

codex alimentarius commission



FOOD AND AGRICULTURE
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DRAFT CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF AFLATOXIN CONTAMINATION IN TREE NUTS COMMENTS AT STEP 6

(IN RESPONSE TO CL 2004/27-FAC)

The following comments have been received from: Brazil and Venezuela

BRAZIL:

The current proposed text for the Code of Practice for the Prevention and Reduction of Aflatoxin in tree nuts, it introduces some concepts or inapplicable or inadequate practices which concerns to the extrativist process, of very peculiar character as the one of the exploration of Brazil nuts, since the same doesn't consider specific aspects as the widespread geographical dimension, infra-regional structure conditions, the complicated access to the regions producers and the formation difficult logistics, product lots transportation and commercialization.

It allies still to the cited factors, the enough favorable climatic variables to the fungi development, like high temperatures and humidity during all year, inclusive at that time of product crop, of difficult control in the forest environment and during the product fluvial transportation. And also, the incipient base of technical nowadays existing information regarding contamination behavior or specific characteristic of the product. important to determine or to indicate aflatoxina control more effective applicable along the productive chain.

There isn't commercial plantings of the Brazil nuts. All the producer area is native and characterized for more or less homogeneous concentrations of brazil nuts trees, located in the middle of the amazon forest, being next or not to the product flow ways (usually rivers and igarapés; eventually highways), being characteristic of the extrativistic process, the widespread geographical dimension of the region producer, the difficult access to the producer's areas , the storage rustic structures existence and the typical means of transportation use of the region, like animal, tractors, trucks, canoes, small boats, rafts, among others.

The chestnuts or seeds, in number of 15 to 25 units or seeds, they find lodged inside the chestnut fruit, denominaded hedgehog, of global format, with thick and hard peel, measuring of 8 to the 15 diameter cm. The pods collection period, process that consists in the catches of the same by collectors under the chestnuts (trees with average of 20 mts of height), happens usually after the fruits natural fall period, due to the accidents risk (each hedgehog weighs on an average 1Kg). Therefore, is difficult to establish product common rule or minimum period of permanence in the collection location or in the warehouses, because the

same is variable, depending on the access conditions, distance among Brazil nuts trees native and processing companies, commercialization used means of transportation and flow.

The implementation of the product practices and handling, by the geographical dimension and the nature of the extrativistic process in the Amazon region, constitutes, is an enterprise of average and long terms of gradual implantation, already unchained by the Agriculture Department, Cattle breeding and Supply, with local governments involvement, class entities and representations, Universities, Research Institutes, Science and Technology and too much segments affections to the contamination problem management.

By the exposed, for the necessary adaptation of the Code of Practice in analysis to the specific conditions of Brazil nuts, that considers all the complexity and different nature from the extrativistic process and foresee possible measures of are undertaken, we plead that be respected the Code current text alteration proposals of Project the Code of Practice for Prevention and Reduction the Aflatoxin in Tree nuts, mostly that is contained in the item 3.2, they that are referred the special practices for the product, included a terms glossary and the relative section to the safety and quality system the being adopted in the future, item 4.1 of the cited code.

PROPOSED DRAFT CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF AFLATOXIN CONTAMINATION IN TREE NUTS (AT STEP 5 OF THE PROCEDURE)

INTRODUCTION

1. The elaboration and acceptance of a Code of Practice for tree nuts by Codex will provide uniform guidance for all countries to consider in attempting to control and manage contamination by various mycotoxins, specifically aflatoxins. In order for this Code of Practice to be effective, it will be necessary for the ‘, producers and processors in each country to consider the general principles given in the Code, taking into account the agronomic and [extrativistics](#) practices associated with the tree nuts produced in their regions, before attempting to implement provisions enumerated in the Code. It is important for producers or for the [extrativists](#) to realize that Good Agricultural Practices (GAP), represent the primary line of defense against contamination of nuts with aflatoxins, followed by the implementation of Good Manufacturing Practices (GMP) [Good Extrativistic Practices, Good Transportation Practices and Good Storage Practices \(GSP\) during the handling, processing, storage and distribution of nuts for human consumption](#). Only by effective control at all stages from the farm through to processing can excellent quality of the final product be assured. However, the complete elimination of mycotoxin contaminated commodities, including tree nuts, is not achievable at this time.

2. This Code of Practice applies to all varieties of tree nuts of commercial and international concern, including almonds (*Prunus amygdalus*), Brazil nuts (*Bertholletia excelsa*), cashews (*Anacardium occidentale*), hazel nuts (*Corylus* spp.), macadamia nuts (*Macadamia* spp.), pecans (*Carya* spp.), pine nuts (*Pinus* spp.), chestnuts (*Castanea* spp.), pistachio nuts (*Pistacia* spp.) and walnuts (*Juglans* spp.). It contains general principles for the reduction of aflatoxins in tree nuts that should be sanctioned by national authorities. National authorities should educate producers, the [extrativists, transporters, storing and others agents of the productive chain](#) regarding the practical measures and environmental factors that promote infection and growth of fungi in tree nuts resulting in the production of aflatoxin in orchards or in the forest ([areas of extrativism](#)). Emphasis should be placed on the fact that the planting, pre-harvest and post-harvest strategies for a particular nut crop depend on the climatic conditions of a particular year, and traditional production, harvesting and processing practices followed in a particular country or region [the peculiar and still, relative conditions to the extrativista process of the Brazil nut and its logistic complex](#). National authorities should also support research on methods and techniques to prevent fungal contamination in the orchard or in the forest ([areas of extrativism](#)) and during the harvesting, processing and storage of tree nuts. An important part of this is the understanding of the ecology of *Aspergillus flavus/parasiticus* in connection with tree nuts.

