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DRAFT TANZANIA STANDARD

Post-harvest handling and storage of wheat grain— Code of practice

TANZANIA BUREAU OF STANDARDS

0. Foreword

Post-harvest losses for wheat grain can occur at any points after harvest during drying, threshing, shelling, winnowing, sorting, aggregation, transport and storage. Reducing post-harvest losses can increase thevolume and value of grains within the market and available for consumption and sale.

This standard has been developed to take into account:

a) the needs of the market for the quality wheat grains;

b) the need to facilitate fair domestic, regional and international trade and prevent technical barriers to trade by establishing a common trading language for crop producers, buyers and sellers;

c) the needs of the producers in gaining knowledge of market standards, conformity assessment and post-harvest handling;

d) the need to transport the product in a manner that ensures keeping of quality until it reaches the consumer;

e) the quality and safety parameters of the product should meet before they are put on the market; and

f) the need to promote good agricultural practices that will enhance wider market access, involvement of small-scale traders and hence making farming a viable means of generating income.

Harvest and post-harvest handling of wheat grain — Code of practice

1. Scope

This Tanzania Standard specifies the code of practice for harvest and post-Harvest Handling of common wheat grain (*Triticum aestivum L*.), club wheat grain (*T. compactum Host*.), and durum wheat grain (*T. Durum Desf*.) intended for human consumption.

2. Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

TZS 437, *Wheat grain — Specification*

3. Terms and definitions

For the purposes of this standard, the following terms and definitions should apply

3.1

wheat grain

grain obtained from the varieties of species of common wheat (*Triticum aestivum* L.), club wheat (*T.compactum* Host.), and durum wheat (*T. Durum* Desf.)

3.2

harvesting

operation of gathering mature earheads

3.3

drying of earheads

operation during which the harvested plant with earheads are dried to the desired moisture content so as to undergo the next operation of threshing

3.4

threshing

operation of separating the grains from the crop with mature earheads

3.5

winnowing

operation of blowing air through grains in order to remove the chaff

3.6

drying of wheat grains

operation during which wheat grains are dried to the safe storage moisture content

3.7

moisture content

amount of water in the grain expressed as percentage of the total weight of the sample

3.8

transportation

process of moving of earheads/grains of wheat from one location to a n other during different unitoperations of post-harvest handling

3.9

post-harvest losses

measurable quantitative and qualitative loss of wheat grains occurred during the various post-harvestoperations like harvesting, threshing, drying, cleaning, transporting and storage

3.10

quantitative loss

reduction in weight and volume

3.11

qualitative loss

loss which occurs as a result of degradation of physical, chemical and biological properties, under the effect of environmental conditions

3.12 pest
any living thing whether plant, animal or fungus which impart trouble to human being or their possession or enviroment

4. General guidelines

Throughout the whole process of harvest and post-harvest handling the following should be considered:

a) the products being handled should comply with TZS 437;

b) hygiene conditions should be maintained throughout the whole process of post-harvest handling and storage as per TZS 109;

c) facilities, materials and equipment used should comply with the requirements of relevant standards;

d) chemicals and their use should comply with relevant standards and regulations; and

e) measures should be taken to prevent attacks by pests such as insects, moulds and rodents throughout the post harvest handling and storage process(for the control of pest refer to Annex A).

5. Specific guidelines

i. Pre-harvesting

. Pre-harvesting should consider the following:

a) prior to the harvest, it is important that farmers are already prepared for their harvesting and postharvest activities and they should ensure that:

   i. the equipment needed for their harvest and postharvest activities are available and in good workingcondition;

   ii. the place of important activities like drying and threshing has been identified;

   iii. there should be sufficient storage space for the crop;

   iv. the grain stores and food grade packaging materials have been thoroughly cleaned;

   v. the residues of the old harvest (last season's crop) has been removed from all cracks and crevices anddisposed in a hygienic manner;

b) farmers should ensure the timely harvest of the wheat grain crop to avoid losses and the following should be considered:

   i. the time of harvesting can be identified by the change of colour of the plant from green to yellow showing the maturity of grains;

   ii. not to wait for stalks and leaves to dry because they remain green in most of the hybrid and composite varieties;

iii. farmers can collect a wheat grain from its panicle in the field itself and test the hardness, size, shape and maturity of the grain and decide the time of harvesting.

