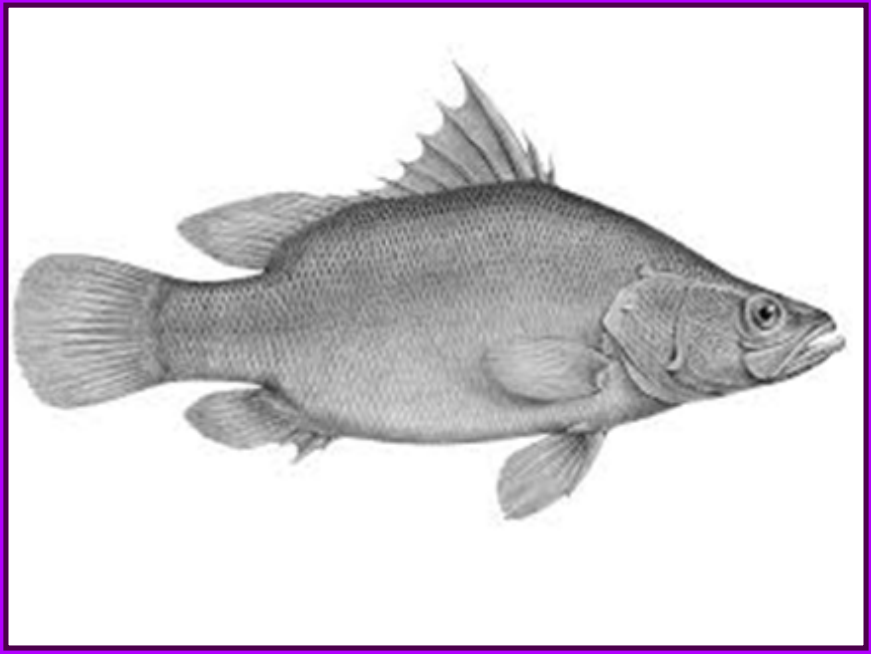
CODE OF PRACTICE FOR SAFETY AND QUALITY ASSURANCE FOR SUN DRYING AND SALTING OF NILE TILAPIA AND NILE PERCH (SKIN ROLLS, SLATES, BLADDERS, HEADS) IN THE ARTISANAL FISHERIES SUB SECTOR



THE REPUBLIC OF UGANDA

Ministry of Agriculture,
Animal Industry & Fisheries
Directorate of Fisheries Resources

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1.1 METHODS FOR SALTING OF FISH

1.1.1 Brine salting in which the fish are put in a solution of salt in water

a) Most brine solutions range between 80-100% which is 270-360g of salt/litre of water. A good brining practice involves testing the brine strength regularly, use only good quality salt, and making up new brines for each batch of fish and removal of the scum which forms on the brine surface.

b) Immerse the fish in saturated brine about 20 minutes for a 7cm fish

c) Sun-dry on elevated racks for 16-18 hours

d) Fish may be lightly smoked at this stage depending on consumers' preference

e) Pack the final product in plastic bags to prevent over drying in the dry season and to protect against contamination and infestation

f) Such a product can have a shelf life up to six months

g) Salt-tolerant bacteria do not grow if the fish is well dried or fully immersed in brine.

