

1 Foreword

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3 The Philippine National Standard (PNS) Code of practice for the prevention and
4 reduction of aflatoxin contamination in corn (PNS/BAFPS 27:2008) was developed to
5 provide uniform guidance for all corn stakeholders, as well as serve as common reference
6 and basis for compliance to Good Agricultural Practices (GAP) for corn. This code
7 provides adequate measures to manage aflatoxin contamination in the supply chain
8 following the framework of farm to table approach to food safety. It also provides
9 guidance to all persons involved in producing and handling corn intended for human and
10 animal consumption for entry into local and international trade.

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12 In 2017, the Bureau of Agriculture and Fisheries Standards (BAFS) took the initiative to
13 revise the Standard to account for results of recent studies and advances for the
14 prevention and reduction of aflatoxin contamination in corn. This revision is in
15 accordance with the protocol of the Bureau's Standards Development Division (SDD) to
16 review and, if applicable, revise standards every two (2) years, especially those that pose
17 risk to consumer safety and health. A Technical Working Group (TWG) for the revision of
18 the Standard was created and authorized under Special Order No. 523 Series of 2017.
19 The TWG was composed of the following agencies and institutions: National Food
20 Authority (NFA), National Food Authority – Food Development Center (NFA-FDC),
21 Bureau of Animal Industry (BAI), Food and Nutrition Research Institute (FNRI),
22 Philippine Center for Postharvest Development and Mechanization (PHilMech),
23 University of the Philippines Los Baños (UPLB), and Department of Agriculture (DA) –
24 Corn Program.

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26 This document was drafted in accordance with the editorial rules of the BPS Directives,
27 Part 3.

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29 This Standard cancels and repeals PNS/BAFPS 27:2008.

30 **1 Scope**

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

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38 **2 Normative references**

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40 The following documents, in whole or in part, are normatively referenced in this
41 document and are indispensable for its application. For dated references, only the edition
42 cited applies. For undated references, the latest edition of the referenced document
43 (including any amendments) applies.

44

45 *PNS/BAFPS 20:2008, Good Agricultural Practices (GAP) for Corn*

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47 **3 Terms and definitions**

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49 For the purposes of this Code, the following terms and definitions apply:

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51 **3.1**

52 **aflatoxin**

53 group of highly poisonous and carcinogenic compounds which are produced by strains
54 of the fungi, *Aspergillus flavus* Link and *Aspergillus parasiticus* Speare on suitable
55 substrate such as corn, peanuts, copra, and other oilseeds, etc. Aflatoxin content is
56 expressed in µg/ kg

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58 **3.2**

59 **corn stakeholders**

60 includes corn farmers, traders and users

61

62 **3.3**

63 **corn**

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

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66 **3.4**

67 **foreign matter**

68 all matters other than corn grains such as sand, gravel, dirt, pebbles, stones, lumps of
69 earth, clay mud, chaff, straw and seeds of other crops

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71 **3.5**

72 **moisture content (MC)**

73 amount of moisture in the corn on cob or shelled corn expressed in percent (%)

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78 **3.6**79 **physiological maturity**

80 required number of days of the corn to mature (days to maturity) usually characterized
81 by the presence of the black layer at the base of the corn kernel. The black layer indicates
82 that the corn is already mature

83

84 **4 Recommended practices based on good agricultural practices (GAP) for corn**

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86 **4.1 Farm production practices**

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88 4.1.1 Observe proper land preparation for healthy and uniform growth of the corn plant
89 as recommended by the PNS for GAP Corn (PNS/BAFS 20:2008).

90

91 4.1.2 Production areas must be kept clean and tidy at all times. Field sanitation
92 practices must always be maintained. Farm debris as sources of inoculum must be
93 removed to manage population of *A. flavus* or *A. parasiticus*. If possible, a one (1) month
94 to two (2) months fallow period will be observed before planting.

95

96 4.1.3 The recommended practices for soil and soil nutrients are in accordance with the
97 PNS for GAP Corn (PNS/BAFS 20:2008).

98

99 4.1.4 Use varieties or hybrids that are adaptable to the locality and approved by
100 National Seed Industry Council (NSIC) as seed material.

101

102 4.1.5 Maintain the recommended row and plant spacing and thin to optimum
103 population density to avoid overcrowding. This can result in reduced yield due to
104 competition for soil nutrients and sunlight. Overcrowding of plants may lead to humid
105 and warm conditions in the canopy which favors insect, microorganism, and disease
106 development. To reduce sources of infection, roguing of diseased plants should be
107 implemented.

108

109 4.1.6 Observe the appropriate method and time in applying the recommended
110 combination and amount of fertilizers based on the result of soil analysis. Nutrient
111 deficiencies or over fertilization particularly nitrogen (N) may lead to greater
112 susceptibility to insect pests and diseases.

113

114 4.1.7 Seed inoculant may be used to supplement part of the corn plant nutrient
115 requirement.

116

117 4.1.8 Apply Integrated Pest Management (IPM) such as using biological control agents
118 and natural enemies of pests and diseases, and the proper use of pesticide only when
119 necessary.

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121 4.1.9 Practice appropriate weed control measures such as proper land preparation, off-
122 barring at 15 to 20 days after planting (DAP), and/or hilling-up at 25 to 30 DAP to
123 minimize weed population. Care should be taken during cultivation to avoid damage to
124 the plant.

125

126 4.1.10 Maintain the water requirement to avoid moisture stress particularly during
127 flowering up to the maturation stage, if applicable. At these stages, the crop is more
128 susceptible to aflatoxin contamination.

