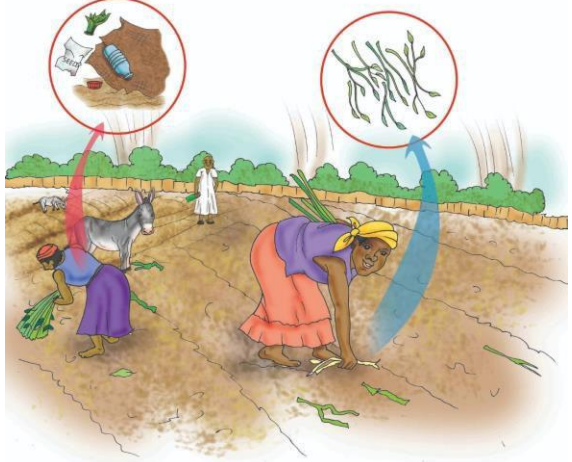
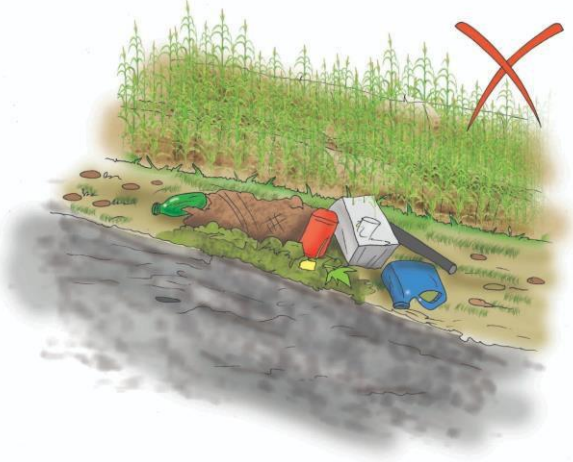
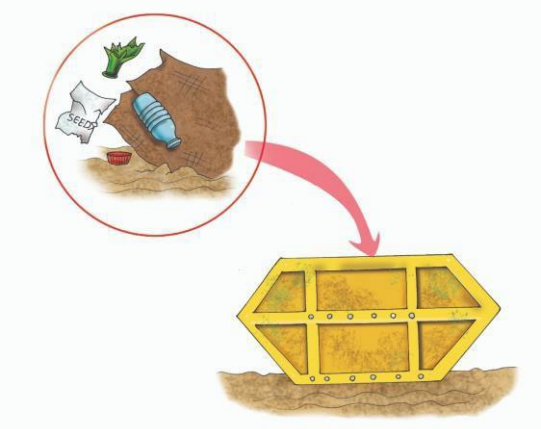
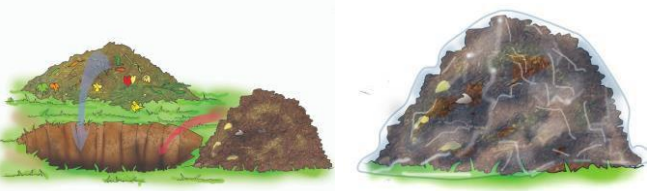
Recommended Practices (Good Agriculture Practice - GAP)

- Proper field sanitation & management
- Application of Integrated Pest Management; use of authorized pesticides, using proper techniques
- Mechanization of field preparation and farming techniques, plowing, sowing, harvesting
- Drying, seed extraction, packing and storage must be in clean and controlled environment (shed/pack house)
- Construction of latrines near the fields with wash basin & soap
- Use of certified seeds from National Seed Agency authorized breeders
- Water management & irrigation
- **Composting**: replenishes the soil with nutrients, softens the top layer, retains water and traps carbon dioxide)







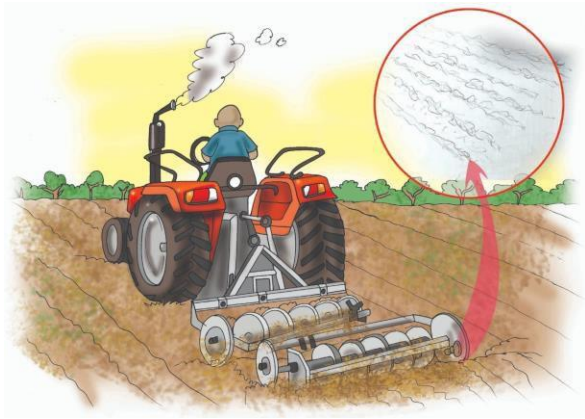
Recommended/proposed Crop Rotation for pest control and soil management:

- North Kordofan: peanut-sesame-millet
- Al Gadarif: sorghum-sesame-soyabean

i. Field Sanitation

Current Practice	Recommended Practice
<p>Field preparation for sowing of sesame</p> <ol style="list-style-type: none"> Cleaning of plant debris Cleaning of other waste 	<ol style="list-style-type: none"> Collect all organic matter/plant material in the field to make compost – organic/natural fertilizer and to reduce disease or insect pest that may affect the next season/crop. 
<p>Improper disposal of waste/garbage – tossed on the side of the road</p> 	<ol style="list-style-type: none"> Collect all inorganic/waste/garbage material and place in the dumpster/garbage disposal  <ol style="list-style-type: none"> Place in the compost pile/dig a hole in the ground and bury this material (organic material, waste from field, household kitchen, manure etc) Alternately, moisten the organic material and cover with canvas, terrapin above ground in a designated area of the farm 







Field Preparations

Current Practice	Good Agriculture Practice
<p data-bbox="97 230 432 257">Traditional/Semi mechanized</p> <p data-bbox="97 288 671 380">a. Tillage: (after the first rains) digging, stirring, and overturning using animal drawn plough/rake, or chiseling with chisel shanks</p>   <p data-bbox="145 1379 560 1406">b. Furrows: current/manual practices</p>  	<p data-bbox="817 230 960 257">Mechanized</p> <p data-bbox="817 288 1469 470">a. Tillage: (after the first rains) Use of tractors to till the land and carve out symmetrical furrows to ensure even growth of the crop and proper irrigation. Deep ploughing will mix the topsoil and expose the pests to sunlight and birds which will help in their control/removal.</p>   <p data-bbox="865 1482 1461 1541">b. Furrows: symmetrical/evenly spaced furrows using machines</p> 

ii. Use of certified seed

Promote the use of National Seed Authority (NSA) certified seeds

- implementing controls at local markets
- manual sowing of seeds not recommended; mechanized sowing recommended results in better growth; more yield

Current Practice	Recommended Practice
<p>a. Farmers use previous crop seeds or purchase low quality, cheap seeds from local market</p> 	<p>a. Farmers to purchase seeds certified by NSA from certified and registered seed/plant breeders approved by NSA</p> <p style="text-align: center;">NSA APPROVED SEED SHOP</p> 
<p>b. Seeds are mixed with chemicals/pesticides with hands to ensure that they are resistant to pest infestation</p> 	<p>b. However, if farmer uses seeds that are NOT certified by NSA, then those seeds are to be mixed with the recommended pesticides for seed treatment in a drum to minimize contact with hands and wearing protective tools.</p> 
<p>c. Manual sowing of seeds – scattered distribution</p> 	<p>Mechanized sowing of seeds ensures even distribution</p> 

Poor growth and low yield and poor quality of sesame seeds




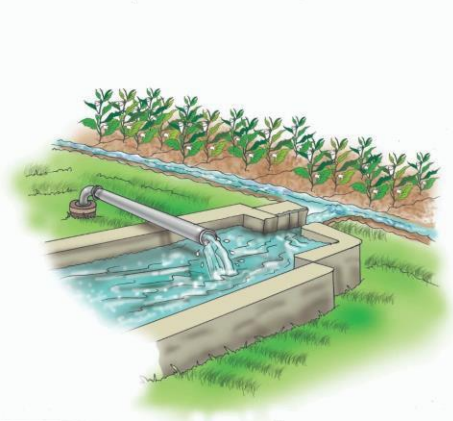
Result: Low yield & low-quality sesame production

Better growth, higher yield with good quality of sesame seeds



Result: Higher yield; better quality; healthier sesame production

iii. Water Management/Harvesting of Rainwater & furrow irrigation

Current Practice	Recommended Practice
<p data-bbox="89 1104 638 1137">Water harvesting; Water management & Irrigation</p> <p data-bbox="89 1167 279 1200">North Kordofan:</p> <ul data-bbox="89 1200 810 1352" style="list-style-type: none"> • Sandy soil poor absorption of water so, water harvesting is not possible if we didn't add a plastic sheet in collecting basin. • Water storage (traditional method) 22-25,000 cubic meters in huge ditches - haffeer - (1.5-2 meters deep) surrounded by barriers and wooden gates (during the rainy season)  <ul data-bbox="89 1800 782 1865" style="list-style-type: none"> • Water used for livestock and domestic use • Water storage in hollowed-out trees/barrels for the livestock 	<p data-bbox="871 1104 1497 1137">Harvesting of rainwater, irrigation and water management</p> <p data-bbox="871 1167 1497 1288">A rainwater harvesting system comprises components of various stages – storage ditches/tanks for re-use/recharging water table; transporting rainwater through pipes or drains/furrows</p> <p data-bbox="871 1317 1061 1350">Furrow Irrigation</p> 

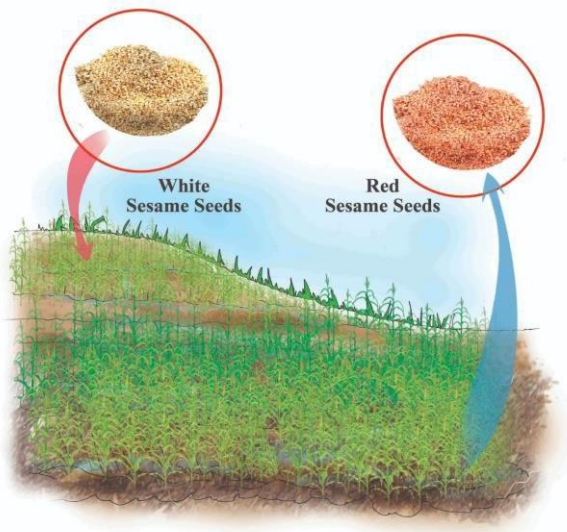


- Deep wells have been dug and ground water is pumped out for drinking, domestic use and irrigation



Al Gaderif: (heavy rains & excess of water)

- Different sesame varieties grown in depending on the water content
- White sesame planted (require less water) on high grounds where water can run off
- Red sesame varieties planted in the areas with high-water content (low lying areas)


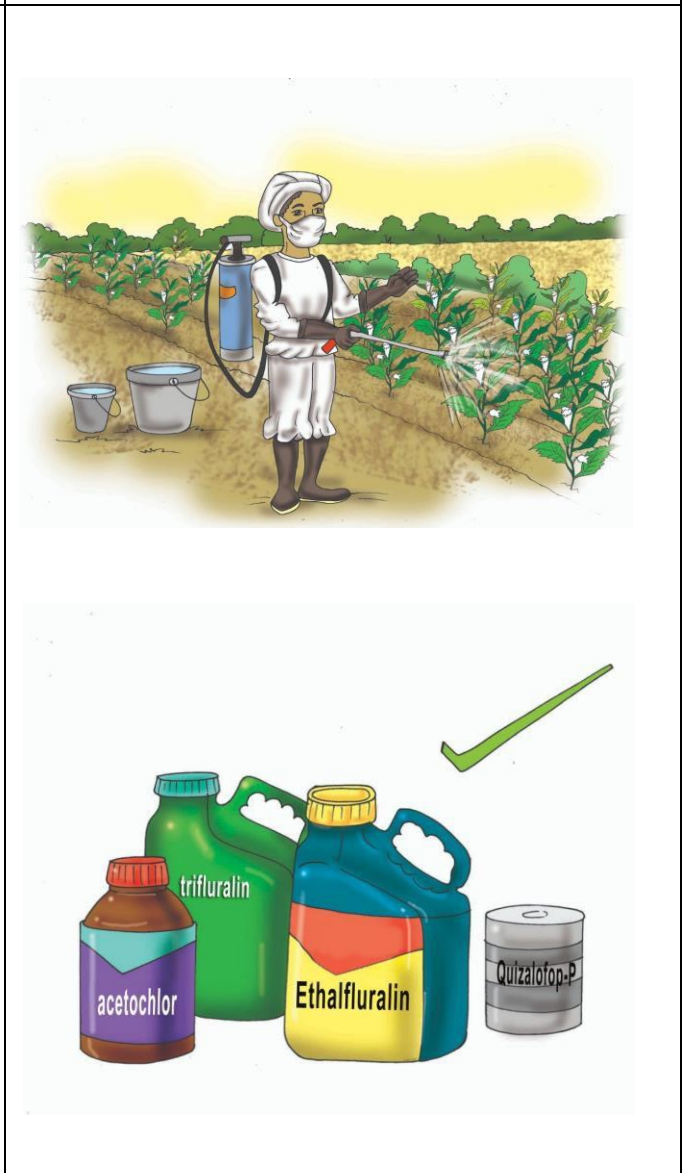


iv. Integrated Pest Management/Biological Control of pests



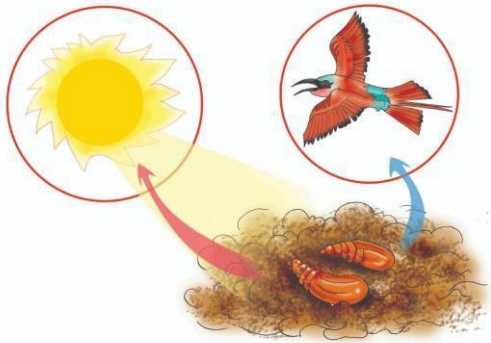

Biggest problem is still the usage of cheap non-effective, or incorrect and even banned pesticides