1.1.2 Dry salting in which granular salt is rubbed onto the surface of the fish

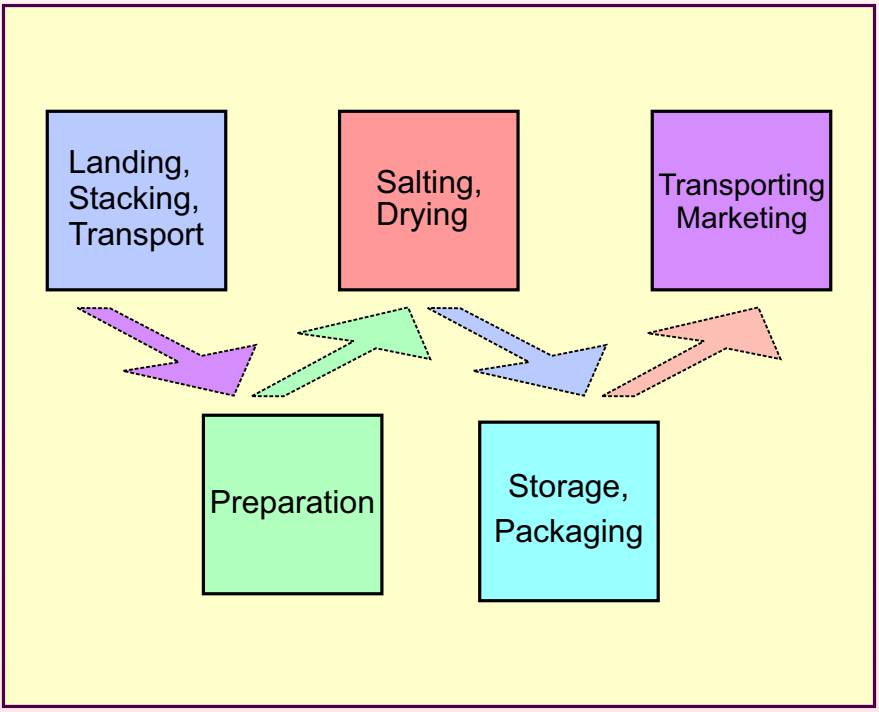
a) Kench salting is when granular salt is rubbed into the surface of split fish, the fish are stacked with a sprinkling of salt between each layer, and the liquid (pickle) which forms is allowed to drain away.

b) Fish salted in pure salt (NaCl) may be soft and yellow. If calcium and magnesium salts are present, they give a whiter color which gives a bitter taste.

c) Salt used on fish should contain at least 95% NaCl and be as dry as possible. If impure salt is all that is available, most of the calcium and magnesium impurities should be washed away using clean water because calcium and magnesium salts do not dissolve as quickly as NaCl.

d) In dry salting, a mixture of large and fine grain sizes is recommended because, although fine grain is preferred in making brines because it dissolves rapidly in water, if it is applied directly on a fish, it causes too rapid removal of water from the surface which then hardens and prevents penetration of salt inside, a condition called 'salt burn'.

1.1.2. VALUE CHAIN FOR SALTED TILAPIA AND NILE PERCH



1.1.3. RAW MATERIAL RECEIVED FROM THE BY- PRODUCTS OF FISH PROCESSING AND EXPORT FACTORIES

1.1.3.1 Bad Practices

a) Receiving contaminated raw materials
b) Poor transportation facilities
c) Poor hygiene of receiving containers
d) Poor personal hygiene e.g. dirty clothes, fingernails
e) Poor handling practices e.g. throwing products on ground, stepping on fish

1.1.3.2 **Good Practices**

a) Processors should ensure they do not buy spoilt fish or by-products because the quality of the processed product will be poor

b) By-products got from factory for salting should be put in clean containers when they are being received

c) Ensure that raw materials are transported in protected and hygienic facilities

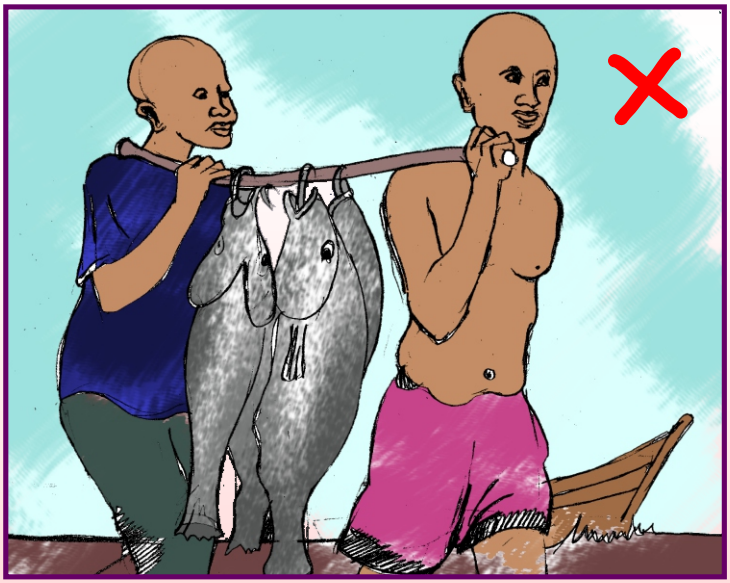
d) Ensure hygiene of persons handling the products

e) Avoid handling practices that may result into contamination of product e.g. spitting, stepping on fish product, throwing on ground etc