129
130 4.1.11 If detopping of corn plants is to be practiced, this should be done after
131 physiological maturity has been attained. Early detopping could lead to shriveled and
132 inferior corn grains.

133
134 4.1.12 Practice crop rotation to minimize build-up of aflatoxin producing fungi inherent
135 in the soil.

136

137 **4.2 Practices during harvest**

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139 4.2.1 Farm workers involved in harvesting and succeeding operations should wear
140 appropriate clothing and protective gadgets such as long sleeves and dust mask.

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142 4.2.2 Harvest corn at physiological maturity as recommended (approximately 100 to
143 120 DAP for yellow corn and 90 to 100 DAP for white corn). Harvesting should be
144 completed in the shortest time possible especially during rainy season. Care must be
145 exerted to prevent damage and contamination of corn ears with soil. Use clean mats,
146 screens, and/or other suitable underlays to prevent corn ears from soil or foreign matter
147 contamination.

148

149 4.2.3 As much as possible, harvesting should be done on sunny days.

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151 4.2.4 Dehusking is discouraged during rainy season to prevent *A. flavus* infection.

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153 4.2.5 Air-dry immediately the unhusked ears in a well-ventilated area to minimize
154 fungal contamination.

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156 4.2.6 Use clean bags or other suitable containers for the newly harvested corn ears.

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158 4.2.7 Before using machines for harvesting and other post-harvest operations, ensure
159 that all the equipment to be used are functional, clean, and well-maintained to minimize
160 undue damage to the grain.

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162 4.2.8 Sort-out and discard corn ears that show visible signs and symptoms of premature
163 sprouting, insect damage, or microbial infection.

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165 4.2.9 Discarded corn ears should be disposed in a compost pit away from the
166 production area. The recommended depth of the compost pit is one to two (1-2) meters.

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168 **4.3 Practices after harvest**

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170 **4.3.1 Hauling and piling**

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172 Haul newly harvested corn ears immediately after harvest. Hauling or transport facilities
173 (e.g. wagons, trucks) to be used for collecting and transporting the harvested corn from

174 the farm to drying facilities or to storage area should be clean, dry, and free from insects
175 and visible microbial growth. For corn ear with husk, the recommended maximum days
176 of piling is three (3) days.

177

178 **4.3.2 Shelling**

179

180 4.3.2.1 Clean, dry, and properly calibrated mechanical sheller should be used to minimize
181 mechanical damage to the kernels and further avoid aflatoxin contamination.

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183 4.3.2.2 Before shelling, dry the corn ears to 18-20% MC to minimize grain damage. At this
184 MC, the seed can overcome mechanical damage brought about by the shelling machine.

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186 4.3.2.3 Shelled corn should be placed in clean and dry sack containers. Avoid using
187 containers previously used for fertilizer.

188

189 4.3.2.4 If immediate shelling is not possible, temporarily store the corn ears in cribs or
190 any structure with good ventilation.

191

192 **4.3.3 Drying**

193

194 4.3.3.1 Dry the corn grains to 13 to 14 % MC within 48 hours after shelling. Ensure that
195 corn has been dried uniformly to 13 % or 14 % MC. This can be determined with the use
196 of a calibrated moisture tester. The measurement of the moisture content of the corn
197 should be determined from a representative sample randomly taken from the batch.

198

199 4.3.3.2 When using a mechanical dryer, the air-drying temperature should be within 43°C
200 to 50°C. Do not expose corn grains to higher temperature to avoid stress cracks.

201

202 4.3.3.3 In case of sun drying, the shelled corn should be protected from direct contact
203 with the soil. Avoid mixing of dry grain with wet grain or any foreign matter.

204

205 4.3.3.4 If immediate drying is not possible, temporarily store the corn ears in cribs or
206 other well-ventilated structures to prevent heat build-up and microbial growth.

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208 4.3.3.5 Clean suitable containers should be used for the dried corn grains.

209

210 **4.3.4 Transport**

211

212 4.3.4.1 The bagged corn grains should be moved to a suitable storage or processing area
213 as soon as possible after drying.

214

215 4.3.4.2 To avoid re-wetting of bagged corn grains during transport, appropriate covering
216 for the container should be used. Bagged corn grains to be transported should be
217 properly stacked inside the transport vehicle.

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221

222 **4.3.5 Storage**

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224 4.3.5.1 The storage structure should be made of durable materials and should be able to
225 withstand strong winds, rain, and earthquakes. It should be situated in areas where there
226 is no flooding. The design of the warehouse should be able to meet the following
227 minimum requirements, namely:

228

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

232

233 4.3.5.2 During storage, follow the first-in first-out (FIFO) principle.

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235 4.3.5.3 The MC of corn should be maintained at 13 to 14 % at all times in storage to
236 prevent the growth of *A. flavus* and/or *A. parasiticus*.

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238 4.3.5.4 Observe proper piling of bagged corn grains inside the warehouse.

239

240 4.3.5.5 Maintain cleanliness at all times to prevent pest infestation and disease infection.

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242 4.3.5.6 Periodically measure the temperature of the stored corn during storage. A
243 temperature rise may indicate microbial growth and/or pest infestation. Visually check
244 corn for evidence of mold growth and separate the infested/ infected portion. Subject
245 infected samples for aflatoxin analysis if possible.

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247 4.3.5.7 If the corn stocks will be stored for more than a month, pest control
248 administration should be in accordance with PNS Good Warehousing Practices for
249 Bagged Grains (PNS/BAFS 193:2017).

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