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China Notifies Standard for the Prevention and Reduction of Aflatoxin in Food (SPS 1068)

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Report Highlights:

On March 16, 2018, China notified the World Trade Organization (WTO) of the draft Code of Practice for the Prevention and Reduction of Aflatoxin Contamination in Food, as SPS/N/CHN/1068. The Code applies to the peanuts, corn, cottonseeds, tree nuts, and feed for dairy cows. The deadline for comments is May 15, 2018. The proposed date of entry is yet to be determined. Comments can be sent to China's SPS Enquiry Point at sps@aqsiq.gov.cn.

BEGIN TRANSLATION

National Food Safety Standard

Code of Practice for the Prevention and Reduction of Aflatoxin Contamination in Food

GB XXXX - XXXX

1. Scope

The Standard specifies basic requirements and management rules for controlling aflatoxin in food in harvest, storage and processing processes.

The Standard applies to peanuts, corns, cottonseeds, tree nuts, and cow feed.

2. Terms and Definitions

2.1 Water Activity (a_w)

Water activity is the state with which water exists in food or food materials, i.e. the combination degree between water and food or food materials (free degree), which is called water activity for short. The ratio of saturated vapor pressure of water in food or food materials to the saturated vapor pressure of pure water at the same temperature is always used to reflect the value of water activity.

2.2 Warehouse Drying

Warehouse drying is a technology with which newly harvested food materials with high water content are placed in a qualified warehouse, then are dried by means of mechanical ventilation in the same warehouse, and are stored in the warehouse after being dried.

3. Gathering

3.1 Harvesting personnel should receive training on personnel hygiene, sanitation and operation.

3.2 Before harvesting, inspect the equipment and facility for harvesting and storage to ensure their proper operation; remove the residues on the equipment to prevent contamination to the subsequently harvested crops by the potential contaminants; during harvest, when having equipment breakdown that may possibly lead to damage to crops, the harvesting equipment should be repaired immediately, and the repair time should be as short as possible.

3.3 When harvesting, transporting, drying and storing crops, the conveyances used should be clean and dry and have no insects or mildew.

3.4 Ripe crops should be harvested in time; avoid harvesting immature crops. Ensure that crops with similar ripe degree are harvested at the same time as possible.

3.5 Separately harvest crops that are damaged or dead due to diseases or insect attack.

3.6 Avoid harvesting crops in an overly humid environment; if crops are harvested in the wet environment, they should be dried immediately after harvest.

3.7 During harvest, avoid mechanical damages to crops as possible, prevent invasion of fungi that produce aflatoxin, such as *aspergillus flavus* and *aspergillus parasiticus*.

3.8 After harvest, reduce the harvested crops' contact with soil; remove the residues of soil and straws to prevent invasion of fungi that produce aflatoxin, such as *aspergillus flavus* and *aspergillus parasiticus*.

3.9 In harvest, water content of crops harvested in different locations in the same farmland also vary significantly. Therefore, water content of each batch of crops should be determined synthetically by water content of multiple sampling points; determine subsequent storage of the crops based on the water content.

4. Before Storage

4.1 Pre-cleaning

Pre-cleaning could remove a large amount of straws and other plant residues which may carry molds or mold spores. Wind separation and sorting can be adopted to clean food materials. If there is cleaning equipment, it is recommended to use the mechanical methods to remove foreign matters, other crops' seeds and residues before the food materials are transported to the warehouse. However, such cleaning should not cause damages to food materials.

4.2 Drying

4.2.1 Newly harvested food materials should be dried with such methods of air-drying in the sun and forced air circulation as soon as possible; reduce the storage time before drying so as to reduce the risk of mold growing.

4.2.2 During drying, water content should be reduced to a safe range for storage while minimize damages to food materials. During drying, avoid excessive drying or excessive high drying temperature to preserve nutritional values and ensure the crops are suitable for milling or other processing. Meanwhile, before storage, drying capability should be fully considered; ensure the crops to be stored could be dried within a reasonable period of time. During drying, water content should be tested in a timely manner; the samples used for water content testing should be representative. To avoid change of water content due to mixing and storage of the same batch of food materials before and after drying, the dried materials should be stored separately.

4.2.3 When necessary, "warehouse drying" can be adopted. Food materials can be placed in warehouses with mechanical ventilation. Food materials with high water content can be dried by using natural air or slightly heated air as drying means, and then be directly stored the dried crops in the warehouse.