- only possible to solve by local market controls
- trained inspectors
- farmers trained by the inspectors; demonstration of the use of correct pesticide
- training on what happens, if “wrong” pesticides are used – loss of international clients – public health hazard (food safety)
- increase awareness amongst farmers and public (Plant Protection Directorate & National Council for Pesticide Registration), MoH, ARC, SSMO and private sectors (suppliers of pesticide) on the use of pesticide

Application of Pesticides

Current Practice	Recommended Practice
 <p>The illustration shows a farmer in a white thobe and ghutra using a backpack sprayer to apply pesticides to a field of young plants. A large red 'X' is drawn over the scene. Below this, four pesticide containers are shown: a box of Endosulfan, a yellow can of Organochlorine DDT, a brown bottle of Heptachlor, and a blue can of Lindane. A large red 'X' is drawn over these containers.</p>	 <p>The illustration shows a farmer wearing a full protective suit, including a mask and gloves, while using a backpack sprayer to apply pesticides to a field. A large green checkmark is drawn over the scene. Below this, four pesticide containers are shown: a purple bottle of acetochlor, a green jug of trifluralin, a blue and yellow jug of Ethalfuralin, and a grey can of Quizalofop-P. A large green checkmark is drawn over these containers.</p>

Integrated Pest Management & Biological Controls

Current Practice	Recommended Practice
<p data-bbox="119 309 478 338">Sesame Pests and Diseases:</p> <ul data-bbox="119 342 654 376" style="list-style-type: none"> <li data-bbox="119 342 654 376">• Sesame seed bug: <i>Elasmolomus sordid</i>   	<p data-bbox="798 342 1021 376">Identify the pests</p> <p data-bbox="798 380 1476 560">Aphids, leafhoppers and thrips: Aphids, leafhoppers and thrips are common pests of sesame. All three are sucking pests that tend to cause stunted growth and may injure buds, thus preventing development of seedpods.</p> <p data-bbox="798 600 1077 633">Pre-sowing practices:</p> <p data-bbox="798 638 1204 672">Timely sowing should be done.</p> <p data-bbox="798 676 1428 743">Field sanitation, rogeing (removing undesirable plants from the field),</p> <p data-bbox="798 784 1468 963">Crop rotation; Deep ploughing of fields; Destroy the alternate host plants; remove weeds Pre-rain deep ploughing (two/three times) to expose the hibernating pupae to sunlight and predatory birds.</p>  <p data-bbox="798 1411 1476 1518">At the time of field preparation, cultivate the field to destroy the weeds already grown in the field.</p> <p data-bbox="798 1559 1220 1630">Biological controls Apply neem cake @ 80 Kg/acre.</p> 

Management by insecticides

1. Cypermethrin (0.25% DP)
2. Malathion (5% DP)



- Gall Midge: *Asphondylia sesami* Felt



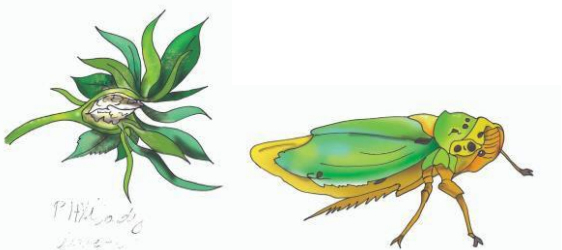
Management by Seed treatment (dusty) (Mixed fungicide and insecticide)

- Bacterial Blight: *Xanthomonas campestris*
The bacteria survive in the infected plant debris and seeds it spread by rainwater



Management: seed treatment, remove and burn infected plant debris

- Phyllody: Phytoplasma
Infected in flowering stage



Transmitted by insects Jassid & leaf hoppers

Seed treatment: Treatment with *Trichoderma viride* @ 4 g/Kg of seed or NSKE 4%

Cultural control:

Avoid planting overlapping crops in adjacent area.

Crop rotations:

sorghum-sesame-soya bean/ground nuts (legumes) effective in reducing disease incidence. (Al Gaderif)

North Kordofan: peanut-sesame-millet

Al Gadarif: sorghum-sesame-soyabean

Provide good drainage

Seed treatment:

Treatment with *Trichoderma* @ 4 g/Kg of seed, *Pseudomonas fluorescens* @ 2 g/Kg seed or *Bacillus subtilis* @ 2 g/Kg seed or NSKE 4%

Common practices:

Use resistant/tolerant varieties.

Use healthy, certified and weed seed free seeds.

Vegetative Growth

Common practices:

Destroy crop debris (collect and place in compost or burn)

Provide irrigation at critical stages of the crop;

Avoid water logging

Avoid water stress during flowering stage;

Common mechanical practices:

Collect and destroy

- disease infected and insect infested plant parts
- eggs and early stage larvae
- the older larvae during early stages of the crop
- infested shoots and pods and destroyed
- the caterpillars and the cocoons which are found on stem and destroy them in kerosene mixed water.

Use yellow sticky traps @ 4-5 trap/acre

Use light trap @ 1/acre between 6 pm and 10 pm

Install pheromone traps @ 4-5/acre for monitoring adult moth activity (replace the lures with fresh lures after every 2-3 weeks)

Erect bird perches @ 20/acre for encouraging

Management by using insecticide



• Weeds: using herbicides



1. Cycloxydim (SC)
2. Haloxyfop –p-methyl (EC)
3. Fluroxypyr-P-butyl (EC)
4. Clethodim (EC)

Pesticides purchased from the local market, where there is little or no control by the regulatory authority

Some of these pesticides are approved others are not.



predatory birds such as King crow, common mynah etc.




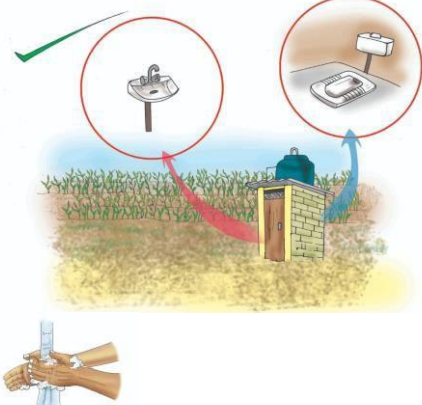


Recommended herbicides/weed killers

Southern Ag 2, 4D Amine Weed Killer

This inexpensive, selective broadleaf weed control and grass killer is a classic. It uses the chemical 2, 4-D, which is highly effective against weeds.



v. Good Hygiene/Sanitation Practices & personal hygiene

Current Practice	Recommended Practice
<p>Farmers, workers must NOT go to the toilet in the field</p>  <p>After using the toilet, farmer/worker must wash his/her hands before returning to the field</p>   <p>Farmers/workers must NOT use old, rusty, dirty broken tools.</p>	<p>Farmers, workers must use proper latrines in the field with sink & running water; wash hands with soap after using the toilet</p>  <p>Clean all machine parts (farming equipment & pack house/storage facility)</p>  <p>Wash harvesting crates regularly using brush, detergent solutions</p> <p>Harvesting tools must be cleaned daily after harvest in the evening by dipping cleaning liquid/disinfectant; Wipe with clean cloth to dry and dip in chlorinated solution</p> 

Take all necessary equipment to the field



Paint rusty equipment with required and clean them regularly and paint (rust proof) when required – give clear instructions which paints can be used



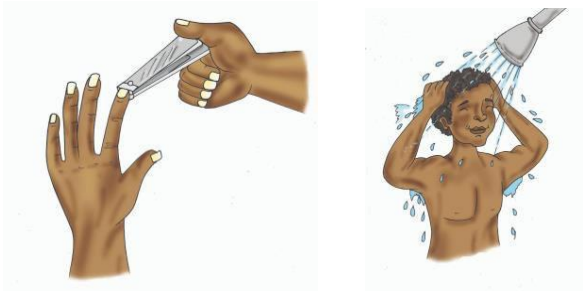
Clean transportation vehicle and spray with permissible pesticide (sun dry for 4-6 hours)



Clean packhouse floor; storage areas with detergent and water and then apply disinfectant or pesticide



Personal hygiene
Cut your fingernails



Take shower/clean yourself properly before going to the field and after returning from the field and change clothes

vi. Use of fertilizer/Concept of Organic farming

Current Practice

Use of **farmyard** manure & chemical fertilizers;



Farmers use manure to fertilize the soil



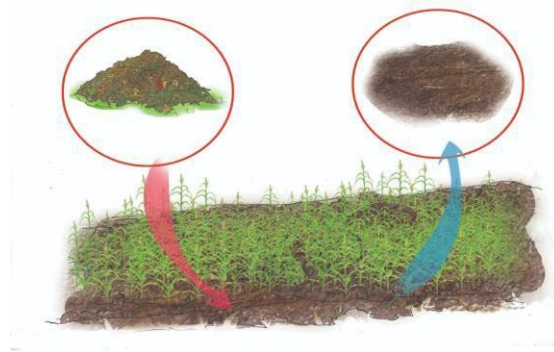
Recommended Practice

Use the composted mature organic fertilize in the field



Compost is darker (nearly black) in color (distinguishing it from manure) and applied using in the furrows, before sowing

Farmers use chemical fertilizers



vii. Harvesting

Current Practice

Artisanal/manual harvesting



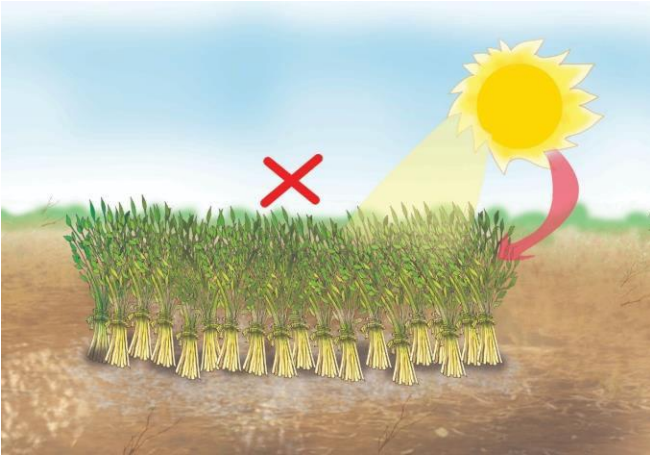
Recommended Practice

Mechanized harvesting

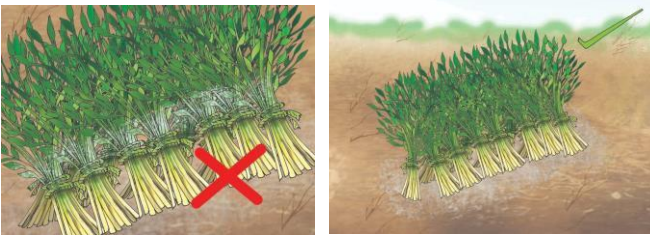


Place the stalks on clean trucks/trailers and transport to packhouse/shed for drying

Stalks placed in the field for drying



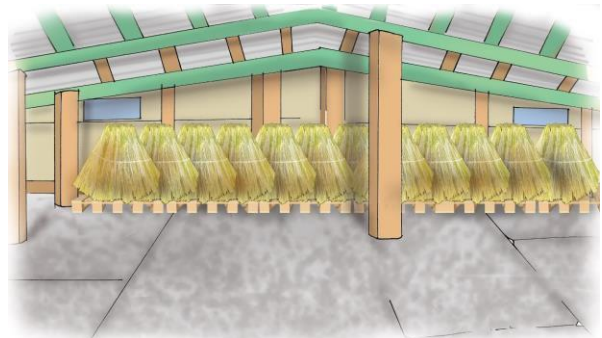
Pesticides most NOT be sprayed on the stalk in the field for drying under the sun



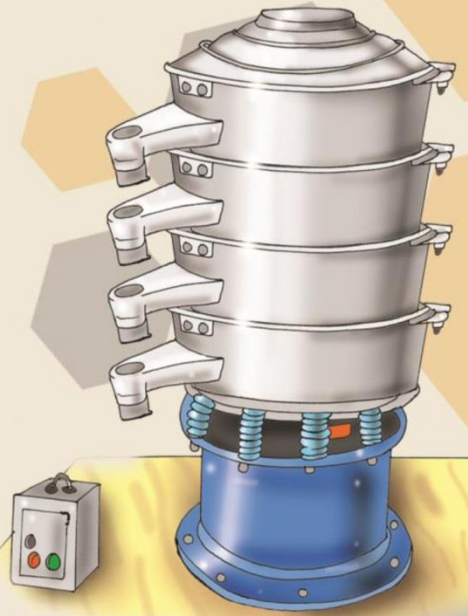
If sun drying is used, then farmer must spray the pesticide on the ground and place the bundles of plant stalk on top of the pesticide



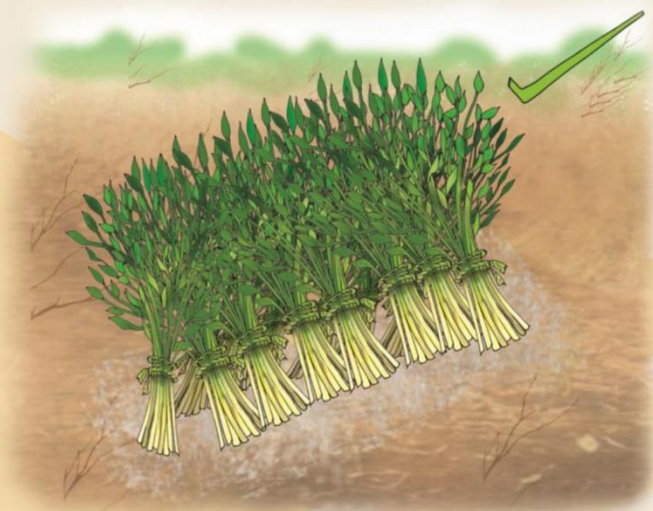
Drying should take place in the controlled environment (well ventilated clean room/shed with pest control) with washable hard floors; with temperature and humidity control.