1.1.4. FISH RAW MATERIAL RECEIVED BY ARTISANAL OPERATORS DIRECT FROM THE LANDING SITE

1.1.4.1 Bad Practices

a) Dropping and piling of raw material on the ground during landing
b) Contamination of landed fish with inshore dirty water
c) Spillage from waste water or cross-contamination with waste water runoffs
d) Poor handling practices and poor personnel hygiene
e) Potential for contamination from animals and birds roaming at the landing sites
f) Potential contamination from poor garbage management
g) Exposure to direct sunshine
h) Reception of already spoilt fish from landing sites



1.1.4.2 **Good Practices**

a) At landing sites, the raw material fish should not be thrown on the ground but received direct into clean containers

b) Care should be taken when retrieving the fish from the boats to avoid contact with dirty inshore waters

c) Only good quality fish should be received

d) The workers should have the necessary protective wear like aprons, gloves and boots for use in handling the raw material fish

e) Ensure personnel hygiene and good handling practices

f) Ensure proper management of waste material/garbage

g) Keep away animals and birds from area of operation at the landing site and artisanal processing centres

h) Provide a shed/protection against direct sunlight

1.1.5. TRANSPORT

1.1.5.1 Bad Practices

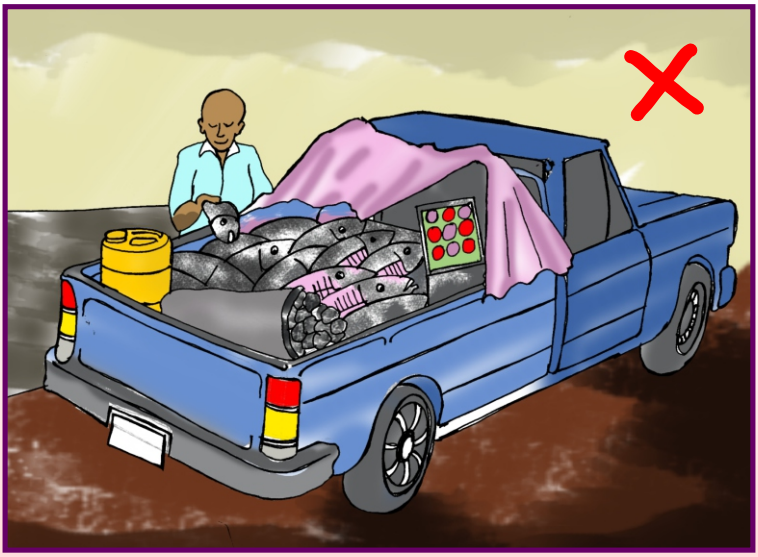
a) Use of dirty containers or pickups

b) Transporting exposed carcasses and other factory by-products at the back of the truck

c) Failure to maintain the cold chain during transport

d) Transportation with other products e.g. oils, car tyres, charcoal and food

e) Poor drainage system of the fish transport containers



1.1.5.2 **Good Practices**

a) Where possible the raw material fish obtained should be immediately iced and the icing should be maintained even during transportation for further processing (salting)

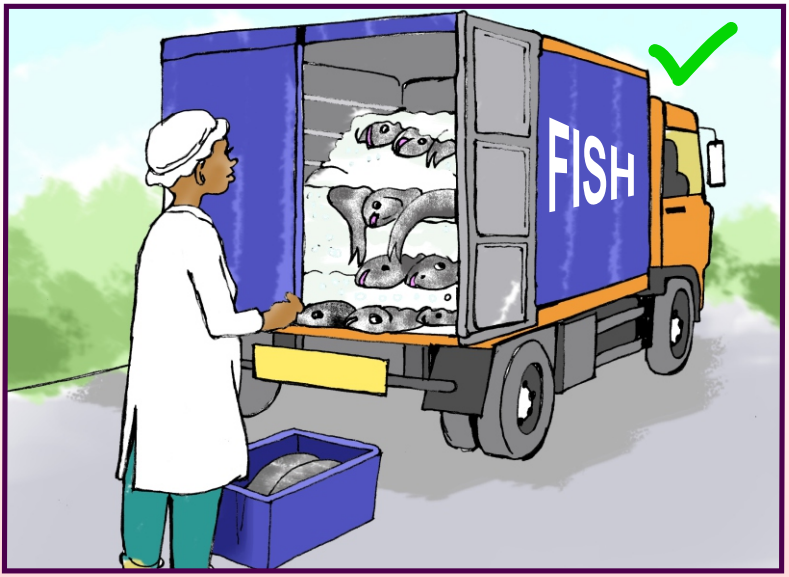
b) Where icing is not possible, the raw material should be transported and covered in clean containers or pickups in cools weather where possible