4.2.4 If mechanical drying is not available, food materials should be placed on clean flat surfaces outdoors for air-drying in the sunshine as possible. During drying, avoid contamination by rainfall, dews, soil, insects, ornithocopros and other contaminants. For even and fast drying, food materials should be spread out into thin layers and be stirred frequently to accelerate evaporation of water and reduce the time of drying in the sun. Unable to dry the food materials under the sun, the food materials harvested could be placed in the shade for drying, ensure necessary ventilation in the drying sites.

4.3 Cleaning

After drying, clean the food materials and remove damaged kernels and foreign matters damaged by broken/insect bites/germinated/moldy and unripe. If using gravity separation or optical separation or other approaches to remove kernels that are easy to be contaminated; if using mechanical approaches to remove foreign matters, avoid mechanical damages to food materials.

5. Storage

5.1 General Requirements of Storage Sites

5.1.1 Storage sites should be kept dry and ventilated; avoid the storage site to be affected by rainfall, snowfall, groundwater and vapor condensation, or invasion by rodents, birds and insects. The storage facilities should be in good conditions with good drying and ventilation facilities. The warehouse site and storage facilities/equipment should meet relevant requirements by GB 22508¹; environment of the warehouse and storage facilities/equipment in the processing plants should meet relevant requirements of GB 14881².

5.1.2 Before accepting crops, the warehouse and the storage facilities should be cleaned to reduce or remove foreign matters and contamination sources, such as dust /fungal spores/material residues/ animals' and insects' excrement /soil/ insects/ stones/ metal/cullet.

5.2 Storage and Management Measures

5.2.1 Check the temperature and humidity in storage facilities on a regular basis. Abnormal rise in temperature probably means microbial growth and/or occurrence of insects. If there is abnormal rise in temperature or water content, the reasons should be found and reasonable measures should be taken to maintain the temperature in the reasonable and even range.

5.2.2 During storage, food materials may also be moved from one warehouse to another to facilitate fore ventilation and avoid occurrence of potential hot spots.

5.2.3 Finding deteriorating or mold growth in food materials, the food materials that have obviously been contaminated should be isolated and appropriately take samples for aflatoxin testing. While removing the contaminated food materials, avoid mixing the deteriorated materials with the remaining materials that seems to be in good condition. A small amount of severely contaminated food materials could significantly increase the aflatoxin content in food materials. After removal of deteriorated food materials, if necessary, use ventilation to reduce temperature and water content of the remaining stored materials to a reasonable level.

5.2.4 Establish the facility management plan to minimize the risk of rodents, insects and fungi invasion. For example, follow the comprehensive insect/fungi prevention plans' guidance and use the proper and registered pesticides/fungicides or other alternative measures. Use pesticide and fungicide that will not affect safety of the food materials' final intended use, strictly control the dosage, and follow the instructions in use. Using anti-mildew agents (such as propionic acid, a kind of organic acid) is beneficial for safe storage of food materials.

5.2.5 Install necessary testing devices for aflatoxin testing. Aflatoxin should be tested when food materials enter and exit warehouses, separately. If using the rapid testing methods and devices, proper rules for testing results analysis should be developed.

5.2.6 Food materials which are contaminated with aflatoxin should be separated from those that are not contaminated in storage.

5.3 Storage Requirements

Monitor the temperature of the storage space, monitor the temperature and water content of food materials regularly. In general, water activity (a_w) below 0.70 can restrain the growth of fungi that produce aflatoxin (such

¹ GB 22508 - Code of Hygienic Practice for the Storage and Transport of Unprocessed Food Grains

² GB 14881 - General Hygiene Regulation for Food Production

as *aspergillus flavus* and *aspergillus parasiticus*). Reasonable water content should be determined by the variety, kernel size, quality, storage period and storage conditions (such as temperature) of the materials. If necessary, proper sampling and testing measures should be taken to regularly monitor the aflatoxin level of stored food materials.

5.4 Monitoring Requirements

Properly record all steps of harvest, drying, cleaning and storage in each harvest season; items to be recorded include measurement values (such as ambient temperature, water content of materials, ambient humidity) and any changes other than traditional practice; such records shall be documented. Such records can be used to explain reasons of aflatoxin occurrence each year and avoid occurrence of similar situation in the future. If possible, verified prediction models can be used to for management and prevention measures to control fungi growth and aflatoxin generation in the above steps.