Stalks placed on pallets 10-12 cm above the floor and 6-8 cm from the walls



Post-Harvest



Current Practice

Most post-harvest activities take place on the farm resulting in nearly 60% loss of quality produce (seed & oil). The activities in the fields which often results in:

1. Poor quality of seeds
2. Contamination of seeds (resulting in rejections)
3. Inadequate storage facilities (no pest/rodent control)
4. Non-compliant warehousing facilities
5. Diminished returns on high value produce

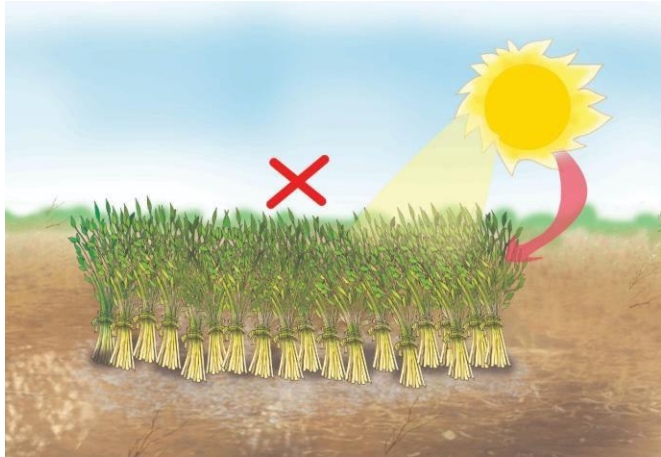



Of the harvested sesame seed, 90% (purchased by local vendor/trader) is stored for transportation to be first placed in common storage facility/open-air/roadside stockpile. Sesame is then transported to centralized warehouses/factories/exporters for re-sorting and packing to be either loaded on trucks and exported via trade routes by road) or loaded onto containers for shipment through Port Sudan.

The remaining 10% of the harvested sesame seed is stored and used for oil extraction by the farmer. Traditional oil extraction (cold extraction) is carried out in the field using manually operated grinder (often operated using a camel) and collected with rag cloth and wrung into plastic bottles. This results in poor quality of oil, which is unfiltered hence is often contaminated with particulate matter (not fit for export).

Proposed practice

The project proposes that in order to follow best international practices, all post-harvest activities should take place in a controlled and clean environment. Shed/pack house on the farm, storage/warehouse facility where temperature and humidity control is possible, documented and monitored. The area should also have demonstratable pest and rodent control. Such practices will reduce the risk of contamination of sesame seeds, improve the quality of the seeds and seed oil and go a long way in assuring compliance to market SPS requirements. The project also proposes to use mechanized procedures wherever possible to improve efficiency and minimize contamination.

This guide illustrates and proposed interventions related to best post-harvest practices

Current Practice	Recommended Practice
<p data-bbox="82 421 236 454">Harvesting:</p> <p data-bbox="82 488 670 560">All activities are carried out in the field; harvested stalks bundled together in the field;</p>  <p data-bbox="82 1093 614 1126">Pesticide is sprayed on the stems of stalk</p>  <p data-bbox="82 1686 750 1794">Now farmers place the harvested stalks placed on top of the pesticide (sprayed on the ground) but still left out in the open field to be dried under the sun</p>	<p data-bbox="785 421 938 454">Harvesting:</p> <p data-bbox="785 488 1508 595">The harvested stalks of the sesame must be transported from the field in clean vehicles and stored as bundles in clean room/shed/pack house</p>  <p data-bbox="785 1077 1500 1218">The room/shed/pack house area must be washed and fumigated using approved pesticide(s) 1-2 days prior to storage of plant stalk (verified through regular inspection)</p> 



Bundles of sesame stalks placed on top of the pesticide that is spread over the ground for drying over a 2-week period

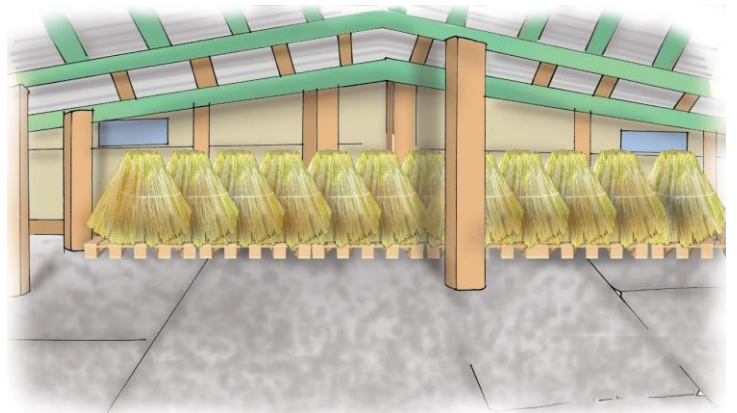
Dried stalks threshed in the field on plastic sheets



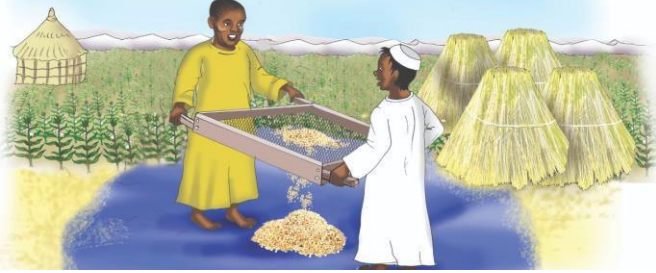
Dried stalks being threshed in the field
Sesame seeds are gathered together in the field on plastic sheets



Sesame seed stalks (bundles) to be place in the clean covered area (shed/packhouse - pest/rodent control area), with hard (washable floor) – for drying over a 2-week period



Sesame stalks placed in control environment for a maximum 2-week period for drying



Seeds sieved and collected in the field
Sieved through home-made sieves in the field & collected

Current Practice

Extraction, sorting and cleaning of sesame seeds
On Farm:



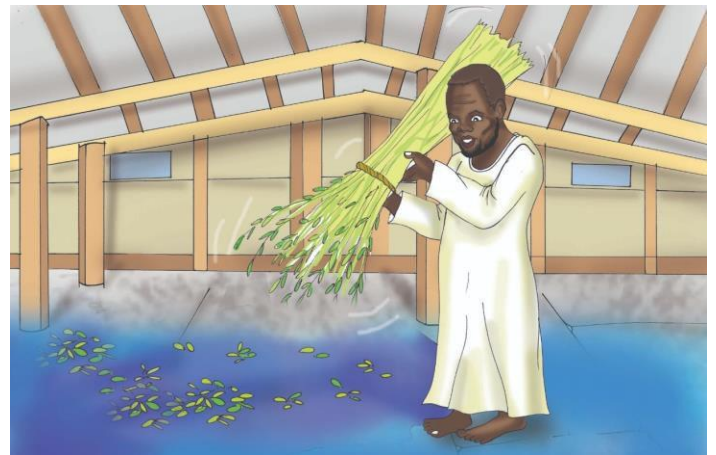
Seeds collected, poured into clean jute bags and transported to local storage facility (on farm)



Recommended Practice

Extraction, sorting and cleaning of sesame seeds
In shed/pack house

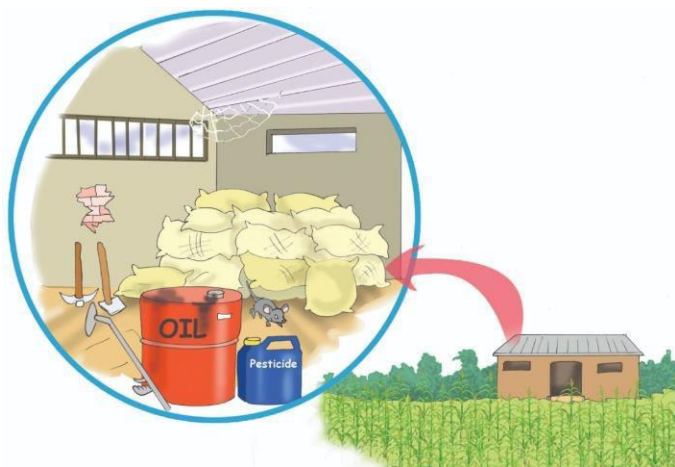
Manual: The seed extraction and sorting should still take place in a covered area with hard washable floor



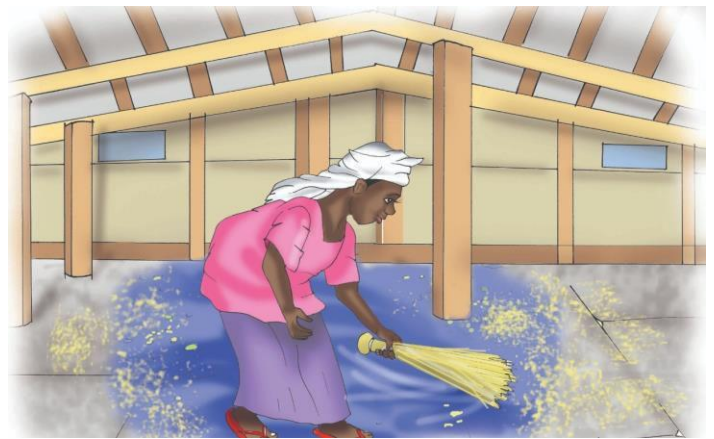
The sesame seeds are to be gathered and sieved using clean (washable metallic sieves)



Sacks of sesame seed loaded onto a tractor trailer or a donkey drawn cart and transported to storage facility (on farm)



Sesame bags stacked in very basic storage area - small rooms on the farm, which is not clean and no rodent/pest control. No temperature or humidity control.



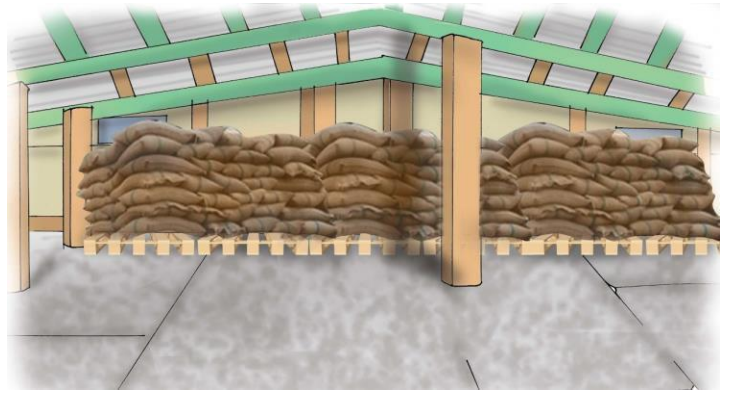
The seeds must be sieved using washable metal sieves and packed in clean/new jute bags



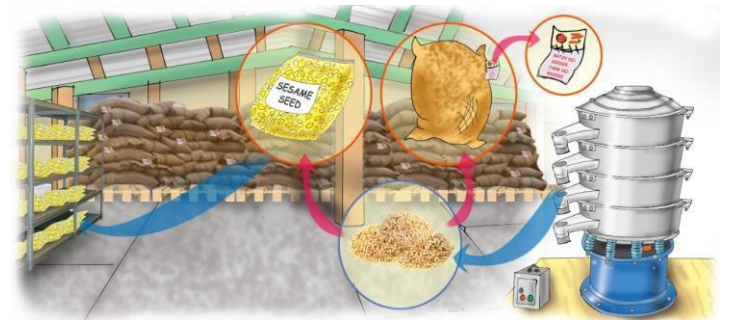
Packing of sesame seeds:

The sieved Sesame seeds are packed into jute bags, tagged/labelled and placed on raised platforms/tables in the shed/pack house on the farm

When using jute bags, certain criteria must be fulfilled – mainly jute bags are contaminated with mineral oil – and are non-compliant. New, clean jute bags must be used; or plastic bags may be used

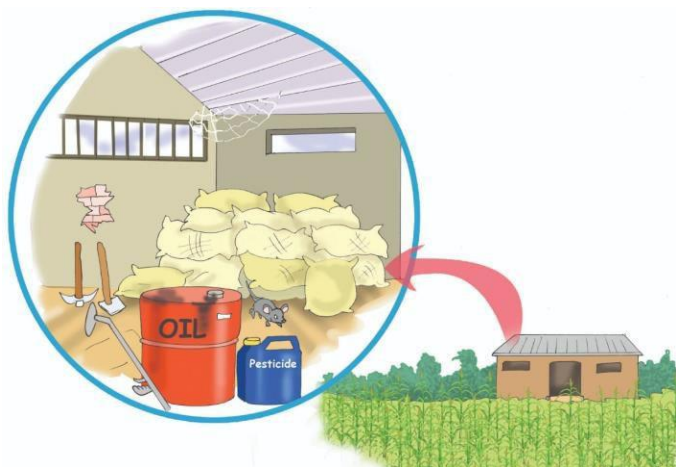


Mechanical: Extracted Seeds are mechanically cleaned (dry) and sorted using a mechanical sieve in the pack house/shed, packed in clean bags and stacked in the shed