c) People should not sit on the fish or by-products at the back of pickups/trucks

d) The fish or skeletons should be covered with tarpaulin to avoid contamination with dust

e) Avoid transportation with other products likely to impair, damage or contaminate fish products

f) Ensure proper fish transport container drainage



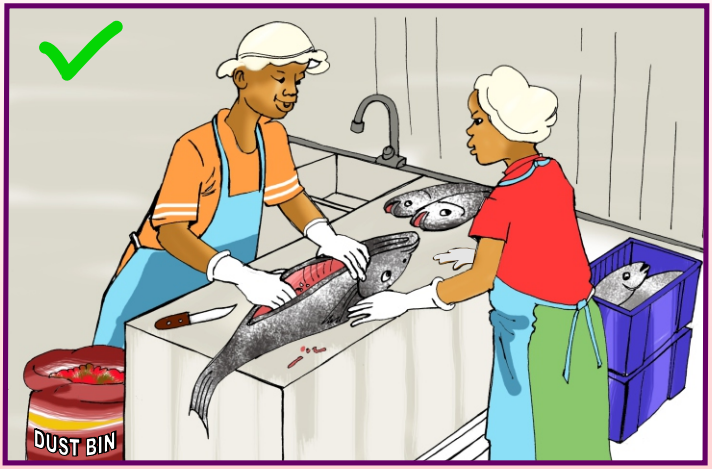
1.1.6. PREPARATION (washing, gutting and rolling)

1.1.6.1 Bad Practices

a) Poor hygiene of work surfaces
b) Improper handling and disposal of waste material from the gutted fish and slated fish
c) Poor workers hygiene
d) Poor sanitation of working premises
e) Re-use of same water used to clean the product
f) Improper disposal of waste water
g) Improper processing practices
h) Operating on inappropriate, uncleanable work surfaces
i) Unrestricted access of all persons, animals and birds to processing and drying areas
j) Poor health conditions of the workers (germ-infected wounds and communicable diseases)
k) Hygiene of the surrounding environment
l) Poor handling practices
m) Processing and drying areas that are not secured from dust, insect infestation, stray animals, rain water, mud and waste water runoffs

1.1.6.2 **Good Practices**

a) Use only fresh fish for a good final product
b) Scale and split, behead before splitting unless the heads are required
c) Remove all but the tail third of the back bone
d) Clean carefully, remove guts, liver and gill membranes
e) Scale the flesh as far as the skin but not through it
f) Wash, soak in 10% brine for 30 minutes
g) Drain the water on the fish before drying
h) Workers should have protective gear (mouth/nose gear), aprons, gum boots, head scarf and hand gloves
i) The work surface should be raised from the ground, made of cleanable material e.g. aluminum, stainless steel or steel mesh
j) The work tables /racks should drain the water safely away from the work premise
k) Workers should be hygienically clean and those with communicable infections not allowed to touch the products
l) Limit access to persons, animals and birds to processing and drying areas
m) Regular medical check for handlers
n) Carry out processing in secured locations to avoid all sources of potential contamination.