3. Fungi in the *Aspergillus* species are rapidly growing hyaline molds that are common opportunists found in the soil and on decaying matter. Their colonies are usually yellow, yellow-green, yellow-brown, or green; granular, velvety, or cottony; and have a white peripheral apron and a distinct margin.

4. The aflatoxin-producing *Aspergillus* species, and consequently dietary aflatoxin contamination, are ubiquitous in areas of the world with hot humid climates. *Aspergillus flavus/A. parasiticus* cannot grow or produce aflatoxins at water activities less than 0.7; relative humidity below 70% and temperatures below 10°C. Under stress conditions such as drought or insect infestation, aflatoxin contamination is likely to be high. Improper storage conditions can also lead to aflatoxin contamination after crops have been harvested. Usually, hot humid conditions lead to mould growth on the stored food and to high levels of aflatoxins.

5. Some procedures used to reduce and prevent aflatoxin production include: (1) selection of resistant varieties, if practicable, (2) minimize the presence of insects and other pests in the orchard during the growing phase, (3) minimize physical damage to nuts during harvesting and transportation, and (4) ensure that nuts are properly cleaned, dried and labeled when placed in a storage facility equipped with temperature and moisture controls. [Measures for the prevention and aflatoxin reduction for Brazil nut, for its specific or special nature, are described in item 3.2. of this Code.](#)

1. SCOPE

6. This document is intended to provide guidance for all persons involved in producing tree nuts for entry into international trade for human consumption. All tree nuts should be prepared and handled in accordance with general hygienic principles and practices that are pointed out in appropriate sections of the Recommended International Code of Hygienic Practice for Tree Nuts¹, and the Recommended International Code of Practice- General Principles of Food Hygiene², which are relevant for all foods being prepared for human consumption. These codes of practice indicate the measures that should be implemented by all persons that have the responsibility for assuring that food is safe and suitable for consumption.

2. RECOMMENDED PRACTICES BASED ON GOOD AGRICULTURAL PRACTICES (GAP) GOOD MANUFACTURING PRACTICES (GMP) AND GOOD STORAGE PRACTICES (GSP)

2.1 CRITERIA FOR ORCHARD SITES OR PICKING SITES

7. Growers should obtain background information concerning the potential orchard site to determine if: (1) the soil composition is ideal to support the growth of the desired tree variety (2) there is adequate drainage of ground water (3) there are any environmental factors inherent to that location (such as wind-, soil- and dust-borne contaminants and pollutants) that might have a negative impact on safety concerns for human foods and (4) there is an available source of water suitable for irrigation and other purposes.

8. Neighboring fields should not be used for plants which are known to be easily infected with *A.flavus/parasiticus* (e.g. maize) and consequently serve as a source of infection (spores spread by winds, insects, etc). Furthermore plants carrying specific insects that damage tree nut kernels, which may be a vector in the infection process, should also be avoided.

9. If the tree nuts are obtained from around cultivation, the picker should ascertain that there are not any environmental factors inherent to that location (such as wind-, soil- and dust-borne contaminants and pollutants) that might have a negative impact on safety concerns for tree nuts. [The practical ones recommended to the orchards are not applied to the *extrativista* process of the Brazil nuts.](#)

2.2 PLANTING

10. In designing the layout of the orchard, information concerning plant spacing may be obtained from plant breeders or agricultural personnel. Adequate spacing is necessary so that trucks and equipment needed for spraying trees can be accommodated and that ventilation of the orchard is maintained to reduce the growth of fungi.

11. Where possible and practical, the orchard surface area should be prepared before planting by destroying or removing all debris that may have served, or may potentially serve as substrates for the growth of mycotoxin-producing fungi. If there are areas vulnerable to soil erosion, no-till practices may be required in the interests of soil conservation.

12. Before planting, growers should consult with appropriate plant breeding authorities or tree nursery personnel to ascertain the availability of species that are resistant to various factors (e.g., frost, microbial and fungal diseases) that can have an impact on the safety and quality of nuts produced in the orchard.

13 Growers should be familiar with GAPs associated with the use of formulated fertilizers, manure and other biosolids that may be used to enhance the nutritional state of the soil, without increasing the risks of introducing hazards originating from microbial or fungal sources in the orchard.