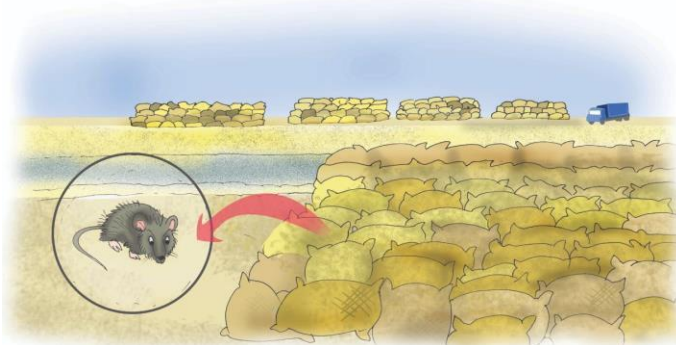


Current Practice

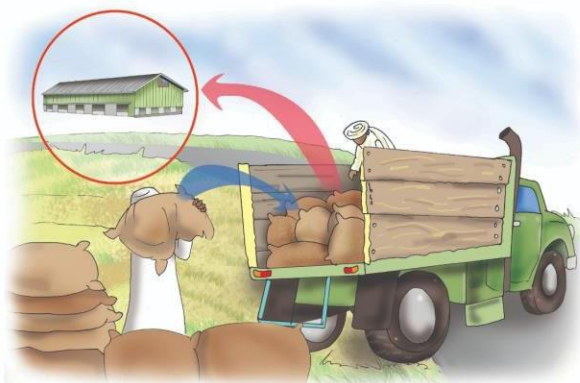
Storage on farm



Sesame bags used but have no labels; Stacked in very basic storage area (not cleaned, no rodent/pest control; no temperature & humidity control)



Storage facilities on the roadside (exposed to the environment, no pest and rodent control) (no labelling & traceability system)

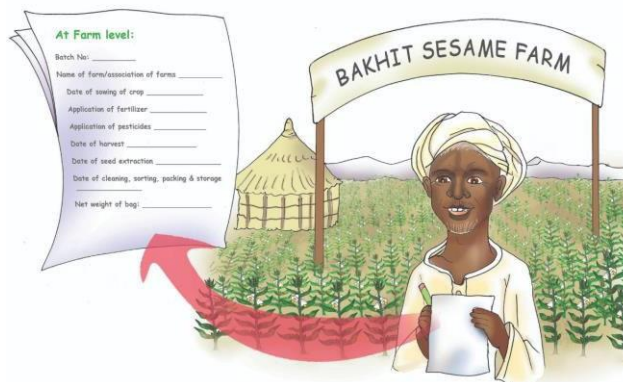


Bags loaded on open trucks and transported from roadside storage to warehouse for further sorting and re-packing.

Recommended Practice

Labelling of Sesame Seeds (certified)

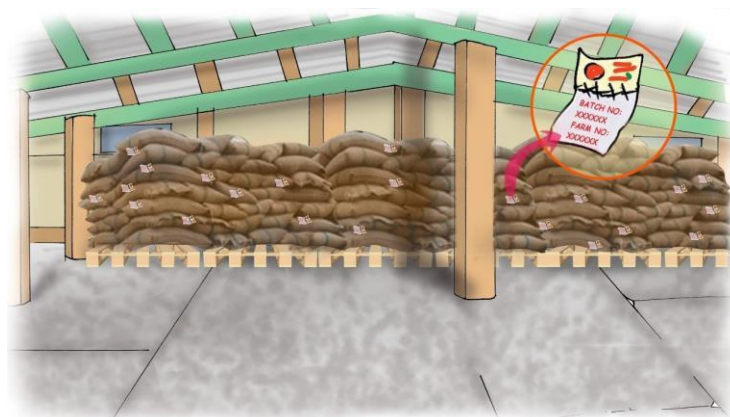
The bags have tagged with a labelled with the information linked to traceability document and moved to a storage facility (on farm)



The bags have tagged with a labelled with the information linked to traceability document and stored in shed

Batch No: _____
Name of farm/association of farms _____

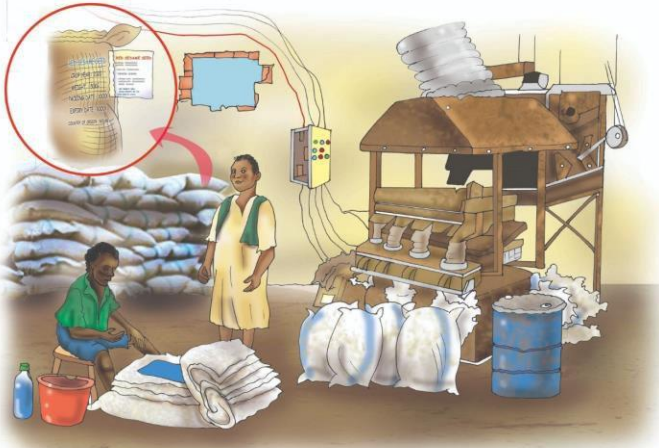
Date of sowing of crop _____
Application of fertilizer _____
Application of pesticides _____
Date of harvest _____
Date of seed extraction _____
Date of cleaning, packing & storage _____
Date of transportation _____
Net weight of bag: _____



Bags of sesame (labelled/tagged) stored at the farm in the sheds/pack house. The tagged bags transported to the common facility center/warehouse where foreman verifies and cross-checks the consignment

Storage facilities in Warehouses

Sesame is re-sorted, sieved, placed in new jute bags, labeled and stacked in the warehouse



Foreman verifies and cross-checks the consignment



Type of Sesame Seed: Red/White

Exporter: XXXXX

Importer: XXXXX

FSSAI No: _____

Origin: SUDAN

Harvesting Date: _____

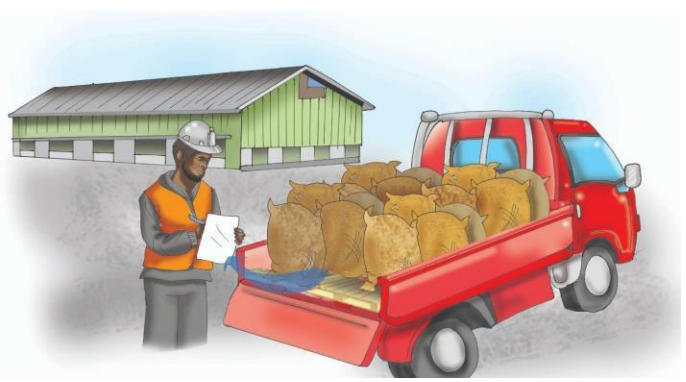
Packing Date: _____

Expiry Date: _____

Net Weight: 50 Kg

Gross Weight: 50.1 Kg

SHAK SSMO LOT No: _____



Warehouse well organized, clean with temperature & humidity control.

Bags stacked on palettes and away from the walls.



The information on the consignment is updated by storage/warehouse foreman and is linked to the farm batch number and the traceability system:

Batch No: _____

Farm Batch No: _____

Date of receipt of product _____

Date of re-packing/re-sorting: _____

Date of Expiry: _____

Certificate of compliance (SSMO tag/batch): _____

Net weight of bag: _____

Number of bags per container/truck: _____

Date of transportation to:

Local Market: _____

Export Market: _____

Processors/Exporters: _____



Sacks of sesame seed loaded onto open trucks for export or transportation to factories for further processing/value addition and then exported



Transported in covered trucks to the export destination or factories for further processing/value addition and then exported



Transportation SOPs



Currently all post-harvest activities are carried out in the field.

Drying of sesame stalk; threshing of sesame/extraction of seeds – sieving; packing into bags

Bags are transported for temporary storage to thatched huts on the farm; sold to local vendor/local trader/exporter

Transported in open trucks to open air/roadside stockpiles by the farmers/local trader

Transported in open trucks to centralized storage/warehouse facility by trader/exporter

Transported in open trucks directly to factory by processor/exporter

Recommended Practice includes:


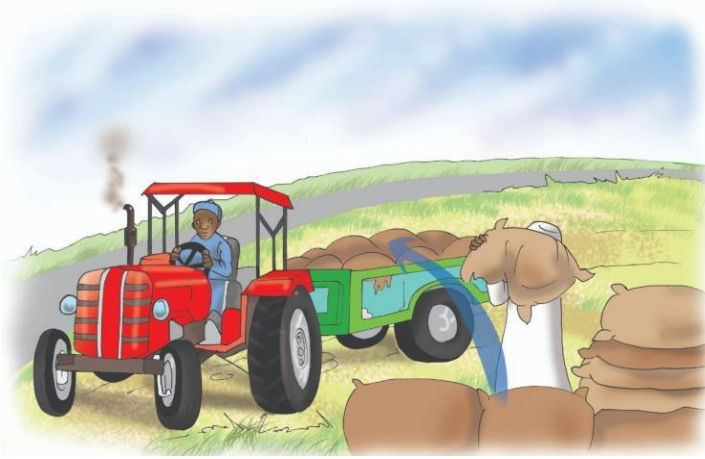



Stalks transported on clean trucks (placed on palettes) to shed (cleaned and treated with pesticide)

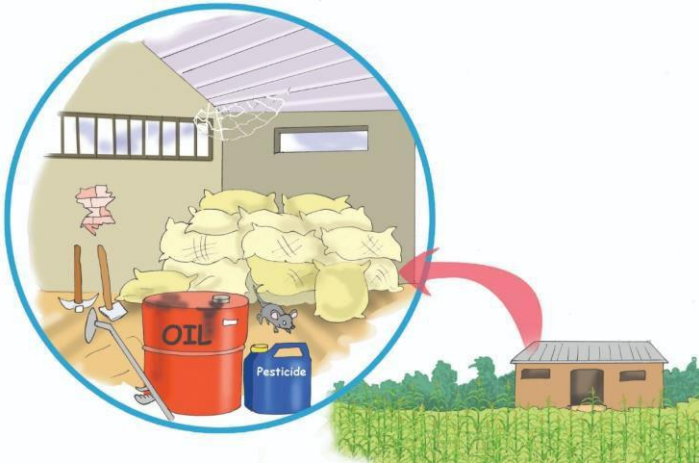
Threshing and sieving takes place in the shed (covered area)

Seeds collected and placed in bags & stored in the shed/pack house

Bags loaded on a clean truck/trailer and covered with canvas (protected from direct sunlight)

Transported to warehouse & from warehouse to export destination (in clean covered trucks)

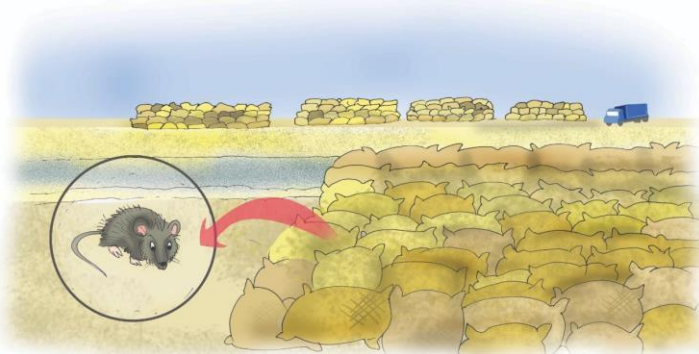
Current Practice	Recommended Practice
<p data-bbox="86 259 766 409">From farm to shed Sesame stalks dried and threshed in the field; seeds sieved and collected from plastic sheet placed on the ground.</p>  <p data-bbox="86 797 738 947">Seeds are collected and packed in clean jute bags; Bags loaded on tractor trailers transported to the local shed/storage area</p> 	<p data-bbox="817 259 1469 371">Transport the stalk from farm to shed/pack house on clean palettes placed on cleaned tractor trailer/truck</p>   <p data-bbox="817 1149 1481 1261">Use of cleaning agent/detergent and water and then dried in open air;/under the sun sprayed with pesticide 6 hours prior to loading</p> <p data-bbox="817 1305 1430 1417">A check should be performed at the central warehouse by extension officers/inspectors on how the truck was cleaned</p>
<p data-bbox="86 1525 411 1559">At the farm storage shed</p>	 <p data-bbox="817 1832 1477 1944">Transport the packed seeds in clean trucks/tractor trailers from farm pack house to centralized storage facility</p>



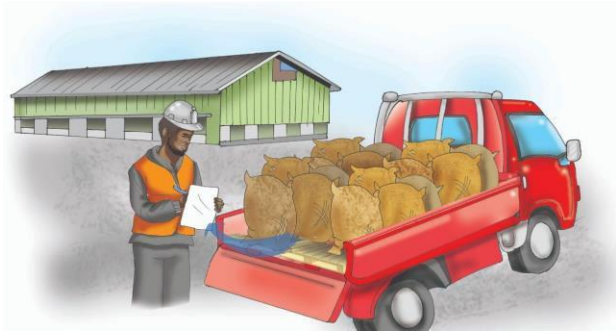
From the farm to local storage area/collection center bags loaded on tractor trailer and transported to larger open-air storage area/roadside



Roadside storage facilities exposed to the elements, no pest and rodent control.



Bags loaded on open trucks and transported from roadside storage to warehouse for further sorting and re-packing.