1.1.7. SALTING

1.1.7.1 Bad Practices

a) Use of poor type of salt
b) Poor hygiene of equipment and containers
c) Poor workers hygiene
d) Failure to properly clean the product before salting
e) Poor storage of already opened salt which may have remained after use
f) Re-use and abuse of salt

1.1.7.2 **Good Practices**

a) Salt for salting of fish should be transported and stored dry and hygienically kept and covered in salt bins, storerooms, containers or in plastic sacks

b) In order to minimize infections of salted fish the re-use of salt should be avoided

c) The quality of salt used in salting of fish should be suited for the end product

d) Refined salt (almost pure Sodium Chloride) is needed for the dry-salting of fatty fish

e) Too much Calcium may reduce the rate of salt penetration to an extent that spoilage may occur;

f) The size of the salt granules used should be carefully considered mixing of large and small particles could be considered for better products.

g) The use of very fine salt granules could result in the formation of clusters which is not favorable for ensuring the uniform distribution of salt on the fish.

h) The use of very coarse salt granules could result in damage to the fish flesh during salting and may reduce the rate of maturation;

i) Small crystals of salt should be used for dry-salting of fatty fish and large crystals for lean fish;

j) Salted fish should be sorted into species, sizes and graded according to trade quality categories for the relevant market;

k) Loose salt should be removed from the fish before sorting and new salt should be added before packaging; All the process should be done quickly to reduce spoilage

l) Mixture of large and small crystals should be used for dry salting with the large crystal twice as many as the small ones

m) The best fish for salting are small whole fish or fillets of larger fish. Large fatty fish should not be salted whole, instead split; remove the guts to expose a larger surface area for contact with salt.

n) Use 1kg of salt for every 3kg of split fish

o) In salting, processors should apply a thin layer of salt on the salting platform, then on the cut surface and lay the fish in a single layer on the platform, cut side down. After the first layer sprinkle with more salt, stack the next layer of fish over the first with skin side down

p) Alternate fish and salt layers and have skin against skin and cut surfaces against cut surfaces as a pile is worked out.

q) The skin must be uppermost on the last layer and covered with a thick layer of salt. Cover the pile.

r) Leave until the next day and restock using more salt as necessary, this helps to remove more water from the fish

s) For more salty fish stack for 24 hours and for less salty fish, leave the fish stacked for 6-12 hours only.

t) Large fish are split before salting, this increases the surface area and reduces the depth of the flesh which the salt has to penetrate

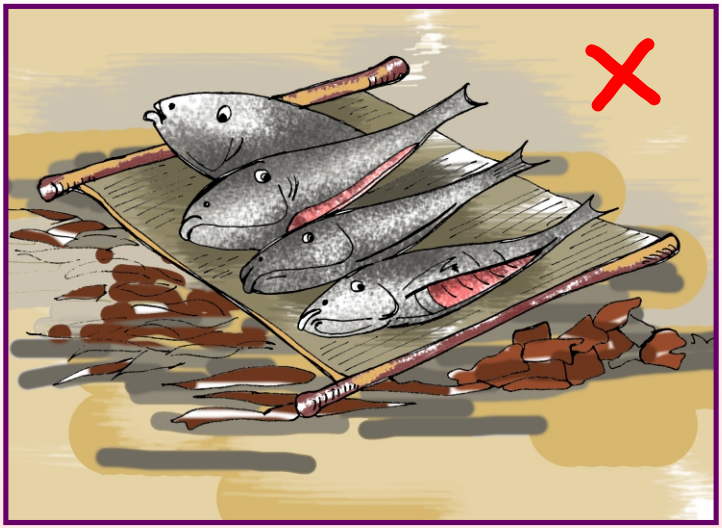
u) Always ensure clean product and work surfaces before salting

v) The workers should put on protective gear

1.1.8. DRYING

1.1.8.1 Bad practices

a) Drying fish on the ground
b) Inadequately dried fish
c) Improper or lack of drainage system
d) Lack of drying racks and drying wet fish on ground
e) Use of dirty materials such as tarpaulin to dry fish or sometimes drying wet fish direct on the ground
f) Carrying out drying in areas with potential for contamination from dust, vehicle or industrial fumes, waste and rain water run-offs etc...