6. Transportation

6.1 Containers, vehicles and vessels that transport food materials should be dry, and free from materials that may contaminate the transported crops (such as food material kernels, dust, bacterial plaque, mold odor, insects, etc.) If necessary, the containers for transport should be cleaned and sterilized before use; however, the clean and sterilization should not contaminate the carried crops.

6.2 Proper measures should be taken to protect the transported crops, such measures include using sealed containers and water proof canvas. Minimize temperature fluctuation, and avoid vapor condensation.

6.3 During transport, avoid damages caused by insects, birds and rats. Relevant provisions should be followed when chemicals are used.

6.4 Crops which are contaminated by aflatoxin should be transported separately.

7. Processing

7.1 It should meet relevant requirements on materials in GB 14881.

7.2 Sampling and multipoint analysis should be conducted according to the principle of random distribution. There should be a testing plan for testing. If using the rapid testing methods and devices, proper rules for testing results analysis should be developed; the tests should strictly follow the sampling methods and testing procedures. Avoid taking samples in an adverse situation (such as bad weather). Use clean, well-maintained tools in testing. After sampling, the samples should be resealed properly as soon as possible.

7.3 Materials should be sorted to further remove moldy kernels, damaged kernels and kernels with abnormal colors to prevent them from entering the next step of production and processing.

7.4 After sorting, the aflatoxin content in edible part of materials should meet the provisions of GB 2761³. Unqualified materials separated in the sorting process should be destroyed or be isolated from edible food.

7.5 It is prohibited to mix low quality materials with high-quality materials to meet the aflatoxin limit requirements.

³ National Food Safety Standard for Maximum Levels of Mycotoxins in Foods, GAIN report to be uploaded shortly.

Appendix I Peanuts

1. Harvesting

1.1 It should comply with provisions in Chapter 3 of the Standard.

1.2 In the case of drought stress, peanuts which have not been irrigated should be gathered separately.

1.3 Use cover with good air permeability to cover stored peanuts to avoid generating vapor which would cause local mildew of peanuts.

2. Before Storage

2.1 It should comply with provisions in Chapter 4 of the Standard.

2.2 In field, dry peanuts under sunshine to some extent and harvest them as fast as possible; avoid severe knock, squeeze and stacking in harvest. The harvested peanuts should be winnowed initially, and then be spread out on drying yards; the harvested fresh peanuts should be dried rapidly (within 3 ~ 5 days) to control the water content below 10%. While drying in sunshine, avoid damages to the peanuts caused by rain, insects, rats, and birds. Fresh peanuts should not be piled up before their water content is reduced to 8% ~ 10%.

2.3 Peanuts should be spread out indoor for air-drying in rainy days and then be spread out on drying yards in later sunny days.

2.4 During mechanical drying, avoid overheat when using supplement heat wind air dry the peanuts, which will cause damage to the overall quality of peanuts (for example, kernel separation after shelling). For reference parameter values of the drying process with drying air, see Table 1, and when the average water content is reduced to below 10%, stop drying.

Table 1 Control Values for Parameters in the Drying Process

Water content in materials, %	Maximum stack height (m)	Minimum ventilation volume ($\text{m}^3 \cdot \text{h}^{-1} / \text{m}^3$) (minimum wind speed $\text{m} \cdot \text{s}^{-1}$)	Recommended drying temperature, °C
10~20	2.20	300 (0.04)	45~50
20~30	1.50	600 (0.11)	40~45
30~40	0.90	900 (0.28)	35~40
40~50	0.70	1200 (0.48)	35~40

2.5 Before storage, ensure that the water content of peanuts are reduced to the safe level (below 10% for peanuts with shells, and 9% for peanut kernels); screen the peanuts, remove immature fruits, damaged pods, moldy peanuts and foreign matters.

3. Storage

3.1 It should comply with provisions in Chapter 5 of the Standard.

3.2 Peanuts should be piled up in bags. Peanuts which have been not been dried or cleaned should be packed in such packing materials that do not cause vapor condensation (such as sacks). Peanuts which have been dried and cleaned should be packed in composite polyethylene film bags. The bagged peanuts should be piled up in lines that for the shape of “非”, half “非” and “回” (note: these are Chinese characters indicating the shape of lines of piled peanut bags).

3.3 Leave proper distance between peanuts and walls/floor for air circulation, moving the bags and cleanliness inspection.