14. Growers should consult with local or national authorities to determine insects and other pests that are commonly found in their region that might attack tree nuts causing them to be more susceptible to fungal infections that can lead to aflatoxin production.

15. Growers should take adequate precautions to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard, and take extreme care to protect the products from contamination with these wastes.

[16. Currently do not exist commercial cultivation of the Brazil nut](#)

2.3 PRE-HARVEST

16. During the growing seasons, roadways near the orchards should be watered or oiled periodically to minimize outbreaks of mites as a result of dusty conditions. Cultivation practices, in the vicinity of the orchard, that might disperse *Aspergillus flavus/A. parasiticus*, and other fungal spores in the soil to aerial parts of trees should be avoided.

17. Pesticides approved for use on tree nuts, including insecticides, fungicides, herbicides, acaricides, and nematocides should be used to minimize damage that might be caused by insects, fungal infections, and other pests in the orchard and adjacent areas. Accurate records of all pesticide applications should be maintained.

18. Irrigation should be implemented in regions with high temperatures and very little rainfall during the growing season to minimize tree stress, however, irrigation water should be prevented from contacting the nuts and foliage.

19. Water used for irrigation and other purposes (e.g., preparation of pesticide sprays) should be of suitable quality for the intended use.

20. All equipment and machinery, which is to be used for harvesting, storage and transportation of crops, should not constitute a hazard to health. Before harvest time, all equipment and machinery should be inspected to ascertain that they are clean and in good working condition to avoid contamination of the nuts with soil and other potential hazards.

21. Trade Associations, as well as local and national authorities should take the lead in informing growers of the hazards associated with aflatoxin contamination of tree nuts and how they may practice safe harvesting procedures to reduce the risk of contamination by fungi, microbes and pests.

22. Personnel that will be involved in harvesting nuts should be trained in personal hygienic and sanitary practices that must be implemented in the pre harvest, harvest, post harvest and in processing facilities throughout the harvesting season.

[23. Specific practices of that if it calls "pre-collect, collect and post collect" for Brazil nuts are described in item 3.2](#)

2.4 HARVEST

24. Harvesting of nuts should begin as soon as practicable after maturation to minimize problems involving

fungal attack and insect infestation. Some varieties of nuts become contaminated with aflatoxins while still on the tree as a result of insect infestation and hull splitting, therefore, the earlier the harvest, the less chance there is for contamination to occur because there is a greater chance that the outer hull will remain intact to protect the underlying shell from insects and fungal spores. The area under the trees should be cleared of any debris or decayed materials where *A. flavus* or *A. parasiticus* might reside.

25. Nuts, harvested by shaking the trees, should ideally be collected by mechanical harvesters with catching frames, or on some type of protective sheets or tarps under the trees to prevent nuts from falling to the ground. In regions where certain varieties of nuts are traditionally harvested by shaking the trees and/or allowing mature nuts to fall freely to the ground for collection by harvesting equipment or by hand, the orchard should not be used for grazing or holding cattle or other animals. If the land has been so used, the land should be worked immediately prior to harvesting (disced, rottilled, soil turned in some manner, or other feasible methods), to lessen the hazard of fecal contamination of tree nuts. In addition, procedures should be in place to ensure their removal as soon as possible to decrease exposure to *Aspergillus flavus*/*A. parasiticus* spores that may be denser in the air near the ground and associated with plant debris.

26. The nuts, after collection, should be sorted to remove damaged, [rotten, emptys, rancified nuts](#), foreign materials, and transported, as soon as possible, to a processing facility for immediate processing (hull removal) in containers (e.g., trucks, conveyers) that are clean, dry, [protected against humidity](#) and free of insects and visible fungal growth. High humidities, which are conducive to proliferation of mold and development of mycotoxins, should be avoided to the greatest extent practical. Conveyances for transporting nuts should be constructed of a material that will permit thorough cleaning and maintenance so as not to constitute a source of contamination for tree nuts. If the nuts cannot be transported immediately to a processing facility they should be temporarily stored in a way that will keep them dry and protected from rain, insects, rodents, birds and drainage of ground water.

2.5 POST-HARVEST

27. Nuts remaining on the trees after harvest should be removed during the winter months [or in the period between harvests](#) to reduce the over wintering of various insect populations.

28. Trees should be pruned and treated with appropriate pesticides prior to each growing season.

29. The orchard floor or woodland should be cleared of litter and debris from the harvesting operations in order to decrease the colonization of *Aspergillus* fungi in the orchard or woodland.

30. Containers, equipment and machinery that have been used for harvesting operations should be cleaned and stored in a clean location to minimize inadvertent contamination with fungi, chemicals, fertilizers or toxic substances.

31. Harvesting and storage procedures implemented each crop year should be documented by making notes of measurements (e.g., temperature, moisture, and humidity) and any deviation or changes from traditional practices. This information may be useful for explaining the cause(s) of fungal growth and mycotoxin formation during a particular crop year and help to avoid similar mistakes in the future.