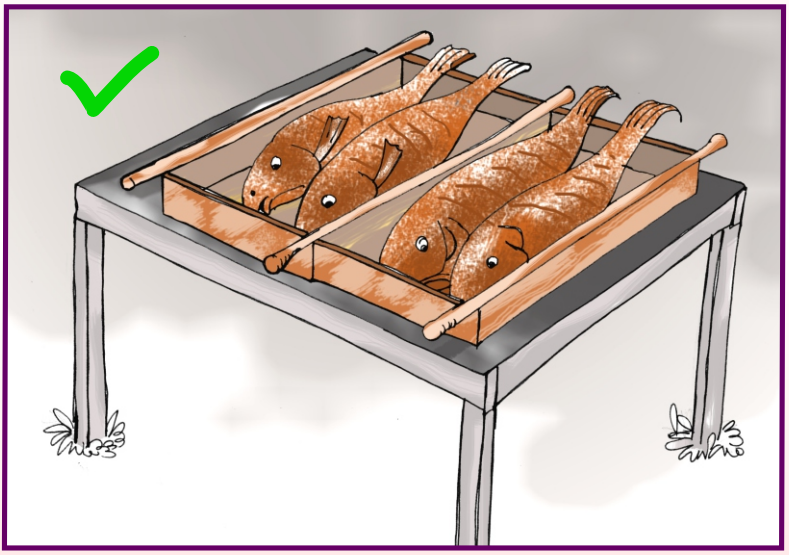
1.1.8.2 **Good Practices**

The best practice for drying fish under natural conditions is to:

a) Raise the fish above the ground by 1m, this increases air movement and allows air to pass under them, so the fish dry from both the upper and lower surfaces.

b) Fish placed on racks above the ground are less likely to be contaminated by dust or sand and are protected from animals,

c) Fish dried on racks can be easily protected from rain by covering them with plastic sheets. Fish on the ground can be protected from the rain but not from the muddy water on the ground.



d) Sloping racks allow any surplus water on the surface of the fish to drain away, e.g. water trapped in the gill or body cavities can cause spoilage and or increase the drying times.

e) Racks should be sited away from forests or high buildings which would reduce air movements.

f) It is important to remove the fish from the racks at night or during rain when humidity tends to rise. If fish are piled up overnight and covered with plastic, the absorption of water will be minimized, and they can be put out for further drying the next day.

g) If the fish are press piled at night by placing weights on top of stacks of fish, movement of water to the surface will be encouraged and the drying rate will be increased.

h) Drain and set to dry, if drying conditions are good, dry in the shade and not directly in the sun

i) Leave on the drying racks during the first night, thereafter, remove the fish and pile them up under pressure each night until drying is complete, using greater pressure and longer press times towards the end of the drying period

j) Continue to alternate drying and pressing until no further weight is lost, store and bale

k) Fish should not be dried on the ground since it easily gets infected with fly larvae that stay in soil and move to feed on feed.

l) Fish should be dried completely to avoid smell from off flavors which attract flies to the fish products

m) House flies lay eggs on fresh fish and during the early stages of drying. These flies become less attracted to the fish as they dry.

n) Sufficient and quick drying of the fish before the eggs hatch into larvae flies reduces the problem. Once fish has dried enough to stop fly problems, they become susceptible to beetle infestation.

o) Brining or salting before drying will often deter housefly attack.

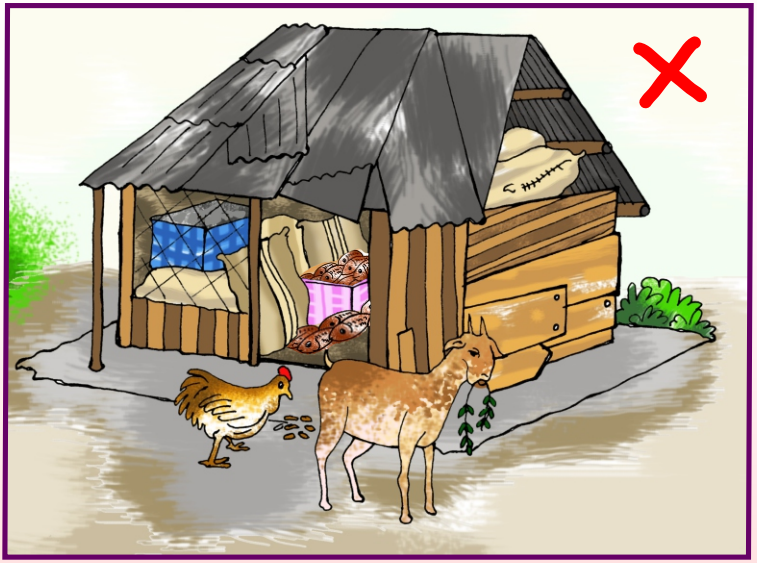
p) House fly infestation can be reduced by spraying a food grade contact insecticide below the drying racks. The insecticide should not be allowed to contaminate the fish and must be an acknowledged safe chemical for use near food.

q) Insecticide usage should be applied by properly instructed and trained people and used only if other preventative means such as the use of salt or improved drying techniques and better storage facilities have failed. A safe and effective insecticide which can be used to control flies and beetle infestation in fish is Pirimiphos-methyl, but producers must ensure a maximum residue limit of 10mg/kg.