3.4 Generation of aflatoxin during storage and transport is closely related to the storage temperature, water content and hygienic conditions. An environment with the water activity less than 0.7, the relative humidity under 70% and the temperature lower than 15 °C is adverse for fungi growth and aflatoxin generation, and such environment is conducive for long-term storage of peanuts.

3.5 Check the temperature and humidity of warehouse twice a day. Peanuts should be stored at a minimum temperature which is consistent with the ambient environment as possible, though the temperature should not be close to the freezing point. When possible, use air circulation in the storage areas for ventilation of the stored peanuts, which will maintain the proper and even temperature in the whole storage area.

3.6 Inspection of insects: when the temperature of peanuts is below 15 °C, conduct the insect inspection once a quarter; when the temperature is 15 °C ~ 20°C, conduct the insect inspection every half a month; when the temperature is over 20°C, conduct the insect inspection once every week.

3.7 When the water content of peanuts exceeds 10%, dry the peanuts under the sun until the water content is reduced to below 10%.

3.8 During storage, the temperature and humidity should be controlled to prevent peanuts from being bitten by insects, which will cause contamination of aflatoxin and toxic fungi.

4. Transportation

4.1 It should comply with provisions in Chapter 6 of the Standard.

4.2 During transport, use sealed containers to contain peanuts or use water-proof canvas to cover peanuts to avoid vapor condensation caused by temperature fluctuation; avoid vapor condensed water accumulation and prevent exterior water to have contact with peanuts.

5. Processing

5.1 Choose to procure peanuts in regions with lower contamination levels as possible.

5.2 When receiving peanuts from farmers, (the buyer) need to ask origin of each batch of peanuts. Inspect vehicles that transport the peanuts. Observe the general appearance of peanuts when the cargos are discharged. If the unloaded peanuts feel wet, they should be stored separately and dried as soon as possible.

5.3 Before receiving peanuts into warehouses, take certain measures to remove abnormal peanuts that are moldy, damaged, insects-bitten, having wrinkled skins and changed colors.

5.4 The warehouse should be cleaned before receiving peanuts, leaving no residues; warehouses should have proper facilities for insect, moisture and microbial multiplication prevention.

5.5 Inspect materials before they enter factories. Before shelling, the water content of peanuts should be under 10%, water content of peanut kernels should be under 9%, and the rate of moldy peanuts should be less than 1%.

5.6 If a factory has color sorters, the color sorters could be used to remove imperfect kernels that are moldy, damaged, broken or immature, which will reduce contamination of aflatoxin to peanuts.

5.7 If a factory does not have color sorters, workers could pick out imperfect kernels, foreign matters, discolored kernels and damaged kernels along the conveyor belts; this will remove imperfect kernels that are moldy, damaged, broken or immature, which will reduce contamination of aflatoxin to peanuts. Manual sorting stations should have bright lights, control the conveyor belt's speed and material thickness (peanuts are in single layer; avoid stacking of peanuts, which will affect the sorting efficiency; the conveyor speed should allow workers to effectively remove foreign matters and inferior peanuts; workers in the selection stations and the loading stations should have pre-job training.

5.8 The aflatoxin content of edible parts of peanuts after sorting should conform to provisions of GB 2761. Unqualified peanuts picked out during the sorting process should not be directly used for food; they may be used for non-food purposes or be destroyed; they should be separated from edible foods.

5.9 Before shelling, sort the peanuts, remove the moldy/sprouting/insect-bitten kernels, and at the same time remove foreign matters (such as iron pieces, clods, stones and plant stems/leaves). The processing equipment should be clean and tidy, without peanuts with shells, peanut kernels or broken kernels left behind.

5.10 If conditions permit, peanuts should be stored with shells and be shelled before use.

5.11 Control the original water content of peanuts during shelling under the safe water content level; it is prohibited to add/spray water in shelling peanuts.

5.12 Keep the workshops and machines clean. Workshops and shelling machines should be cleaned the same day they are used; no peanuts or broken kernels should remain in the shelling machine to avoid mildew from contaminating products.

5.13 Use the proper shelling methods to avoid damages to the materials.

6. Control in the Production Link

6.1 During processing of peanut products, test the procured peanuts for aflatoxin to ensure each batch of materials procured comply with requirements by relevant standards; regularly clean the facilities and equipment for materials storage, and ensure they comply with relevant requirements. For different varieties, the items to be checked for acceptance include: purity rate, mildew, scab rate, foreign matters, water content, smell, vehicle cleanliness; the aflatoxin content should comply with provisions in GB 2761, the water content should be $\leq 9.0\%$, and no mildew should be detected.