2.6 PROCESSING

32. Personnel involved in all stages of tree nut processing should maintain a high degree of personal cleanliness, wear suitable protective clothing, be trained in food hygiene and general sanitation procedures to a level appropriate to the operations they are to perform in the processing facility. A system should be in place to ensure that all personnel remain aware of all precautions necessary to reduce the risk of aflatoxin contamination in the processing operations.

33. Areas where raw materials are received or stored should be [physically](#) separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. The hulling of nuts should be carried out in a location that is physically separated by partitions from the main

processing area of the facility. Care should be taken to ensure that dust-laden air is not introduced into other areas of the facility through a vent system or other openings.

34. Processors should establish good quality control, [traceability and safety](#) procedures at every step in the processing sequence to avoid cross contamination of aflatoxins between various lots of nuts during processing.

35. Hulling of nuts should begin as soon as possible after harvest. If a short delay in hull removal is anticipated, the nuts should be stored under conditions that will protect them from insects, mites, vermin, domestic animals, fungi, chemicals or microbiological contaminants, debris and dust. If a long delay is anticipated, nuts should be stored under controlled conditions to prevent aflatoxin production. Appropriate fumigation could be used to control insects.

36. Dehulled nuts should be dried as soon as possible, ~~preferably within 72 hours after harvesting~~; the drying rate and heat intensity should be determined by the intended end use of the final nut product(s). The nuts should be dried to a safe moisture level that corresponds to a water activity, A_w , of less than 0.70 at 25°C. *Aspergillus flavus*/*A. parasiticus* cannot grow and produce aflatoxin at water activities less than 0.70. Dehulled nuts that are allowed to sun-dry are at a greater risk of becoming contaminated during the drying process as a result of fungal growth and/or damage by pests.

37. Moisture levels should be checked after drying by taking samples as representative of the lot as possible. Make sure that the equipment needed for moisture measurements is calibrated.

38. Mechanical driers should be available and used to reduce the potential of further aflatoxin contamination in regions where steam or aqueous solutions are traditionally used to facilitate dehulling, and segregation of defective nuts; the water used should be of suitable quality for intended use and never recycled.

39. Personnel and equipment used in the hulling/ [selection/ preparation/ drying/ storage](#) areas of a processing facility should not enter into other areas of the facility; this will reduce the risk of contaminating other areas of the facility. Waste materials should be frequently removed from the working area during operation and adequate waste receptacles should be provided.

40. Various visual (manual) and/or electronic sorting techniques should be used to remove foreign materials and nuts with various defects. Nuts should not be used for processing unless they are free from obvious faecal contamination, infestations, decomposition and other defects. Special precautions must be taken to reject insect-damaged or early-split nuts because they are associated with a high risk of aflatoxin contamination.

41. For nut varieties that are traditionally preconditioned with moisture (steam or water of potable quality) to reduce kernel breakage during cracking, the moisture level of the kernels after cracking should be lowered immediately, to a level that will not support the growth of fungi by rapidly circulating dry air through the kernels.

42. The finished processed products (raw, shelled or in-shell, bulk or consumer ready) should be of the appropriate moisture and packaged so as to maintain their quality under normal transportation and storage conditions without significant deterioration by decay, mould, or enzymatic changes.

43. It is desirable that each plant has access to quality control facilities [It is desirable that the industry possesses responsible trained technician and makes use of good practice manuals of processing, standard procedures of operational hygiene and adjusted systems of traceability](#), being that the amount and type of such control will vary with different nut products as well as the needs of management. Some type of screening or recognized analytical procedure should be used to determine aflatoxin levels and preferable moisture content before products are released from the processing facility

2.7 TRANSPORT OF PROCESSED NUTS TO STORAGE

44. Transport containers should be clean, dry, and free of visible fungal growth, insects and any contaminated material. The containers should be well constructed to withstand handling abuse without breaking or puncturing, and tightly sealed to prevent any access of dust, fungal spores, insects or other foreign material.

45. The nuts should be transferred from transport containers to the storage facility as soon as practicable. If different lots or sub-lots are transported together, they must be physically separated in a way that will ensure that lot identification is maintained. The lots must be indelibly marked with an identification number that can be traced back to the accompanying documentation.

2.8 STORAGE

46. Storage facilities should be clean and dry (if possible keep the relative humidity < 70%), well-vented structures that provide protection from rain, entry of rodents and birds, drainage of ground water and have minimum temperature and humidity fluctuations. Optimally, If possible, temperature should be kept between 0°C and 10°C to minimize fungal growth during storage.

47. Good storage practices should be implemented to minimize the levels of insects and fungi in storage facilities. This may include the use of suitable, registered insecticides and fungicides or appropriate alternative methods. Nuts stored in sacks should be placed on pallets that they allow to the organization and ideal height of the stacks, removal of the floor, walls and distance between the same ones to allow good ventilation, access and the circulation of people.

48. Water activity, which varies with moisture content and temperature, should be carefully controlled during storage and proceeded the control records. *Aspergillus flavus/A. parasiticus* cannot grow or produce aflatoxins at water activities less than 0.7.