1.1.9. STORAGE

1.1.9.1 Bad Practices

a) Use of exposed stores with no netting windows, locks etc
b) Limited or no aeration in the storage facility
c) Use of dirty storage areas
d) Storage of chemicals or substances in the same store with the fish
e) Storage of the product directly on the floor
f) Storage in areas already infested or with potential for infestation with rats and insects like cockroaches etc.
g) Locating stores to areas of potential contamination e.g next to toilets, garbage collection points or flood prone areas



1.1.9.2 **Good Practices**

a) Effective storage of salted/dried fish prevents the products from taking up water and becoming susceptible to spoilage.

b) Stores should be kept cool, dry and well ventilated

c) Buildings should be protected against the entry of insects, birds and rodents.

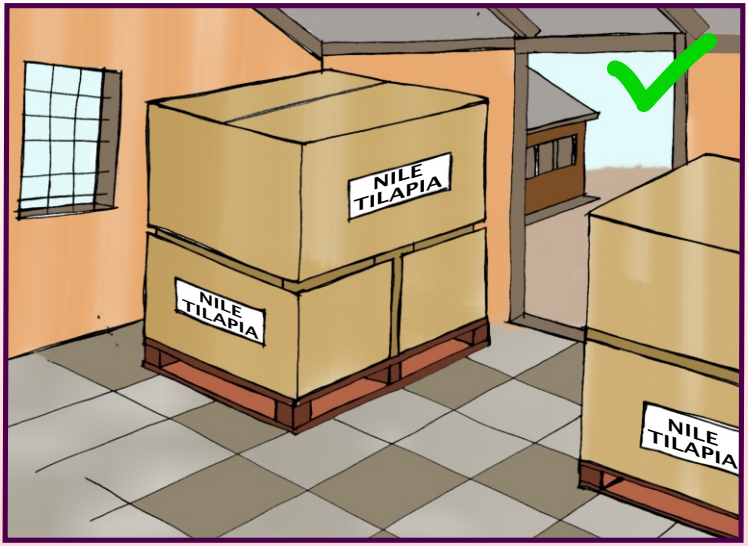
d) Keep away beetles which appear as small brown marks on the fish during storage, in humid conditions or if the fish has not been dried enough; keep stored fish covered, check stored fish regularly and sell the fish quickly

e) In the case of salted fish there is a bacterium which grows during storage in fish with high salt content to give pink marks. To prevent this, dry the fish well and keep it dry and use only good quality salt for drying.

f) To reduce exposure to flies, fish should be placed in covered containers during transport and storage.

g) Do not allow dust and other exhaust fumes from moving vehicles to contaminate the dried fish

h) Avoid the dried fish getting in contact with the ground; stack the fish on raised racks off the ground

