

PHILIPPINE NATIONAL STANDARD

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**Code of practice for the prevention and reduction of
aflatoxin contamination in corn**



BUREAU OF PRODUCT STANDARDS
Department of Trade and Industry

Member to the International Organization for Standardization (ISO)
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Foreword

The PNS Code of Practice for the Prevention and Reduction of Aflatoxin Contamination in Corn was prepared by the Technical Working Group on Corn Quality Management (TWG-CQM) chaired by the Bureau of Agriculture and Fisheries Product Standards (BAFPS) created per Special Order No. 111 dated 30 January 2007. In close coordination with the TWG-CQM members, series of technical reviews and public consultations were conducted to gather inputs from different corn stakeholders on the draft standard for the Code.

This Code of Practice for the Prevention and Reduction of Aflatoxin Contamination in Corn will provide uniform guidance for all corn stakeholders as well as serve as common reference and basis for compliance to Good Agricultural Practices (GAP) for corn. This code will provide adequate measures to manage aflatoxin contamination in the supply chain following the framework of farm to table approach to food safety and will also provide guidance to all persons involved in producing and handling corn for entry into local and international trade intended for human and animal consumption. Among the identified mycotoxins, the aflatoxin has been identified by the World Health Organization (WHO) as a significant source of food borne illnesses.

1 Scope

This document is intended to provide guidance to all persons involved in producing and handling corn for entry into local and international trade intended for human and animal consumption. This code constitutes from on-farm production to on-farm/off-farm storage. This code of practice recommends measures that should be implemented by all persons that have the responsibility of assuring that food and feed are safe from aflatoxin.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Definitions

3.1

aflatoxin

a group of toxic compounds which are carcinogenic (cancer causing), produced by strains of the fungi, *Aspergillus flavus* and *Aspergillus parasiticus* on suitable hosts/substrates such as corn, peanut, copra, cassava and other oilseeds

3.2

corn stakeholders

includes corn farmers, traders and users

3.3

corn

corn on cob and shelled corn of *Zea mays* L

3.4

moisture content (MC)

the amount of moisture in the corn on cob or shelled corn expressed in per cent (%)

3.5

physiological maturity

refers to the required number of days of the corn to mature (days to maturity) usually characterized by the presence of the black layer at the base of the corn kernel. The black layer indicates that the corn is already mature. This is also evidence that there is no more food movement from the mother plant to the kernel, and therefore, there is no increase in weight of the kernel

4 Recommended practices based on good agricultural practices (GAP) for corn

4.1 Farm production practices

4.1.1 Observe proper land preparation for healthy and uniform growth of the corn plant.

4.1.2 Production areas must be kept clean and tidy at all times. Field sanitation practices must always be maintained. Farm debris and/or weeds should be plowed-under to bring back fertility of the soil. If possible, a 1 month to 2 months fallow period will be observed before planting.

4.1.3 Use varieties or hybrids that are adaptable to the locality and approved by National Seed Industry Council (NSIC) as seed material.

4.1.3 Maintain the recommended row and plant spacing to avoid overcrowding. Overcrowding of plants may lead to humid and warm conditions in the canopy which favors insect, microorganism and disease development. It can also result in reduced yield due to competition for soil nutrients and sunlight.

4.1.4 Observe the appropriate method and time in applying the recommended combination and amount of fertilizers based on the result of soil analysis. Nutrient deficiencies or over fertilization particularly nitrogen (N) may lead to greater susceptibility to insect pests and diseases.

4.1.5 Seed inoculant may be used to supplement part of the corn plant nutrient requirement.

4.1.6 Apply Integrated Pest Management (IPM) using biological control agents and natural enemies of pests and disease causing organisms and the proper use of pesticide only when necessary.

4.1.7 Practice appropriate weed control measures such as proper land preparation, off-barring at 12 to 15 days after planting (DAP) and/or hilling-up at 25 to 30 DAP to minimize weed population. Care should be taken during cultivation to avoid damage to the plant.

4.1.8 Maintain the water requirement to avoid moisture stress particularly during flowering up to the maturation stage. At these stages, the crop is more susceptible to aflatoxin contamination.

4.1.9 If detopping of corn plants is to be practiced, this should be done after physiological maturity has been attained. Early detopping could lead to shriveled and inferior corn grains.

4.1.10 Practice crop rotation to minimize build-up of aflatoxin producing fungi inherent in the soil.

4.2 Practices during harvest

4.2.1 Farm workers involved in harvesting and succeeding operations should wear appropriate clothing and protective gadgets such as long sleeves and dust mask.

4.2.2 Harvest corn at physiological maturity as recommended (approximately 100 to 120 DAP for yellow corn and 90 to 100 DAP for white corn). Harvesting should be completed in the shortest time possible especially during rainy season. Care must be exerted to prevent damage and contamination of corn ears with soil. Use clean mats, screens and/or other suitable underlays to prevent corn ears from soil or foreign matter contamination.

4.2.3 As much as possible, harvesting should be done on sunny days.

4.2.4 Dehusking is discouraged during rainy season. Air-dry immediately the unhusked ears in a well ventilated area to minimize fungal contamination.