49. Consideration should be given to fumigating nuts as they are removed from storage for export to control any storage pests that may be present and to prevent infestation during shipment.

3. SPECIAL CONDITIONS FOR SPECIFIC NUT SPECIES

3.1 PISTACHIO NUTS

50. Pistachio nuts are exposed to airborne fungal spores while in the field, during harvesting and/or processing. When the nuts are still on the tree, sometimes the outer hull splits when the shell splits open (early-splits) and sometimes the hull is damaged by wind, insects or other pests. If insects or other pest damages the nut shell, then conditions exist for *Aspergillus* spores to invade and grow on the inner kernel and potentially produce aflatoxins.

51. During the growing season, growers should irrigate carefully and in good time to limit early splitting of the outer hull and reduce the risk of aflatoxin contamination. The mature nuts should be harvested early to reduce the chance for contamination since there is a greater chance that the outer hull will remain intact. The nuts should be delivered directly to the plant for hulling and drying within 24 hours of harvest to prevent shell staining.

3.2 BRAZIL NUTS

~~51. After the outer casings are broken open, the fractured nuts should be eliminated. When pods have been opened in the area, the nuts should not be in contact with the soil without any cover. Ideally the transportation of nuts should be undertaken within 6-7 days. During storage, the nuts shouldn't be exposed to attack by rodents or other animals which may lead to damage to the shells of the nuts, possibly allowing entry of any mould to the nut kernel. Processing of the product should again ideally begin within 1 week after arrival at the processing facility.~~

52. There is not commercial plantings of the Brazil nuts. All the producer area is native and characterized for more or less homogeneous concentrations of brazil nuts trees, located in the middle of the amazon forest, being next or not to the product flow ways (usually rivers and igarapés; eventually highways), being characteristic of the extrativistic process, the widespread geographical dimension of the region producer, the

difficult access to the producer's areas , the storage rustic structures existence and the typical means of transportation use of the region, like animal, tractors, trucks, canoes, small boats, rafts, among others.

53. The chestnuts or seeds, in number of 15 to 25 units or seeds, they find lodged inside the chesnut fruit, denominated hedgehog, of global format, with thick and hard peel, measuring of 8 to the 15 diameter cm. The pods collection period, process that consists in the catches of the same by collectors under the chesnuts (trees with average of 20 mts of height), happens usually after the fruits natural fall period, due to the accidents risk (each hedgehog weighs on an average 1Kg). Therefore, is difficult to establish product common rule or minimum period of permanence in the collection location or in the warehouses, because the same is variable, depending on the access conditions, distance among brazil nuts trees native and processing companies, commercialization used means of transportation and flow.

54. The adequate handling for the Brazil Nuts, must foresee viable and possible practices of being applied, since the hedgehog collection in the forest scope until prepare of the product (benefit or processing), that consider all the complexity and distinct nature of the extrativistic process and allow to prevent and to reduce the contamination by aflatoxin.

3.2.1. PRE – COLLECTION

55. Clean the pods collection or fall area, under each brazil nuts tree, in every extrativistic area of responsibility of each collector or community, before the crop beginning.

56. Discard the old pods (of the previous), remaining crop in the collection area, during the cleaning process of the areas under the brazil nuts trees.

57. Protect, when possible, the soil below the brazil nuts tree, with canvas or any other mean that avoids the pods contact with the soil and the humidity, when of your tree fall.

3.2.2. COLLECTION

58. Reduce to the maximum the period between pods fall and collection as well as time of gathers of the pods in the woods.

59. Accomplish the grouping or gathers of the pods in the woods, preferably in appropriated locations or stages elevated of the rain ground and protected.

60. Break the pods as quickly as possible after collection and gather them, in rainy protected location, humidity and dirtiness (mud, land, animal, leaves, etc), using instruments or adequate findings to avoid mechanical damages to the Brazil nuts inshell and unshell.

61. Discard the rotten, empty or rancified Brazil nuts and to separate that is damaged or broken during the cut. The damaged or broken Brazil nuts, but healthy, must be separated of the totalities and promoted your immediate use or, when not possible, your discards.

3.2.3. STORAGE

3.2.3.1. Primary Storage (inside the forest or in the collection location)

62. Shelter the pods or the chestnuts in appropriated locations, that must own walls with breaches or other ventilation or aeration and coverage means against bad times. Must be elevated of the ground and to own protection against the access of rodents or other animals, by means of inverted cones and other devices.

63. Store the Brazil nuts, packed in preferentially new sacks or in good conditions, with size meshes that avoid the Brazil nuts natural humidity condensation, in sacks and spacing small piles between piles to allow the aeration.

64. Clean the remains of Brazil nuts and others dirtiness in the storerooms to each shipment or to each crop.

65. Discard the pods not benefited or previous crops remaining Brazil nuts or to give other destination to the same.

3.2.3.2. Secondary Storage (in the extrativistic community or in production convergence points)

66. The warehouses must be located in the extrativistic community or next to the product flow points (rivers and highways), own walls with breaches, windows or other means for aeration or ventilation, coverage, and elevated of the ground to their own protection against the access of rodents and other animals, by means of inverted cones and other appropriated devices.