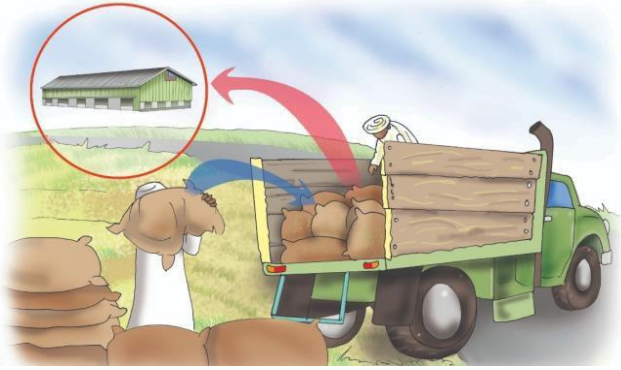
Transport the re-packed seeds in covered trucks/lorries from centralized storage facility (warehouse) directly to local market/exporter or processing plant/factory



Sesame seed oil:
Transported in crates/boxes of bottles

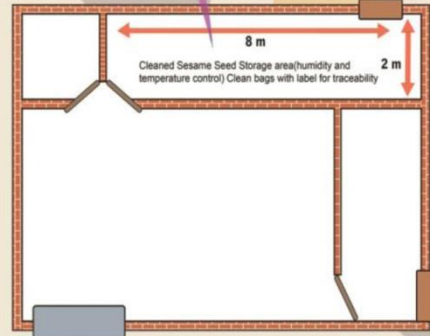
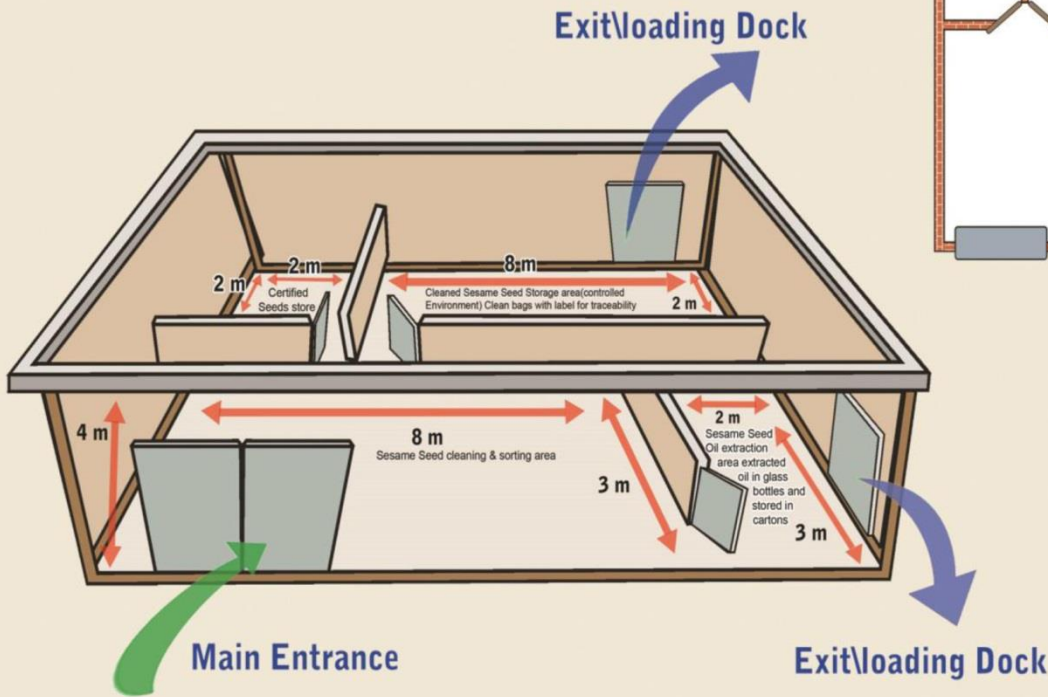


Sacks of sesame seed and crates of sesame seed oil are placed in covered trucks and transported to port for shipment, or directly exported through trade routes (road network)

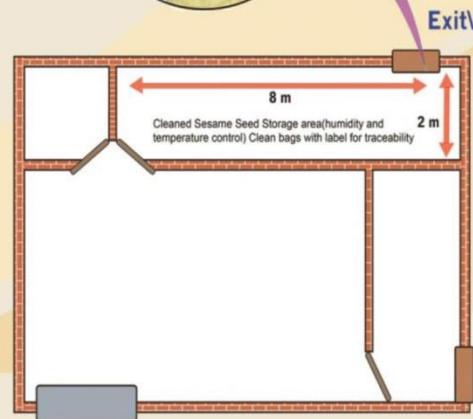


Consignment loaded onto open trucks (stacked to the top) and transported from the warehouse to processing plant or directly exported via trade routes/road network





Standard Operating Procedures for product flow and functions for storage facilities at farm level - A Common Facility Centre



Common Facility Centre (A Pilot Project)

Current Situation

Most post-harvest activities take place on the farm resulting in nearly 60% loss of quality produce (seed & oil). Storage facilities at the farm are small, multipurpose (where livestock, farm equipment and other items are also stored). The sheds have no demonstrable rodent and pest control and no temperature and humidity control

Proposed

The project proposes that in order to follow best international practices, all post-harvest activities should take place in a controlled and clean environment. Shed/pack house on the farm, storage/warehouse – a common facility centre (as a pilot demonstration) where temperature and humidity control is possible, documented and monitored. The area should also have demonstrable pest and rodent control. Such practices will reduce the risk of contamination of sesame seeds, improve the quality of the seeds and seed oil and go a long way in assuring compliance to market SPS requirements.

A cleaning schedule has to be established that minimizes the risk of contamination, ensure pest and rodent management and control. Cleaning protocols and procedures must be carried both prior to the introduction of the sesame product into the shed and then again once the product has been cleaned, processed, packaged and removed from the shed.

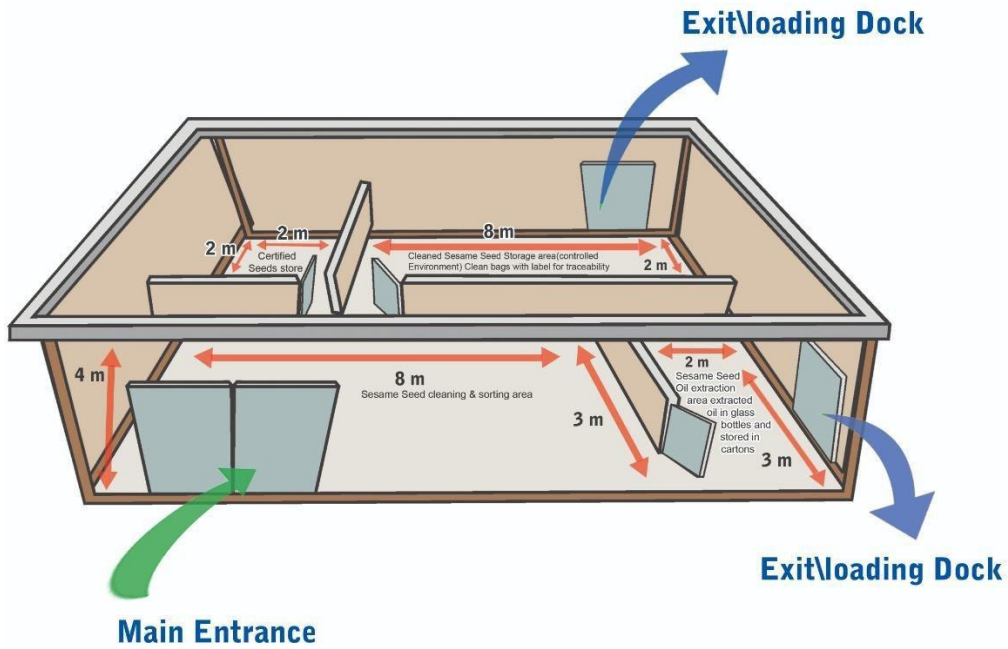
The proposed shed may be 10m x 5m in length and width, and 4m in height, well airated with partitions to separate the various functions.

Area for:

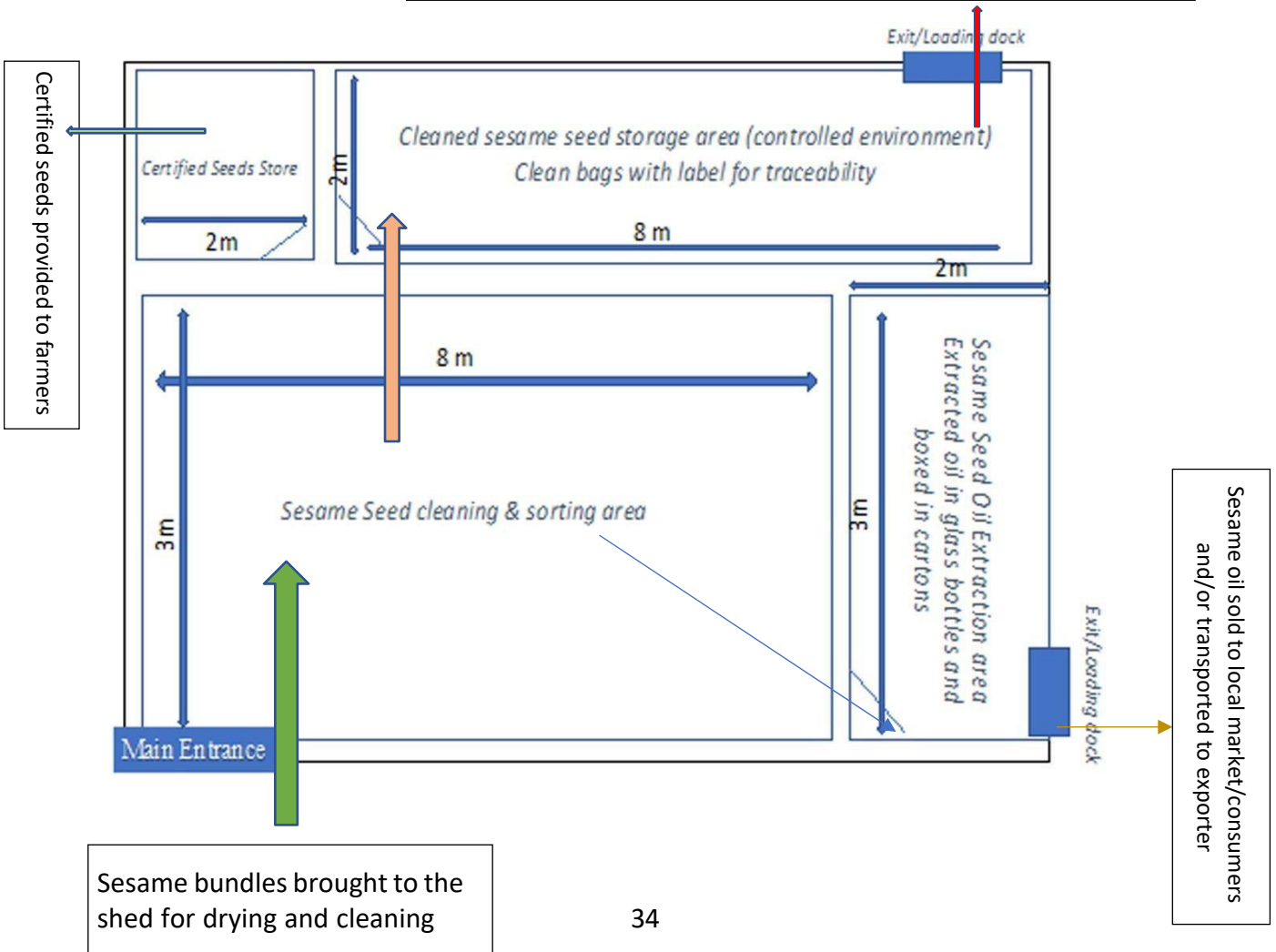
1. Drying, threshing, cleaning and packing
2. Storage of packed sesame seeds
3. Oil extracti
4. Disbursement of certified sesame seed to farmers for planting

Each of the areas above must also have a cleaning schedule and demonstrate both pest and rodent control measures.

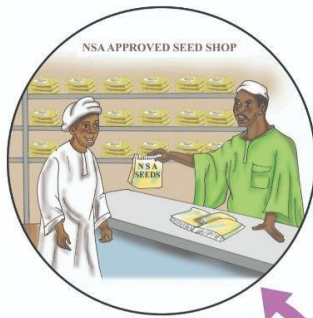
Proposed shed/packhouse at farm – a common facility centre



Packed sesame seed bags placed on trucks for transportation



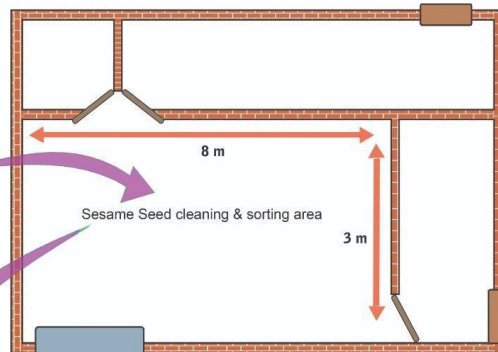
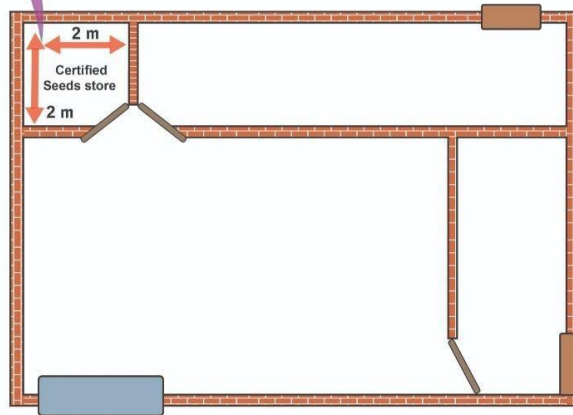
Sesame bundles brought to the shed for drying and cleaning



Farmers are encouraged to purchase certified seeds from NSA authorized agents to ensure maximum yield

Certified seeds provided to farmers

Certified Seed Store



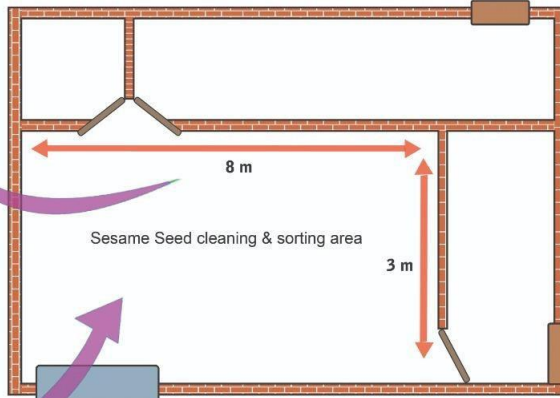
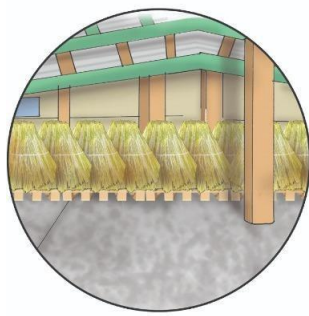
Main Entrance

Wash and clean Sesame shed and spray recommended pesticides



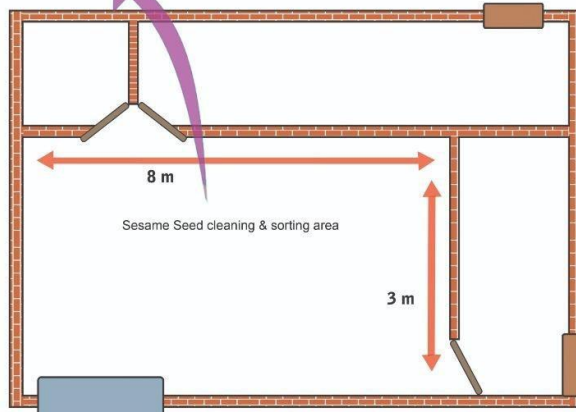
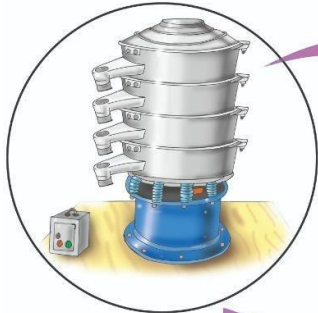
The shed must be cleaned 3-6 hours using detergent followed by application of pesticides prior to placing sesame stalk for drying and threshing and again after the seeds have been collected, stored and transported out of the shed.