4.2.5 Use clean bags or other suitable containers for the newly harvested corn ears.

4.2.6 Before using machines for harvesting and other post harvest operations, ensure that all the equipment to be used are functional, clean and well-maintained to minimize undue damage to the grain.

4.2.7 Sort-out and discard corn ears that show visible signs and symptoms of insect or microbial damage.

4.2.8 Discarded corn ears should be disposed in a compost pit away from the production area.

4.3 Practices after harvest

4.3.1 Hauling and piling

Haul newly harvested corn ears immediately after harvest. Hauling or transport facilities (e.g. wagons, trucks) to be used for collecting and transporting the harvested corn from the farm to drying facilities or to storage area should be clean, dry, and free from insects and visible microbial growth.

4.3.2 Shelling

4.3.2.1 Use clean, dry and properly calibrated mechanical sheller to minimize mechanical damage to the kernels and further avoid aflatoxin contamination.

4.3.2.2 Before shelling, dry the corn ears to at least 21 % MC to minimize grain damage. At this MC, the seed coat is tougher and can overcome mechanical damage brought about by the shelling machine.

4.3.2.3 Use clean and dry containers of the shelled corn.

4.3.3 Drying

4.3.3.1 In case of solar drying, the shelled corn should be protected from direct contact with the soil. Avoid mixing of dry grain with wet grain or any foreign matter.

4.3.3.2 If immediate drying is not feasible, temporary store the corn ears in cribs or other well-ventilated structures to prevent heat build-up and microbial growth.

4.3.3.3 Within 48 hours after shelling, dry the corn grains to 13 % to 14 % MC. When using a mechanical dryer, the air-drying temperature should be within 43 °C to 50 °C. Do not expose corn grains to higher temperature to avoid stress cracks.

4.3.3.4 Ensure that corn has been dried uniformly to 13 % to 14 % MC. This can be determined with the use of a calibrated moisture tester. The measurement of the moisture content of the corn should be determined from a representative sample randomly taken from the whole batch.

4.3.3.5 Use clean suitable containers for the dried corn grains.

4.3.4 Transport

4.3.4.1 The corn should be moved to a suitable storage or processing area as soon as possible after drying.

4.3.4.2 Avoid grain moisture accumulation during transport by using an appropriate covering for the container. Corn grains to be transported should be properly stacked inside the transport vehicle and covered with tarpaulin sheets.

4.3.5 Storage

4.3.5.1 The storage structure should be made of durable materials and should be able to withstand strong winds, rain and earthquakes. It should be situated in areas where there is no flooding. The design of the warehouse should be able to meet the following minimum requirements namely:

- a. prevent re-wetting of dry corn grains;
- b. prevent entry of insects, birds and rodents; and
- c. provide good ventilation to the stored corn.

4.3.5.2 During storage, follow the first-in first-out (FIFO) principle.

4.3.5.3 The MC of corn should be maintained at 13 % to 14 % at all times in storage to prevent the growth of *A. flavus* and/or *A. parasiticus*.

4.3.5.4 Observe uniform piling of bagged corn grains inside the warehouse to allow good ventilation.

4.3.5.5 Maintain cleanliness at all times to prevent insect infestation and disease infection.

4.3.5.6 Periodically measure the temperature of the stored corn during storage. A temperature rise may indicate microbial growth and/or insect infestation. Visually check corn for evidence of mould growth and separate the infested / infected portion. Subject infested/infected samples for aflatoxin analysis if possible.

4.3.5.7 If the corn stocks will be stored for more than a month, it should be treated with the recommended pesticide to be applied by a trained pesticide applicator following the dosage as stated in the label.

5 Record keeping and documentation

Document all activities in the production, harvesting and post harvest operations including the environmental conditions during each activity. Keep records on the data monitoring of temperature, moisture and humidity and any deviation or changes from traditional practices if measuring instruments are available. In its absence, record observations that deviate or substantially affect the normal growth of the crop such as drought, typhoon and excessive rainfall. These information may be very useful in explaining the causes of fungal growth and aflatoxin formation during a particular crop year.

References

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The following referenced documents are indispensable for the application 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:

CAC/RCP 55. 2004. Code of Practice for the Prevention and Reduction of Aflatoxin Contamination in Peanuts. 7 pp.

CAC/RCP 51. 2003. Code of Practice for the Prevention and Reduction of Mycotoxin Contamination in Cereals, including annexes on Ochratoxin A, Zearalenone, Fumonisin and Tricothecenes. 8 pp.

CAC/RCP 45. 1997. Code of Practice for the Reduction of Aflatoxin B₁ in Raw Materials and Supplemental Feeding Stuffs for Milk Producing Animals. 4 pp.

DA-BAFPS. 2004. Philippine National Standards (PNS) for Shelled Corn. 10:2004.

DA-BAFPS. 2004. Philippine National Standards (PNS) for Corn Grits. 15:2004.

Department of Agriculture (Labois, R. V. et. al) (eds). 2004. Integrated Crop Management Module and Manual. Department



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