6.2 For different varieties, check their purity rate, mildew rate and scab rate; the aflatoxin content should comply with provisions in GB 2761.

6.3 Peanuts from different regions should be processed separately to avoid water transfer and subsequent mildew.

6.4 Clean the surface of equipment and operation panels that have contact with food daily; leave no peanut kernels or mills in the equipment to prevent aflatoxin generation caused by damp and mildew, or insect contamination.

6.5 Reduce the retention time of semi-finished products between different stages of production to avoid microbial multiplication and other contamination.

6.6 Peanuts baked should be cooled before packaged; the cooling step will further reduce temperature and to volatilize the moisture; the cooled peanuts should be packaged in plastic bags which should be sealed and packaged in the outer bags for protection. The peanuts should be used as soon as possible.

6.7 The relative humidity for storage should be lower than 50% and the temperature for storage under 15°C; other warehouse management rules should be followed.

6.8 Test the finished products for aflatoxin to prevent aflatoxin contaminated products to enter the market. Finding positive testing results, traceability analysis should be conducted using the batch number to determine causes leading to the problems, and take rectification measures accordingly.

6.9 While producing peanut oil, without sacrificing nutrition and flavor, adopt safe and effective physical, chemical and biological techniques/technologies to remove aflatoxin in peanut oil (such as alkali refining, absorption, ozone, ultraviolet irradiation, etc.), reduce the content of aflatoxin in finished peanut oil as much as possible.

Appendix II Corn

1. Harvesting

It should comply with provisions in Chapter 3 of the Standard.

2. Before Storage

2.1 It should comply with provisions in Chapter 4 of the Standard.

2.2 Harvested corncobs should be transported to dry places for drying as soon as possible, conveyances should be clean and dry, insect-free, and without visible microbial contamination.

2.3 Corncobs for threshing should be dried as soon as possible until the water content is below 21%, so as to reduce damage to corns caused by threshing. During drying, corncobs should not be placed in fields for natural drying in sunshine. Corn kernels after being threshed should be placed in dry and clean places.

2.4 Threshing equipment should be clean and dry; it should be capable of minimizing damage to corns.

2.5 Corn kernels to be stored for a long time after being threshed should be dried within 48 hours until the water content is below 14%. If corn kernels threshed enter the subsequent processing directly, the time between threshing and processing should be reduced as possible.

2.6 When drying the corn kernels under sunshine, they should not have direct contact with the ground; avoid mixing the dried corn kernels with the undried corn kernels or foreign matters.

2.7 In rainy or cloudy days, corn kernels should be spread out indoors and be dried with draught fans; they could be spread out on drying yards in later sunny days.

2.8 In drying with heated air, avoid excessive heat; the heating temperature should be between 43 °C ~ 53 °C to avoid damage to corn quality.

2.9 Clean and sort dried corn kernels to remove damaged kernels and other foreign matters; for example, use density separators or air legs for sorting.

3. Storage

It should comply with provisions in Chapter 5 of the Standard.

4. Transportation

It should comply with provisions in Chapter 6 of the Standard.

5. Processing

5.1 Choose to procure corn materials in regions with lower contamination levels as possible.

5.2 It is recommended to ask for and document relevant procurement information when receiving corns stored by farmers. Inspect vehicles for transport. Observe general appearance of corns when discharging the cargos. The corns should be stored separately and dried as soon as possible if they are wet to the touch. Refuse to accept corns with signs of insect damages or mold growth. Test water content of corns, and dry the corns to the safe water content level as soon as possible.

5.3 Before warehousing, take measures to clean the corns, remove abnormal corns which are moldy, damaged, bitten by insects and which have wrinkled skins and changed colors.

5.4 Before warehousing, clean the warehouse to remove any residues; ensure the warehouse has proper facilities to prevent insects, moisture and microbial multiplication.

5.5 Inspect the materials before they enter factories; ensure the water content of corn kernels is under 14%, the water content of moldy kernels is under 1%, and the aflatoxin content should be within the controllable level. If the water content of corn kernels exceeds 14%, it should be reduced to the required level as provided in this Standard.

5.6 Sort the corns after they enter the factory; further remove moldy kernels, damaged kernels and kernels with abnormal colors to prevent them from entering the next production and processing link.