Rodent traps may be placed outside the shed at certain points to ensure and demonstrate proper control.



Main Entrance

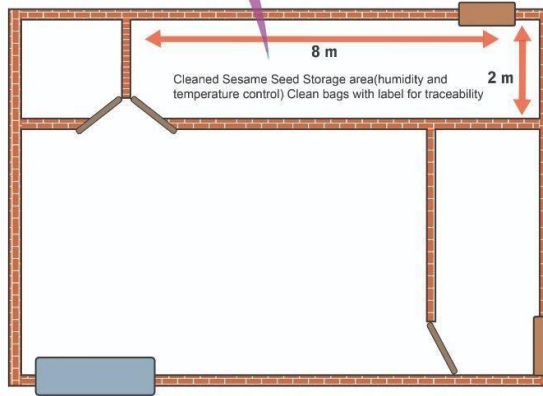
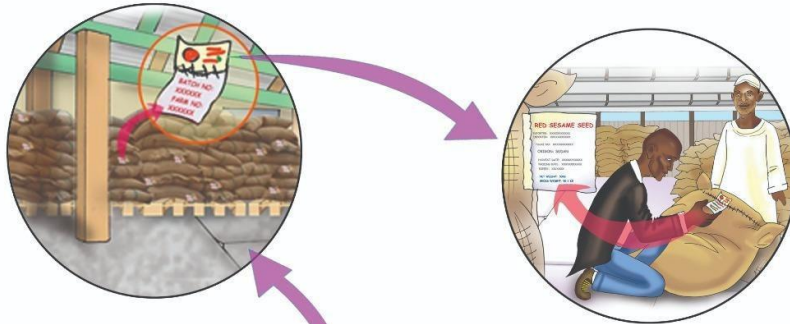
Sesame bundles brought to the shed for drying and cleaning



Sesame Seed cleaning and sorting area

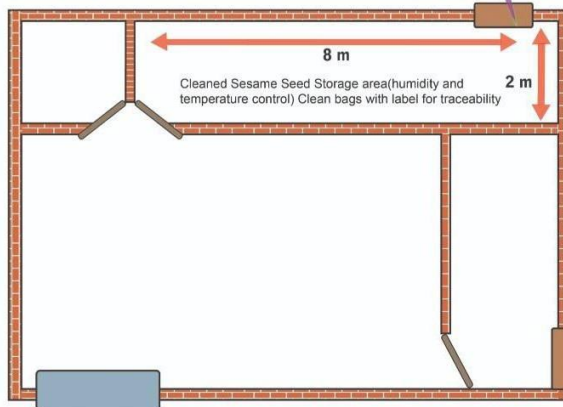
Dried sesame stalks are threshed inside the shed and seeds cleaned using mechanical sieve and collected in clean bags and stored in designated area within the shed

Cleaned Sesame Seed Storage area (temperature and humidity controlled) Clean bags with label for traceability



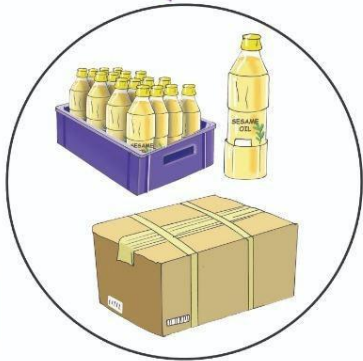
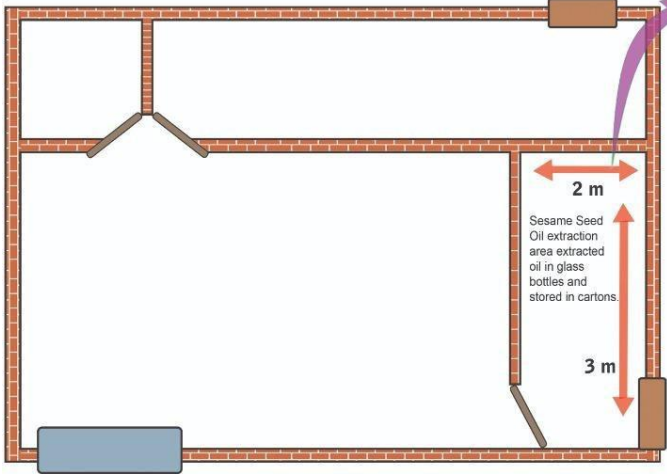
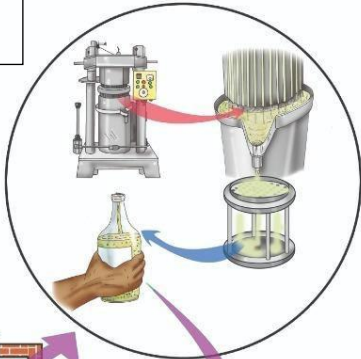
Bags of sesame seed loaded on to trucks for sale in local market, auction halls or to exporters

Exit/loading Dock

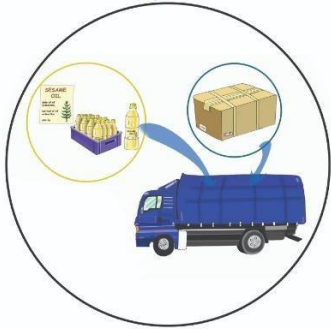
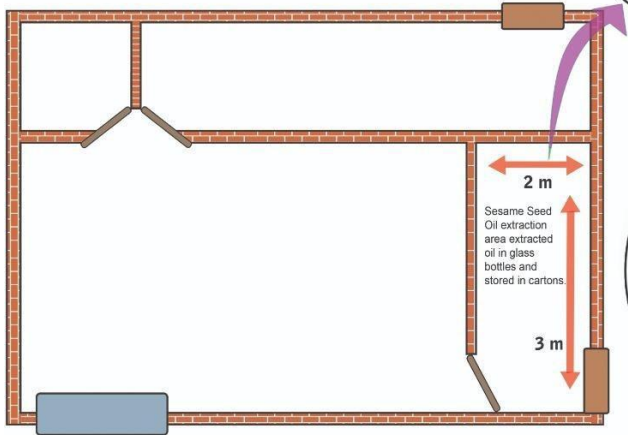
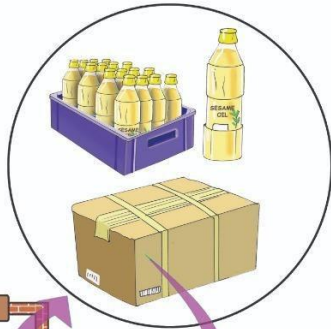


Sesame Oil is extracted using a cold extraction machine and collected in glass bottles & packaged

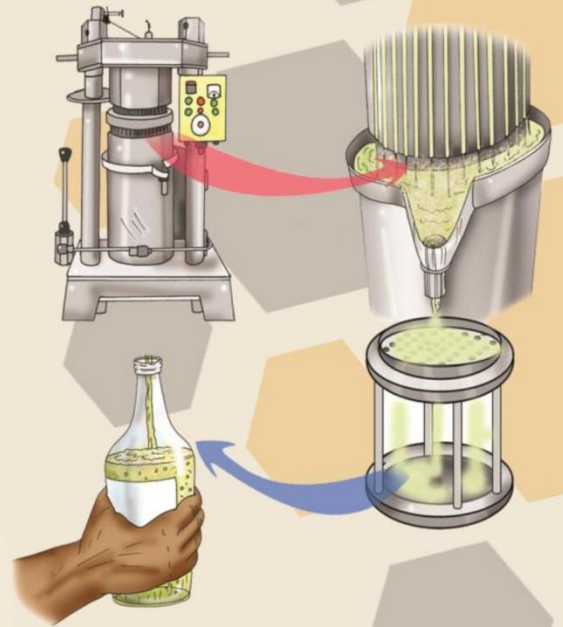
Sesame Seed Oil extraction area extracted oil in glass bottles and stored in cartons



Sesame oil sold to local market/consumers and/or transported to exporter



Sesame oil bottled and sold to local/domestic market or transported to exporters in trucks for further distribution to international markets.



SoPs on sesame seed oil extraction (cold extraction) in the packhouse



Current Sesame Oil Extraction Procedure (traditional/manual method at farm level)

Farmers collect/separate about 10-20% of harvested sesame seed (stored in bags) for extraction of oil to be sold locally. Oil extraction is done manually using large barrel and pestle that is usually powered by camel. Seeds are poured into the wooden/metallic mortar and ground using a pestle. Oil is extracted from the mortar using a cloth and wrung out into a bowl. The unfiltered oil is then poured into plastic bottles (no labels/tags) and sold either at a roadside kiosk or to a local trader.

Proposed Sesame Oil Extraction Procedure (mechanized method at farm level)

The Project proposes that oil extraction should be mechanized and a cold extraction machine with filters should be used. This will ensure the quality, purity and taste of the oil as well as add value to the product. This will enhance the income of the farmer and improve the sales value of the oil, both in the domestic and international markets. Sesame oil must be collected and stored in glass bottles, stored in cool dry place (away from direct sunlight) and transported in crates/boxes. Bottles must be labelled describing the product; date of oil extraction, method of oil extraction (cold, hot) and use-by date & have a code/batch number linked to the established traceability system. The finest of sesame seeds are mechanically cold pressed at a temperature below 45°C then filtered, producing the best in Sesame oil there is on the market today. No chemicals are used to extract this Oil.

Glass verses plastic bottles: Sesame oil should be stored in glass bottles. Glass bottles contain no harmful chemicals, so there is no need to worry about chemicals leaching into the oil. Easier to clean: They're much easier to clean than plastic because they are less likely to develop scratches that hold on to residue and odors. Chemical properties of the oil and plastic will be similar to each other, oil and plastic chemical properties are very similar, but the dissolution rate is not so fast. Sesame oil keep away from the light: the characteristics of sesame oil see easy to save the oxidation of deterioration, taste worse so sesame oil to keep away from light. Sesame oil stopper is best not to use rubber stopper the rubber impacts the taste of the sesame oil taste; the bottle must be sealed with food grade substance and then a plastic cap

Current Practice

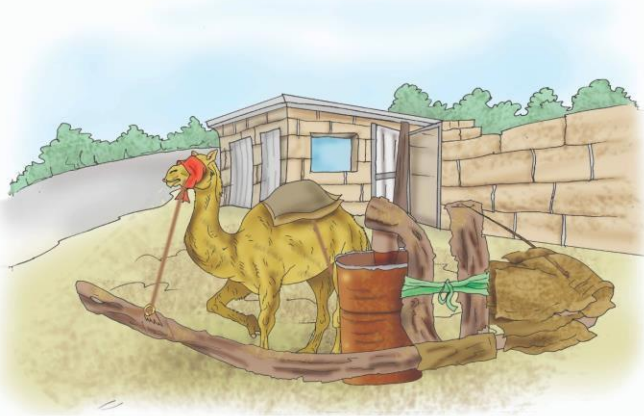
Traditional Method for extraction of sesame seed oil

Farmers collect/separate about 10-20% of harvested sesame seed (stored in bags) for extraction of oil to be sold locally.

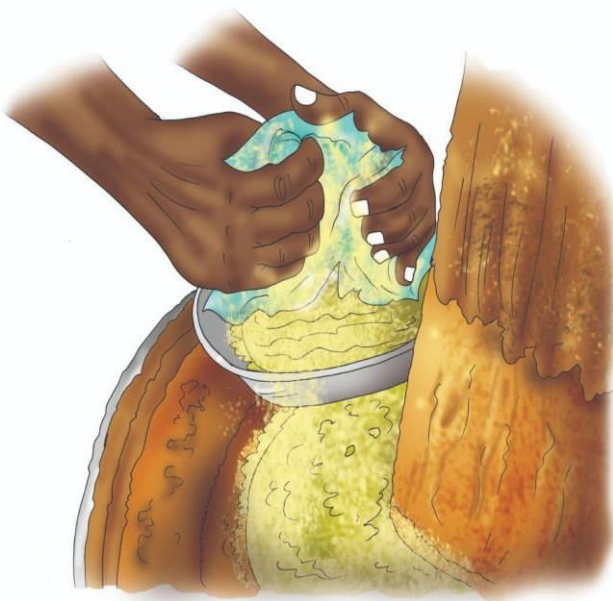
Oil extraction is done manually using large barrel and wooden pestle that is usually powered by camel.