67. Store the Brazil nuts packed in bags preferentially new, with meshes that allow a larger aeration, placed if possible over stages.

3.2.4. TRANSPORTATION

3.2.4.1. First Transportation (inside the extrativistic area)

68. Transport the Brazil Nuts after the breaking of the pods, protected from dirtiness. Baskets (Paneiros) or any other container used in the Brazil nuts transportation must be clean and in good shape of preservation and to be covered with canvas, plastic or other impermeable material, to avoid that the Brazil nuts wet or absorb humidity during the transportation.

3.2.4.2. Secondly Transportation / cross dealer (of the extrativistic area or of the primary storage until processing companies)

69. The sacked Brazil nuts must be transported in vehicles (tractor, truck, canoe, boat, raft, etc.) clean, separated of others goods, protected of humidity, rain and other factors that jeopardize your quality and safety. When transported in vessels, basements or fund, to the protection against the humidity, using wooden stages or canvas.

3.2.5. PROCESSING

3.2.5.1. Inshell Brazil nuts:

70. Proceede in the raw material reception, the origin identification for each lot (sacked or in granary), with vendor data, region producer, crop, quality transportation and minimum requisites conditions (clean Brazil nut, drought, exempt of strange), inclusive controll of the humidity content and record.

71. Lots separation by origin and presentation conditions: build a historical of product quality by origin region, using these data in the raw material reception.

72. Establish the lots processing priority which contain more elevated levels of humidity.

73. Sacked or in granary Brazil nuts should be storage in ventilated, protected environment of animal, plagues and insects, floors and impermeable and washable walls, that must be entire and without cracks, so as to impede moisting again of the Brazil nut. The sacks must be over clean stages and must be observed the walls dismissal requisites, roofs, lateral, height and distance between piles.

74. Classification and selection for collection discerning manual of rotten, damaged Brazil nut and of larger dirtiness, in size and compatible pickers number wake for this end, with adequate and too much adequate illumination conditions.

75. Raw material reception and selection physical separation total area, of the processing too much areas.

76. Proceede the dust control and of the mechanical dryers derived warmth, through exhausts in the location and physical isolation of the dryer area.

77. Keep time control and of the drying temperature, so that this be uniform and to reduce rancification risks and the mushrooms proliferation possibility due to the residual humidity in the nuts above of the safety limit.

78. Monitor the nuts temperature and humidity in the compartment (tulha) during the cooling.

79. The compartments (tulhas) must be clean between each processing.

80. Control of the humidity content record must be done in properly calibrated equipment and by trained technician, keeping the information record.

81. The packings must be clean, droughts, new, be properly marked, with lot identification and of the quality and must be stored in own compartment (packing deposit)

82. The prosecuted and packed lots must be identified and stored in appropriated locations: animal and insects protected ambient, with ventilation or aeration, floors and impermeable and washable walls, that must be entire and without cracks, so as to impede moisturing again of the nuts. The stocks must be kept in ambient isolated of substances and toxic or inappropriate materials.

83. Procede the control sanitary treatments complete record and of plagues control.

3.2.5.2. Unshelled Brazil nuts:

84. The practices for the reception, the raw material and selection storage are the same observed for the inshell Brazil nut.

85. The inshell Brazil nut, after the selection, are submitted to autoclaving or to the equivalent thermal process, with time control, temperature and pressure, aiming the shell softening to facilitate shelling and almonds retreat.

86. After autoclaving, the nut must be submitted to cooling stage in own locations for this end., aiming posterior shelling.

87. The equipments for shelling of the nuts and the work surfaces or local must be of appropriated material and be in good shape of preservation, must be washed and sanitized between each processing.

88. The area of shells and nuts selection must be animal and insects protected ambient, with ventilation / aeration / exhaustion/ refrigeration and adequate illumination (environmental comfort), floors, walls and impermeable, washable lining and by clear colour, so as to impede the contamination focuses proliferation.

89. The vibratory track used to product classification by size, must be sanitized between each processing.

90. The trays for almonds or shelled nuts dehydration, must be of material that allow the sanitization after each lot.

91. Procedure control and time/temperature record during the dehydration process to guarantee the final humidity level.

92. Adopt the same practices recommended for the inshell nut, for the dehydrated nuts final selection, packing conditions and your deposit, benefited or shelled product conditioning and storage.

93. The nuts are usually packed in aluminum sacks or other appropriated packing, closed to the vacuum and packed in boxes of cardboard. The lots in boxes of cardboard must be about clean, respected stages the walls dismissal recommendable technical dimensions, roofs, lateral, height and distance between piles.

3.2.6. GLOSSARY OF TERMS

94. This glossary defines the terms and technical concepts used in this Code of Practice for the Prevention and Reduction of contamination by aflatoxin of the Brazil nut.