5.7 After sorting, the aflatoxin content in edible part of corns should comply with limits in GB 2761. Unqualified corns picked out during the sorting process should be destroyed or separated from edible food. Unqualified corns

to be used to produce edible oil should be stored separately with marks that they are not for direct human consumption.

5.8 When producing corn oil, without sacrificing nutrition and flavor, adopt safe and effective physical, chemical and biological techniques/technologies to remove aflatoxin (such as alkali refining, absorption, ozone, ultraviolet irradiation, etc.), reduce the content of aflatoxin in oil as much as possible.

Appendix III Cottonseeds

1. Harvesting Cottonseeds

1.1 It should comply with provisions in Chapter 3 of the Standard.

1.2 Ripe cotton should be harvested as soon as possible. Harvested seed cotton should be temporarily stored in ventilated and dry places.

1.3 In manual harvesting, dead cotton and normal seed cotton should be gathered separately.

1.4 Before mechanical harvesting, defoliant and ripening agent could be used to reduce branches/leaves/ boll shells/other tissues mixed into seed cotton.

2. Storage of Seed Cotton

2.1 After manual harvest, seed cottons should be placed in cotton sites or other sites for air-drying in the sun as soon as possible; there should be no pollutants around the sites, the cotton stacks should be higher than the ground; roll the seed cotton for air-drying in the sun every day; when the water content is reduced to 12%, send the seed cotton to cotton ginning mills for processing.

2.2 Seed cotton harvested by machines should be directly sent to the cotton ginning mills for processing.

2.3 Pay attention to temperature during storage and transportation of seed cotton; when the stack temperature exceeds 35 °C, take ventilation measures to lower the temperature; moldy seed cotton should be picked out for separate processing.

3. Storage of Cottonseeds

3.1 Test such indexes of water content, foreign matters and mildew rate before storage of cottonseeds; cottonseeds with water content of under 12% can be stored for a long period. Cottonseeds with water content higher than 12% should be stored separately, and have the interior temperature checked. Such inorganic foreign matters as soil and gravels should not exist in foreign matters. Cottonseeds with high damage rate should be stored separately and processed as soon as possible; strictly control moldy cottonseeds that enter the factories; such moldy cottonseeds are not allowed to be processed as oil materials.

3.2 The sites where cottonseeds are placed should have proper measures for cleaning, drying, rainproof, damp proof, rat proof, and bird proof. Cottonseeds should be stored with a distance of 35 cm from the walls and 10 cm from the ceilings to avoid mildew.

3.3 Pay attention to temperature during storage and transportation of cottonseeds; when the temperature exceeds 35 °C, take ventilation measures to lower the temperature; moldy cottonseeds should be picked out, and should not be put back to normal cottonseeds in the stacks.

4. Processing

4.1 When cottonseeds enter the process of processing, first conduct screening and air separation to remove foreign matters; moldy cottonseeds should be picked out and should not enter the processing process.

4.2 After sorting, the aflatoxin content in shelled cottonseeds should comply with limits in GB 2761.

4.3 When producing cottonseed oil, adopt safe and effective physical, chemical and biological techniques/technologies to remove aflatoxin (such as alkali refining, absorption, ozone, ultraviolet irradiation, etc.), reduce the content of aflatoxin in oil as much as possible.

Appendix IV Tree nuts

Note: this appendix applies to pine nuts, Brazil nuts, hazelnuts, walnuts, pistachios and figs.

1. Harvesting

Ripe tree nuts should be harvested as soon as possible to reduce diseases caused by fungi (such as *aspergillus flavus* and *aspergillus parasiticus*) and insects that produce aflatoxin. Tree nuts of some varieties contaminated by aflatoxin and then bitten by insects will crack but can still grow on trees. Therefore, the earlier the ripe tree nuts are harvested, the higher the chance of keeping their shells intact, and thus reduce the possibility of contamination, thus prevent inner shells from being invaded by insects and fungus spores producing aflatoxin.

1.2 Stuffs under trees that may generate toxic fungi (such as *aspergillus flavus* and *aspergillus parasiticus*) or rotten stuff should be cleaned.

1.3 When tree nuts are harvested by shaking trees, mechanical reapers with capturing frames should be used, or protective boards or waterproof cloth should be placed under the trees for collection, so as to prevent nuts from falling onto the ground.