Seeds are poured into the wooden/metallic mortar and ground using a pestle



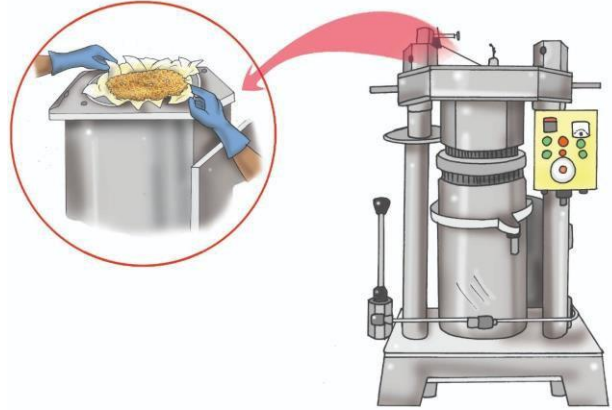
Camel used to drive the pestle to grind the seeds to extract the oil



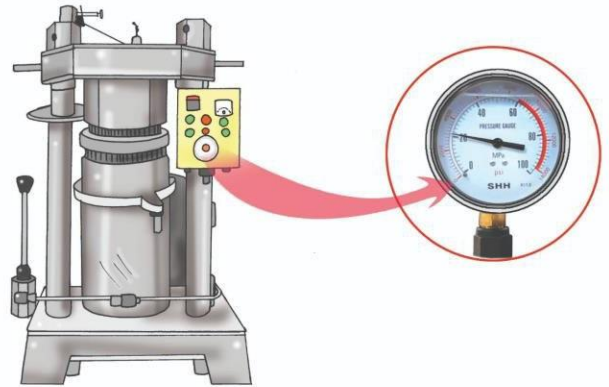
Recommended Practice

Mechanized 'cold' extraction of sesame seed oil

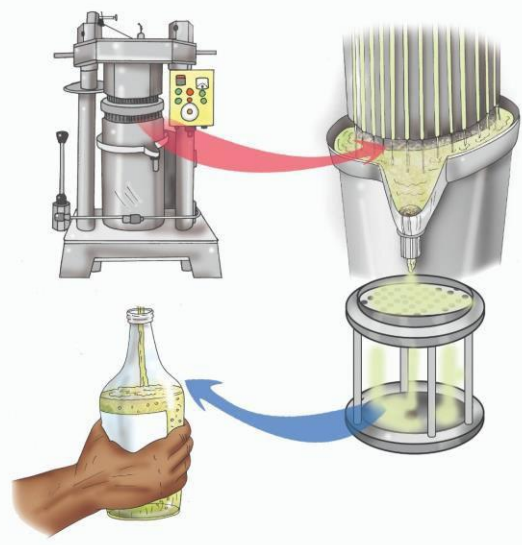
The collected sesame seeds- cleaned (using a mechanical sieve) and poured (e.g. 5 kg) into the cylinder at the top of machine and sealed tightly (as per instruction manual)



The machine is turned on and the press increased gradually (maximum 60 MPa)



The oil is filtered through a series of sieves and collected in glass bottles



The unfiltered oil is then poured into plastic bottles and sold either at a roadside kiosk or to a local trader



The labelled bottles are then sealed with food grade plastic and plastic cap.



The bottles are boxed and loaded onto covered trucks for storage in warehouse, sale to the domestic market, export markets, processors or loaded onto containers for shipment



At Farm level:

Batch No: _____

Name of farm/association of farms _____

Date of sowing of crop _____

Application of fertilizer _____

Application of pesticides _____

Date of harvest _____

Date of seed extraction _____

Date of cleaning, sorting, packing & storage _____

Net weight of bag: _____

BAKHIT SESAME FARM



RED SESAME SEED

EXPORTER: XXXXXXXXXXXXXXXX

IMPORTER: XXXXXXXXXXXXXXXX

FISAL NO: XXXXXXXXXXXXXXXX

ORIGON: SUDAN

HARVEST DATE: XXXXXXXXXXXXXXXX

PACKING DATE: XXXXXXXXXXXXXXXX

EXPIRY: XX/XX/XXXX

NET WEIGHT: 50KG

GROSS WEIGHT: 50.1 KG

Traceability

At processor/exporter level:

Batch No: XXXXXXXX

Supplier Batch No: XX (farm or warehouse)

Date of receipt of product _____

Date of processing of sesame: _____

Date of re-packing/re-sorting: _____

Date of oil extraction: _____

Certificate of compliance for raw sesame (SSMO tag/batch number): _____

Certificate of compliance for processed sesame (oil/hulls) (SSMO tag/batch number): _____

Date of transportation to Export Market: _____

Net weight of container: _____



Currently the traceability system being used in the sesame seed sector is not at par with market requirement and best practices.

The Project proposes to develop a paper-based system (coded) that can be implemented and then be further developed into a computer-based system leading to a bar-code system in the future.

Paper-based traceability system from farm to exporter: This is key and needed as part of market requirement and will be three different levels:


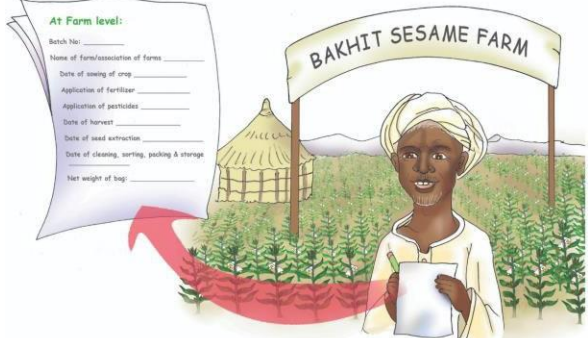

- a. At farm level
- b. At storage/warehouse level
- c. At the processing/exporter level

Farmers need to get and fill out a kind of book/register/paper with as much detail as possible to ensure that a robust traceability and recall system can be implemented

The presence and the content of the book must be verified by trained inspectors/extension officers through a risk-based approach

To start off with the inspectors should check and assist all the farmers, warehouse keepers/storage owners and exporters & guide them on how out the forms and the importance of the traceability system; following which inspections may be scheduled periodically (2-3 rounds) to check that the farmer, warehouse keepers and exporters are all diligently doing their part in implementing the traceability system

To ensure good governance and promote transparency, inspectors visiting the various locations should change if possible – no more as two visits/inspections in a row

Current Practice	Recommended Practice
<p>Sundanese Standards & Metrology Organization (SSMO) places a tag on the bag of sesame seed at the warehouse/storage facility.</p> <p>There is no system currently being used in Sudan that traces the product to the farm/region from where the product was sourced</p> <p>Statement card or a preamble bearing the name and type of the product, the harvest season, the quantity, origin (Sudan), validity and the name of the producing or exporting company</p> <p>This information, even though important, is not sufficient for a robust traceability system and is only placed at the warehouse, storage site prior to distribution (local market; exporter) and is only linked to raw sesame seeds</p>  <p>Inspector examining the information on the tag attached to the bag of sesame seed located in a warehouse/storage facility, destined for sale (export or local market)</p> <p>Details of current SSMO tag:</p> <p>Type of Sesame Seed: Red/White Exporter: XXXXX Importer: XXXXX FSSAI No: _____ Origin: SUDAN Harvesting Date: _____ Packing Date: _____ Expiry Date: _____ Net Weight: 50 Kg Gross Weight: 50.1 Kg SHAK SSMO LOT No: _____</p>	<p>Paper-based traceability system (based on GAP)</p> <p>At Farm level: Farmers trained to filled out the requisite information on paper/chart linked to a batch number:</p> <p>Batch No: _____ Name of farm/association of farms _____ Date of sowing of crop _____ Application of chemical on seed prior to sowing: _____ Application of fertilizer _____ Application of pesticides _____ Date of harvest _____ Date of seed extraction _____ Date of cleaning, sorting, packing & storage _____ Date of transportation (to local vendor/to exporter) _____ Net weight of bag: _____</p>  <p>Farmer filling out the information to pertinent information for a robust paper-based traceability system</p>  <p>Extension officer/inspector verifying information and offering guidance to farmer on the traceability system</p>

At Storage/Warehouse level:

The warehouse keeper/foreman is trained to build on the information received from the farm and add additional details

- Batch No: _____
- Farm Batch No: _____
- Date of receipt of product _____
- Date of re-packing/re-sorting: _____
- Date of Expiry: _____
- Certificate of compliance (SSMO tag/batch number): _____
- Net weight of bag: _____
- Number of bags per container/truck: _____
- Date of transportation to:
- Local Market: _____
- Export Market: _____
- Processors/Exporters: _____



The warehouse foreman filling in the information on the tag attached to the bag of sesame seed received from the farm

At processor/exporter level:

Batch No: _____
Supplier Batch No: ___(farm or warehouse)
Date of receipt of product _____
Date of processing of sesame: _____
Date of re-packing/re-sorting: _____
Date of oil extraction: _____(if necessary)
Date of Expiry: Raw Sesame Seed/Sesame oil/Tahina _____
Certificate of compliance for raw sesame (SSMO tag/batch number): _____
Certificate of compliance for processed sesame (oil/tahina) (SSMO tag/batch number): _____
Date of transportation to Export Market: _____
Net weight of container: _____



The exporter verifies the documents received from the seller to ensure an unbroken chain of traceability and that the product (sesame seed/oil) is compliant to market requirements. This information is then passed on to the buyer in destination market/country





Market Compliance



Currently SSMO issues certificate of fitness after successful analysis of the consignment based on the following tests:

Physical Tests:

NO	Analysis	Limits of standard
1	Colour, taste and odour	characteristic
2	Living and dead insects and their parts	Nil
3	Fungal growth seen by naked eyes	Nil
4	Moisture %	Max 7.0%
5	Impurities%	Max 2.0%
6	Fat%	Min 47.0%
7	Total ash%	Max 6.0%
8	Protein	Min 19.0%
9	Rodent and bird remains	Nil

Microbiological Tests:

NO	Analysis	Limits of standard
1	Salmonella	Nil
2	E-coli	Nil

Chemical Tests:

Aflatoxins:

NO	Analysis	Limits of standard
3	Aflatoxin total (G1, G2, B1, B2)	15 µg/Kg
4	Aflatoxin B1	5 µg/Kg

Heavy Metals:

NO	Analysis	Limits of standard
5	Lead	0.2 mg/Kg
6	Arsenic	0.1 mg/Kg
7	Cadmium	0.1 mg/Kg

Pesticides:

NO	Analysis	Limits of standard
8	2,4-Dichlorophenoxyacetic acid (herbicide)	0.01 mg/Kg
9	Acephate (insecticide)	0.05 mg/Kg
10	Acetamiprid (insecticide)	0.01 mg/Kg
11	Acetochlor (herbicide)	0.1 mg/Kg
12	Boscalid (fungicide)	0.1 mg/Kg
13	Carbaryl (insecticide)	1.0 mg/Kg
14	Carbendazim (fungicide)	0.1 mg/Kg
15	Carbofuran (pesticide)	0.1 mg/Kg
16	Carbosulfan (insecticide)	0.2 mg/Kg

17	Chlormequat (plant growth inhibitor)	0.1 mg/Kg
18	Chlorothalonil (fungicide)	0.01 mg/Kg
19	Chlorpyrifos (pesticide)	0.1 mg/Kg
20	Clothianidin (insecticide)	0.02 mg/Kg
21	Cyhalothrin (pesticide)	0.2 mg/Kg
22	Cypermethrin (insecticide)	0.2 mg/Kg
23	DDT (insecticide)	1.0 mg/Kg
24	Endosulfan (insecticide)	0.6 mg/Kg
25	Fluxapyroxad (fungicide)	0.8 mg/Kg
26	Imidacloprid (insecticide)	5.0 mg/Kg
27	Malathion (insecticide)	0.02 mg/Kg
28	Methomyl (insecticide)	0.2 mg/Kg
29	Profenofos (insecticide)	0.05 mg/Kg
30	Thiamethoxam (insecticide)	0.02 mg/Kg
31	Triazophos (insecticide)	0.05 mg/Kg

This must be modified to best fit the criteria for buyer requirements:

- defining the quality criteria of a major client groups – this is typically more as given in the current standards
- needs to be done by group exporters together with Technical Expert Group (TEG)
- Best practice would be to set-up an **annual National Control Plan**
- Based on client and general food safety criteria a list of to be tested test parameters should be finalized
<https://www.cbi.eu/market-information/grains-pulses-oilseeds/sesame-seeds/europe/>
- product quality criteria test parameter (see above)
 - microbiology: besides general parameter Salmonella is key
(currently EU checks 50% of incoming sesame products from Sudan – laid down in COMMISSION IMPLEMENTING REGULATION (EU) 2019/1793 of 22 October 2019
- contaminants level
 - mycotoxins -partly coming from clients but also from international criteria
- as an example recent publication from similar areas can be used (Nigeria)

Mycotoxin	Concentration in sesame ($\mu\text{g kg}^{-1}$)*			
	Positive (n=24) (%)	Median	Mean	Range
Aflatoxin B ₁ (AFB ₁)	3 (13)	1.6	3.6	0.4-7.2
Aflatoxin B ₂ (AFB ₂)	2 (8)	1.5	1.5	0.8-1.6
Aflatoxin G ₁ (AFG ₁)	0	-	-	-
Ochratoxin A (OTA)	0	-	-	-
Fumonisin B ₁ (FB ₁)	5 (21)	17.1	17.3	7.3-26.7
Fumonisin B ₂ (FB ₂)	2 (8)	8.6	8.6	6.1-11.2
Fumonisin B ₄ (FB ₄)	1 (4)	5.72	5.72	5.72
Deoxynivalenol (DON)	14 (58)	63.7	78.3	28-171
Zearalenone (ZEN)	11 (46)	3.2	3.6	0.1-18.3

*Indicated by LC-MS/MS analysis.