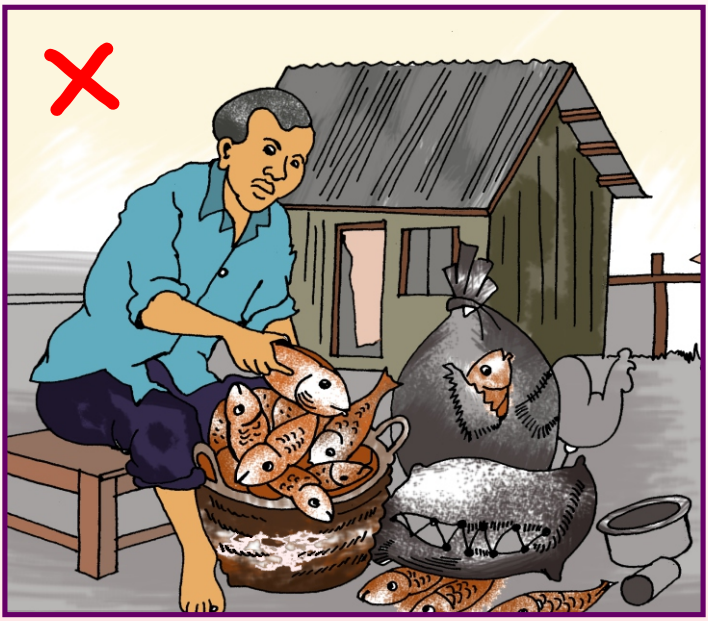


i) Use vermin control measures e.g. use of traps
j) Ensure proper location of the storage facility away from potential contaminants, vermin, dust, etc
k) Ensure proper shelter of the store and secure entry from unauthorized persons.

1.1.10. PACKAGING

1.1.10.1 Bad Practices

a) Use of improper packing materials and methods
b) Stacking of fish under high-pressure
c) Poor hygiene of packing materials
d) Poor hygiene of the packers
e) Packing of improperly dried fish



1.1.10.2 **Good Practices**

a) Fish should be packed in perforated dry bags or boxes to allow free aeration

b) A reasonable amount of fish should be placed in appropriate sizes of packages and avoid squeezing to much fish in small containers

c) Fish packers should observe good hygiene and packing should be undertaken in a hygienic environment

1.1.11. TRANSPORT TO MARKET

1.1.11.1 Bad practices

a) Transport means that allow dust, fuel exhaust fumes and rain or damp conditions to affect the fish

b) Stepping, sitting, stamping, sleeping etc on top of the fish transport truck

c) Transporting too much fish in smaller means of transport which results in stacking and squeezing too many packages and overloading

d) Use of slow means of transport that result in spoilage of fish before reaching the market

e) Use of poor roads with dust and mud, some which enter the product

f) Poor sanitation of transport trucks

g) Poor hygiene of personnel who come into contact with fish during transport

h) Transportation of fish with other merchandise in the same truck cabin

i) Transportation of fish by use of old and subserviced trucks which emit a lot of soot and break down resulting in delays

1.1.11.2 **Good Practices**

a) Ensure proper hygiene and sanitation of the transport vehicle

b) Cover the fish containing packages with a water resistant material say plastic sheet or tarpaulin to protect the product from dust or rain during transportation

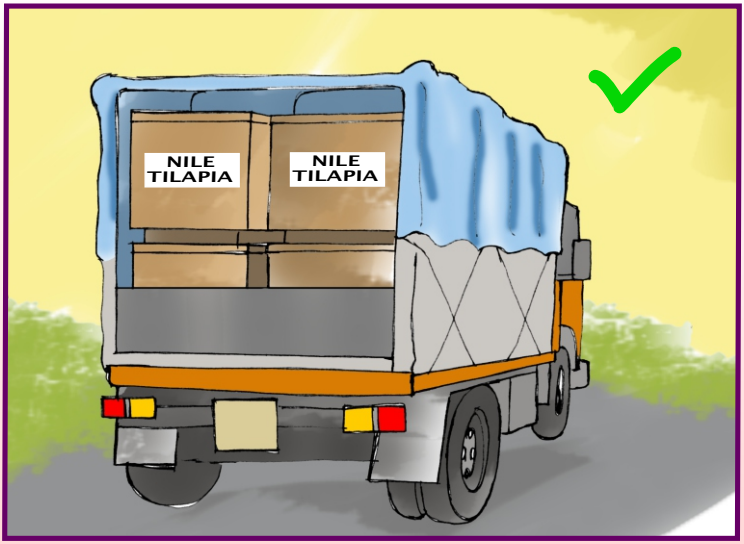
c) If possible, use covered vehicles that provide adequate shelter to fish

d) Do not transport fish with other merchandise in the same truck cabin. If so, ensure that all the merchandise are securely packed to avoid cross-contamination

e) Do not carry persons or their belongings in the same truck with fish

f) Old trucks or pickups which emit a lot of exhaust fumes should not be used to transport fish, or if so should be well serviced.

g) If alternative routes exist, avoid transporting fish on dusty and muddy roads.



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