1.4 Excrement should be removed in time to reduce the chance of tree nuts' exposure to such fungi producing aflatoxin as *aspergillus flavus* and *aspergillus parasiticus*, because spores of fungi producing aflatoxin may gather in the air near the ground and adhere to residual bodies of plants.

1.5 After harvest, trashes and foreign matters produced during harvest and nuts remain in trees should be cleaned up to reduce overwintering of insects and fungi producing aflatoxin in them.

2. Storage

The storage temperature should be controlled within the range of 0 °C ~10 °C to reduce mold growth.

3. Transportation

Tree fruits should be transferred from transport containers to storage facilities as soon as possible. For tree nuts of different batches which are transported together, physical separation for different batches should be ensured. Each batch should have identification marks and records.

4. Shelling

4.1 Processing personnel of tree nuts should maintain personal hygiene, wear protective clothes, and train in food safety knowledge.

A location should be zoned for shelling of nuts in the main processing area of facilities. Ensure that air containing dust will not go through exhaust system or other openings and will not enter other areas in the facilities.

4.2 Control processes should be established for each working procedure to avoid cross contamination of aflatoxin among all batches of tree nuts during processing.

4.3 tree nuts should be shelled immediately after being harvested, or the tree nuts should be stored in suitable conditions to prevent contamination with insects, livestock, fungi producing aflatoxin, chemicals, microbes, foreign matters and dust. Suitable storage conditions should be ensured if tree nuts cannot be shelled for a long time so as to prevent generation of aflatoxin, and proper fumigation approaches may be used to control insects.

4.4 Shelled tree nuts should be dried in air as soon as possible, and the drying rate and calorific intensity should be defined by the intended use of products. The tree nuts should be dried to have safe water content, and the water activity (A_w) should be less than 0.70 at 25°C. When the water activity is less than 0.70, *aspergillus flavus*/*aspergillus parasiticus* cannot grow or produce aflatoxin.

4.5 After drying, water content should be checked with samples of representative batches, and humidity measuring instruments should be calibrated before check.

4.6 Mechanical dryers should be set to make water used conform to processing requirements, and no recycling is permitted.

4.7 Personnel and equipment in a processing area should not enter other areas. During processing, rejected materials should be removed in time, and the volume of containers for rejected materials should meet the need of processing.

4.8 Manual and/or electric sorting technologies should be adopted to remove foreign matters and tree nuts with all kinds of defects. Tree nuts which are obviously contaminated with excrement, contaminated or bad or have other defects should not be used for processing. Tree nuts which are damaged by insects or crack in the early stage should be removed, because these tree nuts have probably been contaminated with aflatoxin.

4.9 Conduct pretreatment with moisture (vapor or drinking water) to reduce tree nuts whose kernels are damaged in cracking period, and reduce the water content of cracked kernels immediately with rapid circulation of dry air, to make fungi producing aflatoxin unable to grow.

4.10 The final products processed (materials, shelled or unshelled, bulk or for consumption) should have proper water content and be properly packaged to prevent products from becoming rotten and going bad in normal conditions of transport and storage.

Appendix 5 Dairy Cow Feed

Study on the biological process of aflatoxin Bi in the bodies of dairy cows indicates that its residues are transferred to milk in form of metabolite aflatoxin Mi. To keep the aflatoxin Mi in milk at the minimum level possible, attention should be paid to residue of aflatoxin Bi in feed daily fed to dairy cows.

1. Harvest

Avoid harvest crops and forages in rainy days; avoid the hot and humid environment during harvest period that will result to risks of aflatoxin generation in the subsequent storage.

2. Before Storage

2.1 Before drying or shelling, the time for stacking newly harvested damp crops should not exceed hours; avoid oxidation due to piling (piling will cause rise in temperature) to reduce risks of fungi producing aflatoxin.

2.2 When cereals and forages are placed outdoors for air-drying in the sun, take preventive measures to protect the crops from rains.

2.3 While producing silages, pay attention to the water content of the harvested crops and proper/even cut length; the harvested crops should be placed in cellars quickly, no contact with rain; silage ferment could be used to reduce multiplication of harmful bacteria and let silages properly ferment.

3. Storage

3.1 During storage of forages, increase space between bales, reduce size of stacks, change the directions of grass stacks to enhance air circulation during storage of forages; forages may not be piled up on the ground, as they will absorb moisture on the ground to and increase the water content of forage grass; avoid placing forages in the same site with other damp products so as to avoid mildew of forages.