<http://www.journals.tmkarpinski.com/index.php/eibr/article/view/41>

This needs to be address on a yearly basis by the Technical Expert Group (TEG)

- heavy metals

partly coming from clients but also from international criteria, however some studies have attributed the contamination to the metal equipment used in the preparation, roasting and sesame – squeezing process, which can be old, rusty and of poor quality, may therefore be the biggest cause of product contamination by heavy metal

This can only be identified by regular checks and adjusted on a yearly base of a National Control plan elaborated by the TEG

- pesticides

partly coming from clients but also from international criteria; this is the most difficult topic to cover as so many pesticides are around.

To put the focus only one the allowed pesticides – for organic farming useless- is not the correct way.

Currently the EU lists approximately 493 pesticides to be controlled for Sesame:

https://ec.europa.eu/food/plant/pesticides/eu-pesticides-db_en

This list needs to be checked by the TEG and compared with the technical feasibility of the lab to run such tests.

The expectation of the clients must be addressed, and it should be made clear from the beginning what has been/can be checked and what has not/cannot be checked.

a. Certification requirements

1. Farm Level
2. Exporter/Processing Level
- ii. Processing
 1. Packaging
 2. Labelling

Buyers may request extra food safety guarantees from you, such as the implementation of good agricultural practices and Quality Management Systems (QMS) regarding the production and handling processes.

Buyers commonly require their suppliers to have a quality/food safety management system in place. These systems require companies to demonstrate their ability to control food safety hazards in order to ensure that food is safe at the time of human consumption.

Suppliers can apply a basic Hazard Analysis and Critical Control Points (**HACCP**) system. Necessary to have a certified and recognized food safety management system such as:

- ISO/FSSC 22000,
- British Retail Consortium (BRC)
- International Featured Standards (IFS): Food

Each group should at minimum set-up a basic HACCP system to be checked by inspectors:

Farm level: every year farmers/farmer associations should be checked – if that is not feasible, a program should be installed when, where and which farmer/farmer organization should be checked – this list should be on the Internet (**GLOBALGAP**)

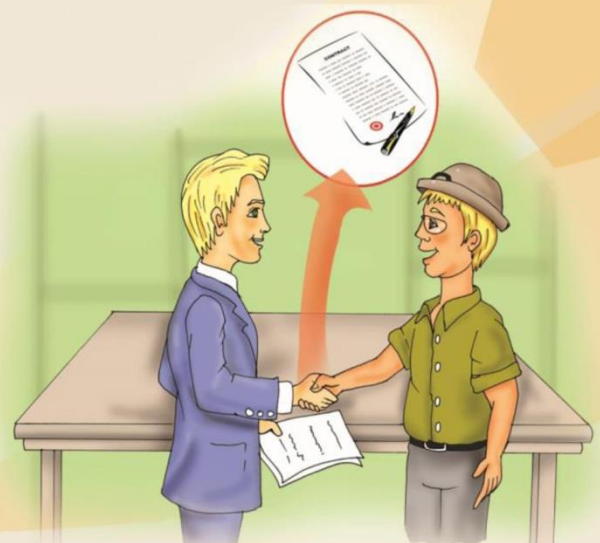
Exporter/Processors: same principle: a list of to be checked and checked players should be available on the Internet. The players can only be published, if they provide a minimum HACCP system

b. Inspection procedures

1. Farm Level
2. Exporter/Processing Level
- ii. Processing
 1. Packaging
 2. Labelling



SOPs on developing B2B linkages



Building B2B linkages in the agriculture sector: Sesame Value Chain in Sudan

Private sector plays a crucial role in the development of the agricultural sector across global markets. Not only are local small and medium enterprises considered essential for economic progress in most developing countries, but larger “lead firms” are increasingly establishing closer ties with SME suppliers due to rising standards in food regulations, traceability, and transparency.

When lead firms establish linkages with SME processors and suppliers, the potential for win-win outcomes soars. Lead firms can lower supply chain risks, reduce costs, and increase access to local quality products, while SMEs gain access to new markets, financing, and skills, as well as generate significant local employment and income opportunities.

Partnerships between lead firms and SMEs in the agricultural processing sector often form organically. However, several barriers exist that could be eased by donors and public sector actors, thereby unlocking economic growth and development impact.

Characteristics of successful B2B linkages

Although agro-processing activities in developing countries are expanding, several obstacles prevent lead firms from linking with SMEs on their own.

If barriers are too great, lead firms may not invest the time and resources to overcome them. Instead, they may bring manufacturing “in-house,” seek suppliers in more developed economies, or leave the supply chain altogether. Thus, benefits to the local economy, as well as improvements to food quality, security, and safety, may never be realized.

Four elements of successful B2B linkages in agriculture

1. Market opportunity

A profitable opportunity must exist to motivate lead firms to engage with SMEs. In the case of Sudan, the Sesame Value Chain Project, implemented by UNIDO & FAO to focus is on improving farming techniques, quality of sesame seeds, enhancing the yields and establishing a robust traceability system at one of the value chain, while engaging with SMEs (small and large) to help them to become more competitive through value addition and ensuring market compliance in order to better access the export market, by demonstrating tight controls along the export supply chain.

2. Mutual benefit

There clearly are tangible benefits of working together to achieve the desired outcome. In case of the sesame value chain project, farmers, local traders, exporters working in tandem with the regulatory bodies is the best approach for developing economies. Exporters source their produce from farms that demonstrate good agriculture practices, ensuing quality product, which in turn is processed in accordance with market requirements and compliance to SPS measures. Such a controlled supply chain can only ensure greater market access and safe produce for all.

3. Sufficient capacity

A minimum level of SME capacity is necessary to meet lead-firm requirements for scale, quality, cost, labor, and environmental standards. Capacity-building activities — such as training, advisory services, and mentoring — can help SMEs contribute to a more assured supply chain. In the case of the Sesame VC project, training starts at the farm level (downstream) and continues along each critical point of the supply chain, resulting in an increase in exports and access to more lucrative markets.

4. Supportive environment

Legal, regulatory, service, and infrastructure factors are critical to establishing B2B linkages. For the sesame project, technical support was provided to upgrade the phytosanitary laws, pesticide regulations, testing and inspection services. A comprehensive and integrated risk based SPS/Food safety system will be established for control along the entire supply chain. All of this will be in line with best international practices and allow Sudan to prepare for accession to the WTO.

Interventions to support B2B linkages

Business linkages do not simply happen because of the presence of large companies in developing economies. Rather, there is an important role for the public sector in enabling linkages. Public sector actors may help to build the capacity of SMEs, work with lead firms to meet their specific needs, or work broadly across an industry.

a. Bottom-up initiatives

In Sudan, for the sesame project, UNIDO and FAO jointly implemented established a project to provide needed support to the sesame growers, processors

(SMEs) and regulatory authorities both at the federal and state levels. A “bottom-up” intervention focused on capacity building of farmers, processors and exporters in the country, helping to position them as suppliers to export markets and distributors.

ii. Top-down initiatives

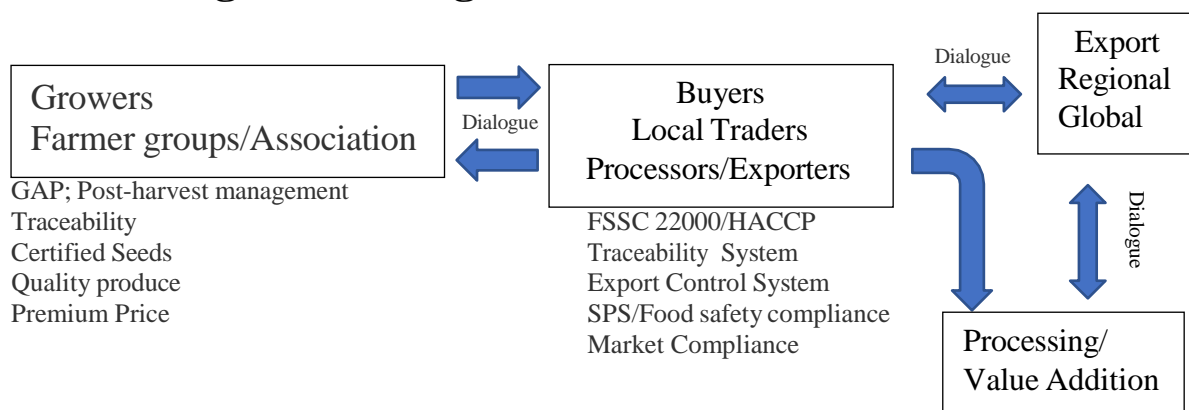
Additionally, the public sector can work in a “top-down” approach, partnering with companies through public-private partnerships tailored to the needs of a company. For the sesame project in Sudan, the project actively engaged with the Chambers of Commerce, Ministry of Trade & Industry to establish a network of growers, processors and exporters through public-private dialogue, a National Training Program to help develop the enabling environment that improved productivity of farmers and processors (SMEs).

iii. Industry-wide initiatives

The public sector should engage in “industry-wide” initiatives to promote broader competitiveness in a specific industry, such as in Sudan where UNIDO worked with sesame organizations, government agencies, producers’ associations, and potential lead SMEs/processors and exporters to increase productivity and improve business practices along the sesame supply chain.

As discussions around the private sector’s role in global development continue to grow, harnessing lead firms to enable SME growth is an innovative approach worth further attention. Greater research into market opportunities, with a focus on the needs of the private sector, will uncover further possibilities for business-to-business linkages while meeting the diverse goals of the private sector, SMEs, development institutions, and the public sector.

B2B linkages flow diagram



B2B linkage– Pilot Sesame Seed Sector

1. Production of quality sesame

Selected progressive farmers (5-10), with demonstrable implementation of GAP, use of certified seeds & IPM will be invited to the event and asked to setup booths, stalls displaying their products, brochures and information that indicates that their produce is compliant to the required SPS measures for market access



Farmers set up booths displaying their products to the buyers and demonstrate good agriculture practices, improved post-harvest handling, transportation, storage facilities and a paper-based traceability system



Farmers and exporters being coached (using guides and training manuals) on strengthening their marketing skills to allow them to get the best possible price for their quality, market compliant product

The coaching will also include how these farmers can best demonstrate quality produce through:

- i. Implementation of GAP; use of certified seeds
- ii. Post-harvest management and control
- iii. Storage and Transportation
- iv. Paper-based traceability system

2. Processing and packaging of sesame seed

Selected local buyers (3-5) and exporters (3-5), with demonstrable implementation of a HACCP plan, FSSC22000 and a functional traceability system, will be invited to the event and asked to setup booths, stalls displaying their products, brochures and information that indicates that their produce is of good quality and compliant to the required SPS measures for market access



Exporters set up booths displaying their products to potential international buyers and demonstrate the quality of sesame products and market compliance, HACCP, compliance to food safety measures and a robust paper-based traceability system

These buyers/exporters will also be coached (using guides and training manuals) on strengthening their marketing skills to allow them to access regional and global markets by demonstrating that adequate management and control systems are in place to ensure a sustainable supply of quality produce at competitive price.

The coaching will also include how these buyers can best demonstrate:

- i. Implementation of a HACCP plan
- ii. FSSC22000 certification (if required)

- iii. Market compliance to SPS/Food Safety measures – MRLs, aflatoxins, microbial contaminants – through test results from accredited laboratory
- iv. Traceability System

3. Enabling environment/Forum

The project will use a wholistic, integrated and coordinated approach to help create the required enabling environment that would address the following:

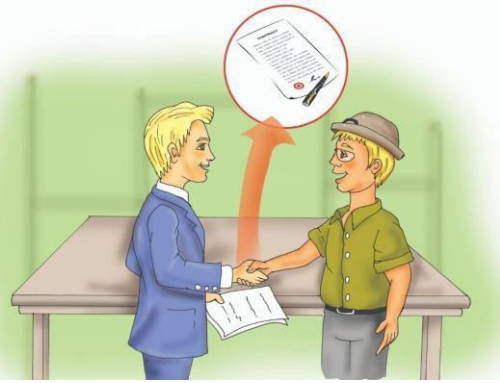
- i. Trust building through dialogue and meetings
- ii. Demonstratable evidence of quality and compliant produce
- iii. Creating business opportunities



Farmers and exporters engaged in trust building exercises and dialogue

Apart from farmers and exporters that project will invite key stakeholders who play a critical role along the sesame value chain. This will include regulators, researchers and specific institutions that help to ensure the production of quality produce, play a role in management and control at critical points of the supply chain and help to demonstrate proof of compliance through accredited testing, certification and inspection services.

The regulators will include the Sudanese Standards and Metrology Organization (SSMO), National Seed Administration (NSA), Agriculture Research Corporation (ARC) and key officials from the ministries of agriculture, trade and industry. These entities will also be asked to set up booths/stalls to display their services such as testing and certification (SSMO), provision of certified seeds (NSA), research and production of quality and marketable variety of sesame seeds (ARC).



Exporters successfully negotiating trade deals with international buyers for sesame products from Sudan

These organizations along with the producers and exporters will be allowed to actively engage with each other in an open forum to generate healthy and constructive discussions on how best to improve the sesame sector in Sudan. Such an approach will help in creating an enabling environment of trust and allow for a more constructive public-private dialogue to help improve the sesame sector in Sudan.



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