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|---|---|
| <u>Productive chain</u> | <u>Systemic conception that covers all the segments, parts or phases of a productive process, with own characteristics and defined in a certain physical space and her inter relations or interdependences.</u> |
| <u>Collection</u> | <u>Operation that consists in catch the pods in the ground, after the nut natural fall.</u> |
| <u>Pod</u> | <u>Brazil Nuts Fruit, of hard consistency and round format, in whose interior finds the nut or seeds.</u> |
| <u>Piling up</u> | <u>Operation that consists in joining in a separated place the collected pods.</u> |
| <u>Primary storage</u> | <u>Pods stock in the forest or in collector property, waiting collection period final.</u> |
| <u>First transportation</u> | <u>Transportation of the pods from the collection zone to the breakage location and of this, to the collector property or next to the flow way (river or of highways), done usually in baskets (paneiros), loaded by men or animal.</u> |
| <u>Paneiros (baskets)</u> | <u>Baskets made of liana, used to the pods or nuts transportation.</u> |
| <u>Breaking of the pods</u> | <u>Pods cut operation for the nuts retreat, done with the use of adequate tool or instrument.</u> |
| <u>Secondary storage</u> | <u>Brazil pods and/or nuts stock in collector property or in extrativistic community's warehouse</u> |
| <u>Second Transportation (cross dealer)</u> | <u>community nuts Transportation or of the secondary or intermediary warehouse up to the processing companies</u> |
| <u>Intermediary storage</u> | <u>Storage to the flow way margin (highway or river), production convergence point or of receipt of nut of the region producer, for the lots larger and delivery formation processing companies.</u> |
| <u>Benefit or processing</u> | <u>Operations series to what the inshell nut is submitted, aiming its prepare for direct consumption, with shell or without shell or use for others purposes (oil extraction, flours, cosmetic)</u> |
| <u>Autoclaving</u> | <u>Operation that consists in submit the nuts with shell to thermal treatment under pressure, time and controlled temperature, aiming facilitate the shelling off.</u> |
| <u>Unshelling</u> | <u>nuts shells retreat manual Process, done one to one, being initially broken the shell by means of rudimental machines, willing side by side in breakage table and afterwards separated the almond shell</u> |
| <u>Drying</u> | <u>Inshell nuts humidity reduction process by means of the use of warmth in rotative mechanical oven.</u> |
| <u>Dehydration</u> | <u>almonds (unshelled nuts) humidity reduction Process by means of warmth in stove</u> |
| <u>Cooling</u> | <u>it consists in the rest of the inshelled nut or of the almonds (unshelled nut), after the drying or the dehydration, aiming at product temperature reduction until the balance with the ambient temperature.</u> |

4. A COMPLEMENTARY MANAGEMENT SYSTEM TO CONSIDER IN THE FUTURE

95. The Hazard Analysis Critical Control Point (HACCP) system is a food safety management system that is used to identify and control hazards within the production and processing system. The general principles of HACCP have been described in earlier documents.

96. The HACCP concept is an all-encompassing integrated management system. When properly implemented in the tree nut industry, this system should result in a reduction in the levels of aflatoxins observed in tree nuts. The use of HACCP as a food safety management system has many benefits over other types of management control systems used in some segments of the food industry. In orchards, many factors that influence aflatoxin contamination of tree nuts are environmentally related, such as weather and insects; these are difficult or impossible to control. After harvesting, critical control points may be identified for

aflatoxins produced by fungi during storage. For example, a critical control point could be at the end of the drying process and one critical limit would be the moisture content or water activity.

97. Good Agricultural Practices (GAPs), Good Manufacturing Practices (GMPs) and Good Storage Practices (GSPs) are programs that should be in place before attempts are made to establish and implement a HACCP system. A manual on the application of the HACCP system for mycotoxin prevention and control was recently published that included a plan developed for controlling aflatoxins in pistachio nuts in S.W. Asia⁵. It is recommended that tree nut producers, processors and others involved in the tree nut industry review this example, the concepts of which should be applicable to all tree nuts.

98. At the Third International Conference on Mycotoxins, which was held in Tunisia in March 1999, one of the general recommendations was that integrated mycotoxin control programs should incorporate HACCP principles in the control of risks associated with mycotoxin contamination of foods and feeds⁶. The implementation of HACCP principles will minimize aflatoxin contamination through applications of preventive controls to the extent feasible in the production, handling, storage and processing of each tree nut crop. Since all countries may not have the required technical expertise and experience to establish effective integrated mycotoxin management systems, the Food and Agriculture Organization (FAO) has given high priority to the provision of training professionals in developing countries on the HACCP approach and its application.

4.1. Safety and quality system of Brazil Nuts to consider in the future

99. The dangers analysis principles incorporation and of control critical points (HACCP) for the risks associates management to aflatoxin contamination in Brazil Nuts in all his productive chain, it depends firstly from the good practices total implementation and of the operational hygiene procedures standards in each production process phase, of the contamination determinate factors sharp identification and of the critical limit for the fungic development and aflatoxins production in each product handling stage, and yet, of the control critical points technical validation, due to the several research jobs in development in Brazil.