3.2 Prevent and control damages by birds near the silage pits; prevent birds taking seeds and breaking the silage films, so as to avoid entrance of air and thus mildew of silages.

3.3 After silages are made, during the feeding period, the depth of silage taking surface should exceed 25 centimeters each day; the cut should be clean and neat to prevent loose and puffed surface that may cause secondary fermentation.

3.4 Feed should be stored in shady, cool, ventilated, dry and clean warehouses. Generally, the warehouse temperature should be controlled between 18°C ~ 26°C, humidity between 45% ~ 65%, and the storage temperature in shady and cool places should be under 20°C. Prevent rodents and birds from entering warehouses.

3.5 For feed stored in warehouses, the containers should be clean and ventilated, with dust removing and cleaning equipment; regularly monitor temperature and humidity in the warehouse, take sample/test and clean the storage containers to prevent mildew of stored feed caused by long-term storage.

3.6 Exterior packages of feed must be clean and dry; feed bags should be stacked on pallets, or on water-resisting layers on the ground. Feed stacks should be neat, flat and arranged in a crisscross pattern; between stacks there should be passages of 50 cm; stacks should not be placed against walls to ensure air circulation.

3.7 Strictly control water content of procured raw materials; the procured raw materials of high water content must be dried before being stored (in an ideal situation, the water content of dried crops is equivalent to 70% of the relative humidity). When cereals are stored in a form of particles, the water content should be under 15%; when cereals are stored after being smashed, the water content should be under 12%. Water content higher than the levels is easy to cause mildew and thus produce aflatoxin.

3.8 Pastures should receive materials strictly following aflatoxin limit standards, and follow the requirements for ventilation/temperature and humidity for materials storage; avoid mildew due to storing a large amount of materials at a time.

3.9 Test Aflatoxin content for materials that have been stored over two months before use to prevent using moldy materials in production.

3.10 Forages should be used according to the principle of “first in, first out” to avoid mildew due to too long storage time.

4. Transportation

4.1 During transport of feed, take proper measures to control the water content and temperature of the feed. Bulk cargo vehicles could be used to transport feed, or cover trucks with water-proof canvas to prevent feed from becoming damp in transport. When using water-proof canvas, avoid significant temperature difference between

inside and outside, which will cause vapor condensation in cargos and result rise in local humidity and temperature.

4.2 During transport, drenching, damping, exposure to strong sunshine and piling up for a long time should be avoided to prevent increase of aflatoxin.

5. Processing

5.1 Test Aflatoxin on feed materials entering factories to ensure each batch of materials comply with standard requirements. Try to purchase bulk raw materials from fixed origin; inspect each batch of materials that are vulnerable to aflatoxin contamination; unqualified materials cannot enter the subsequent production process; the facilities and equipment for materials storage should meet relevant requirements and are regularly cleaned.

5.2 Control water content and temperature during feed processing. If processed feed is packaged in bags and stored without sufficient cooling, temperature difference will result in moisture condensation, which is highly likely to cause mildew of feed.

5.3 Feed production is affected by seasons. During production, add fungicides in proper amount could effectively prevent feed from mildewing during subsequent transport, storage and use, and thus to further reduce the possibility of aflatoxin contamination.

5.4 If feed already has mildews, use adsorbents to absorb aflatoxin in the feed to reduce animal absorption of aflatoxin in the alimentary canal; feed severely molded are not allowed to be fed to animals.

5.5 Clean grinders and lifting device in time, ensure the equipment is clean and there is no feed piled up. Adopt proper cleaning processes, clean production lines regularly, establish warehouse cleaning records; manually disassemble and clean corners which cannot be covered by the automatic cleaning, prevent mildew of feed residue to cause contamination to subsequent products.

5.6 Test finished products of aflatoxin; avoid aflatoxin contaminated feed to enter the market.

5.7 Finished feed products with excessive aflatoxin level should be under strict control and not exit storage; according to product characteristics, the contaminated feed could be destroyed or returned for re-production; the re-processed products could be used for lower grade purposes.

6. Mixing for Total Mixed Rations (TMR)

6.1 Mixing equipment for total mixed rations (TMR) in pastures should be cleaned in time to prevent the residue materials from being piled up on blades and to cause mildew. Forages and silages which are discolored and had gone bad are forbidden to be added into TMR transport mixers.

END OF TRANSLATION