c) avoid pest infestation prior to harvesting; and

ii. Harvesting

Harvesting activity should be done as follows:

a) the wheat grain should be cut at the stalk 5 cm - 7 cm above the ground level;

b) wheat grain should be harvested when the grains are hard and matured with optimum moisture content of 17-20 % to avoid field loss of grains by shattering

c) harvesting before maturity means a low milling recovery and also a higher proportion of immature seeds, high percentage of broken kernels, poor grain quality and more chances of disease attack during storage of grain

d) delay in harvesting results in grain shattering and cracking of wheat grain kernels and expose the crop to insects, rodents, birds and pests attack, as well as lodging

e) harvesting during wet weather conditions should be avoided;

f) harvesting should be done by adopting proper method and avoid missing of the secondary tiller panicles;

g) the harvested crop should be tied into a bundle and carry it to threshing yard without much transportation loss;

h) the harvested material should be protected from rain and excessive dew by covering;

i) harvested wheat grain should be kept separately for each variety, to get true to type variety (grains);

j) contact of the ear heads with soil should be avoided, as it can be source of contamination or attack by insects; and

k) harvested wheat grain should be transported immediately to the threshing yard.

iii. Threshing

Threshing should be done as follows:

i. the machine used for threshing should comply with relevant standards

ii. threshing may be done by manual methods or by power operated multi crop thresher for large quantities;

iii. when power operated threshers are used, should ensure the percentage of broken grains is minimized.

iv. power operated thresher should have operator safety arrangements as per the relevant standard; and

v. threshing machine should not be a source of contamination such as rust, paint, grease.

iv. Drying of wheat grains

The following should be considered in drying of wheat grains:

a) drying of the wheat grains should be done immediately after threshing

b) wheat grains should be dried to 14 % moisture content prior to packaging and storing;

c) the drying area (concrete floor, tarpaulin) should be clean and not be a source of contamination to the wheat grains; and

d) where heated air is used to dry the grains, temperature and drying time should be synchronized so that theydo not result in adverse effect on the nutritional composition and quality of the grains in its intended use

v. Cleaning and sorting

Cleaning may be done manually or by using machine: in order for the grains to comply with the requirements specified in TZS 437.

a) when power operated cleaning machine is used, care should be taken by adjusting the fan speed to reduce the loss of grain in the chaffy outlet;

b) the grains should be aspirated to remove all the straws, chaff and leafy vegetative matter;

c) defective (mouldy, discoloured, shrivelled, rotten, broken, insect damaged, etc) grains should be removed;

d) grading should be in accordance with TZS 437.

e) Wheat grain may be treated with permitted pesticide to eliminate or prevent the pest from attacking the grains (pest infestation)

vi. Storage of wheat grain

The storage facilities should consider the following;

(i) be well managed with good storage practices before and during storing the grains such as cleaning and fumigation;
(ii) they should have sufficient ventilation and aeration;
(iii) There should be a pre-cleaning facilities or machineries before storage to minimize impurities;
(iv) conduct regular inspection for any sign of infestation;

(v) Use pallets to avoid storage of wheat grain with direct contact with the floor;

(b) In case of bulk storage the storage facility should consider the following;
i. wheat grain may be stored in concrete or metallic silo's or any other storage facility before packaging.
ii. the storage Silo or facilities should conform to the relevant standard or requirements
iii. The storage condition (temperature and humidity) should be regulary monitored by the relevant tools for controlling the heat distribution within the structure.