100. It is recommendable to enlarge and to encourage the specific researches studies and lines, inclusive of adapted technologies development, of fungic development inhibitors use for use in the control larger binomial temperature and humidity difficulty productive chain situations or stages, as the transportation and the storage in the extrativistic region, among others aspects.

Venezuela:

| PLACE IN THE TEXT | WHERE IT SAYS: | IT SHOULD SAY: |
|--|--|---|
| Page 190 Appendix XX Section 2.3 PRE-HARVEST | 19. Water used for irrigation and other purposes (e.g., preparation of pesticide sprays) should be of suitable quality for the intended use. | 19. Water used for irrigation and other purposes (e.g., preparation of pesticide sprays) should be of suitable quality <u>according to the legislation of each country,</u> for the intended use. |

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| <p>Page 190 Appendix XX Section 2.4 HARVEST</p> | <p>23. Harvesting of nuts should begin as soon as practicable after maturation to minimize problems involving fungal attack and insect infestation. Some varieties of nuts become contaminated with aflatoxins while still on the tree as a result of insect infestation and hull splitting, therefore, the earlier the harvest, the less chance there is for contamination to occur because there is a greater chance that the outer hull will remain intact to protect the underlying shell from insects and fungal spores. The area under the trees should be cleared of any debris or decayed materials where <i>A. flavus</i> or <i>A. parasiticus</i> might reside.</p> | <p>23. Harvesting of nuts should begin as soon as practicable after maturation to minimize diseases caused by fungal attack and insect infestation. Some varieties of nuts become contaminated with aflatoxins while still on the tree as a result of insect infestation and hull splitting, therefore, the earlier the harvest, the less chance there is for contamination to occur because there is a greater chance that the outer hull will remain intact to protect the underlying shell from insects and fungal spores. The area under the trees should be cleared of any debris or decayed materials where <i>A. flavus</i> or <i>A. parasiticus</i> might reside.</p> |
| <p>Page 191 Appendix XX Section 2.5 POST-HARVEST</p> | <p>27. Trees should be pruned and treated with appropriate pesticides prior to each growing season.</p> | <p>27. Trees should be pruned and when required treated with appropriate pesticides prior to each growing season.</p> |
| <p>Page 191 Appendix XX Section 2.6 PROCESSING</p> | <p>32. Areas where raw materials are received or stored should be separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. The hulling of nuts should be carried out in a location that is separated by partitions from the main processing area of the facility. Care should be taken to ensure that dust-laden air is not introduced into other areas of the facility through a vent system or other openings.</p> | <p>32. Areas where raw materials are going to be received or stored should be separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. The hulling of nuts should be carried out in a location that is separated by partitions from the main processing area of the facility. Care should be taken to ensure that dust-laden air is not introduced into other areas of the facility through a vent system or other openings.</p> |

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| <p>Page 192 Appendix XX Section 2.6 PROCESSING</p> | <p>34. Hulling of nuts should begin as soon as possible after harvest. If a short delay in hull removal is anticipated, the nuts should be stored under conditions that will protect them from insects, mites, vermin, domestic animals, fungi, chemicals or microbiological contaminants, debris and dust. If a long delay is anticipated, nuts should be stored under controlled conditions to prevent aflatoxin production. Appropriate fumigation could be used to control insects.</p> | <p>34. Hulling of nuts should begin as soon as possible after harvest. If a short delay in hull removal is anticipated, the nuts should be stored under conditions that will protect them from insects, mites, vermin, domestic animals, fungi, chemicals or microbiological contaminants, debris and dust. If a long delay is anticipated, nuts should be stored under controlled conditions to prevent aflatoxin production. If required fumigation could be used [REDACTED] to control insects.</p> |
| <p>Page 192 Appendix XX Section 2.6 PROCESSING</p> | <p>38. Personnel and equipment used in the hulling/ drying areas of a processing facility should not enter into other areas of the facility; this will reduce the risk of contaminating other areas of the facility. Waste materials should be frequently removed from the working area during operation and adequate waste receptacles should be provided.</p> | <p>38. Personnel and equipment used in the hulling/ drying areas of a processing facility should not enter into other areas of the facility; this will reduce the risk of contaminating other areas of the facility. Waste materials should be frequently removed from the working area during operation and adequate waste receptacles should be provided for removal of the same.</p> |
| <p>Page 193 Appendix XX Section 2.7 TRANSPORT OF PROCESSED NUTS TO STORAGE</p> | <p>44. The nuts should be transferred from transport containers to the storage facility as soon as practicable. If different lots or sub-lots are transported together, they must be physically separated in a way that will ensure that lot identification is maintained. The lots must be indelibly marked with an identification number that can be traced back to the accompanying documentation.</p> | <p>44. The nuts should be transferred from transport containers to the storage facility as soon as practicable. If different lots or sub-lots are transferred together, they must be physically separated in a way that will ensure that identification of the said lots is maintained. The lots must be indelibly marked with an identity number that makes possible to recognize the accompanying documentation.</p> |