vii. Packaging

Wheat grains should be packaged according to the following:

a) wheat grain should be packed in food grade packaging materials which should safeguard the hygienic, nutritional,and organoleptic qualities of the products;

b) each package should contain grains of the same type and of the same grade designation

c) each container should be securely closed

vii. Transportation

Transportation of wheat grains should consider the following:

a) the grains may be transported in vehicle itself (bulk) or in transportable container then the vehicle and container should be clean, dry and free from undesirable odours and infestation;

b) wheat grain should be handled and transported in such a way so that they remain well protected from sun, rain or other sources of excessive heat, objectionable odour and from any type of cross infestation

c) if the vehicle is not fully enclosed, it should have a covering such as tarpaulin to keep out of the rain or anyform of water;

d) transported grains should be well ventilated with dry air to remove moisture resulting from respiration of the grains and to prevent moisture condensation; and

e) transportation of wheat grains with chemicals and products in liquid form should be avoided

6. Major storage pests

Measures should be taken to control insect infestation using either physical, chemical, mechanical or biological means or combinations of these methods. Assistance may be obtained from extension officers/agricultural officers and other authorized pest control experts on the respective areas in identification and control of storage pest. The prevalent list of storage pest are given in Annex A.

Annex A (informative)

Major stored grain pests of wheat grain and their control measures

Name of pest and figure of pest	Damage
1.Grain Weevil Sitophilus granarius (L.)(Calandra granaria (L.)	Larvae and beetles feed ongrains. Adults feed on flour, massinfestation makes grain moist and warmleading to mould infection.
2.Lesser rice Weevil / *Sitophilus oryzea (*L)/ Greater Rice Weevil *S.Zeamais (Motsch)*	Adults and larvae feed on grains and flour. Larvae bore into grains and feed on the grain.

3.Lesser grain borer *Rhizopertha dominica (Fabr.)*	Beetles and larvae bore the grains and feed. The larvaefeed on flour. Heavy infestation makes the grain warm and moist, which leads to mould formation	
4.Khapra beetle *Trogoderma granarium Ev*	The larva is a very serious stored product pest; the beetle does no damage. The grains are often hallowed out until only the husk remains.	
5.Rust-red and confused flour beetle *Cryptolestes ferrugineus (Steph.) / Tribolium Confusum J.Du V.*	Beetles and larvae feed on undamaged and broken kernel, common mill pest, flour develops sharp odour if badly infested.	

6.Drugstore beetle *Stegobium paniceum (L.)*	The larva is omnivorous, feeds ona wide range of plant materialsand grain. The badly infested grains are full of small round holes.	
7.Saw Toothed grain beetle *Oryzaephilus surinamensis (L.)*	Both beetle and larvae feed on broken grains and attack grains, already infested by other insects. It is a secondary pest together with other grain pests.	

8.Cadelle *Tenebroides mauritanicus (L.)*	It damages grains.	
9.Angoumois grain moth *Sitotroga cerealella (Oliv.)*	It attacks in field also, but mostly in storage, causing loss of weight upto 50 per cent. Badly infested grain has a sickening smell and taste that makes it unpalatable.	
10.Mediterranean Flour *Moth Ephestia (Anagasta) kuehniella Zell.*	The caterpillar feeds on flour, bran, whole grains.	

11.Warehouse Moth *Ephestia elutella (Hubn.)*	The caterpillars attacks grain.	
12.Indian Meal Moth *Plodia interpunctella (Hubn.)*	Attacks grain and grain products, whereby only the grain germs are eaten.	
13.Rodents *Rattus norvegiens (Brown rat), R.Rattus Rattus (Black rat) , Bandicota bengalensis (Indian mole rat), Mus musculus (House mouse)*	Rodents feed on whole and broken grains, flour etc. They spoil more wheat grain than they eat by contaminating it with hair, urine and fasces	

		are put in each hole and burrow and holes are blocked by mud mixture to make airtight.