CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF OCHRATOXIN A CONTAMINATION IN WINE

CAC/RCP 63-2007

1. PREAMBLE

Mycotoxins, in particular ochratoxin A (OTA), are secondary metabolites produced by filamentous fungi found in soil and organic matter, which spread and thrive on grapes during the berry ripening phase.

The formation of OTA in grapes is mainly due to berry contamination by certain mould species, and particular strains thereof, belonging essentially to the *Aspergillus* species (in particular *A. carbonarius* strains and to a lesser extent *A. niger*).

The presence and spread of such fungi in vineyards are influenced by environmental and climatic factors, nocturnal dampening condition of grapes, grape bunch shape, susceptibility of vine varieties, aeration level of the grape bunches, health status of grapes and berry injuries which are the main entry points for ochratoxigenic fungi.

2. CULTIVATION PRACTICES IN THE VINEYARDS

Application of the following preventive measures is recommended, in viticulture regions in which the climatic conditions are favourable to the formation of OTA in vine products in order to reduce endemic risk which favours the onset of the most damaging vine diseases:

2.1 Regional risk information

- Ensure that regional authorities and grower organisations:
  - analyse and identify the species and strains of toxigenic fungi present in their region;
  - combine this information with regional risk factors including meteorological data and viticultural techniques and propose appropriate management;
  - communicate this information to growers.

2.2 Training of producers

- Ensure training of producers with regards to:
  - risk of mould and mycotoxins;

- the identification of ochratoxigenic fungi or the presence of mould spoilage, especially black mould, and period of infection;
- knowledge of preventive measures to be applied to vineyards and wineries.

2.3 Vineyard establishment

- Favour vine establishment in well aerated areas while avoiding very humid areas.
- Draw up plots of land with adequate planting disposition, and vegetation architecture (trellising system) to:
  - facilitate planting operations;
  - avoid direct contact of grapes bunches with the soil;
  - ensure good pest and disease control;
  - minimise the risk of grapes sun burn;
  - promote the uniform ripening of the grape.

2.4 Plant material

- Choose vigorous rootstock and varieties which are less prone to developing mould and grape rot.
- Choose clones or biotypes within a variety which are better adapted to climatic and soil conditions in the specific cultivation areas and less sensitive to mould and rot development, which are often characterised by less compact grape bunches.
- Lay out homogeneous plots of land (varieties, clones) to facilitate growing operations and to ensure better crop and disease control and to obtain uniform ripening of the grapes.

2.5 Growing techniques

- Apply management practices which favour leaf/fruit balance for vines and which reduce excess vigour, in particular, avoiding inappropriate nitrogenous fertilizer applications.
- Favour vegetation or organic cover of soils and avoid working the soil between the beginning of the grape ripening and grape harvest period in order to limit the transfer of soil particles and the associated fungi to the grapes.
- Favour placing grape bunches in an orderly manner to avoid overcrowding.
- If water input is necessary, irrigate as regularly as possible in order to avoid berry splitting and the onset of cracks on the skin which are sources of mould penetration and development, especially in warm regions.
- Avoid using marc containing toxigenic fungi as a fertilizer in the vineyards.

2.6 Pest and disease control

- Carry out leaf removal in the grape cluster zone while recognising the need to limit the risk of sun burn. This must enable the aeration of clusters. This is particularly necessary under hot and humid weather conditions while the grapes are ripening.
- Avoid lesions on the berries and skin damage caused by diseases, insects, phytotoxicity and sun burn.
- Remove shriveled/desiccated berries.
- Apply vine protection plans in order to control dangerous fungal diseases affecting grape quality (oïdium disease, acidic rot).
- Prevent attacks of grape berry moths, grape mealybugs and grape leafhoppers, which favour mould development on damaged berries; pest control needs to be carried out according to biological and epidemic risk; under high risk conditions preventive treatments must be applied by using specific products and taking into account the warnings of plant protection regional services.
- Apply appropriate and registered protective programmes against grape rot and mould using appropriate management to avoid fungal resistance. Appropriate treatments are recommended in all situations which are favourable to the development of toxin producing species.

3. PRACTICES AT HARVEST

Only a healthy grape harvest can ensure optimal quality and safety of vitivinicultural products. Consequently, only a healthy grape harvest can be used for human consumption without the risk of quality loss and without food safety problems for consumers.

The date of harvest must be decided taking into account grape ripeness, sanitary level, and forecasted climatic changes and endemic risk. In high risk OTA areas, it is recommended to advance the harvest date.

When grapes are extensively contaminated by mould:

- the grapes cannot be used for making concentrated musts or wine;
- the grapes can only be used for distillation.

3.1 Production of raisined grapes for wine production

For production used to obtain raisined grapes for wine production (sweet wine), the following actions are recommended:

- Ensure the hygiene of containers to be used for the harvest and/or the drying of grapes.

- Use only grapes not damaged by insects and not contaminated by mould.
- Sort grapes by eliminating damaged or contaminated grapes.
- Place grapes to be dried or raisined in a single layer and avoid overstacking.
- Favour progressive and uniform drying of all parts of the grape bunch.
- Take the necessary measures to avoid development of fruit fly infestation.
- For particular conditions of drying in open air, it is recommended to dry in well ventilated conditions and to cover the grapes at night to prevent condensation and humidity.

3.2 Production of wine grapes

The following actions are recommended if the harvest is moderately contaminated with toxigenic moulds and is to be used in wine production:

- Grapes damaged by insects, mould, or contaminated by dirt particles must be eliminated before harvest or at harvest time depending on harvesting technique.
- Grapes need to be sorted, in order to separate the grape bunches or the damaged parts of bunches. It is important to discard grapes with black mould.
- Harvested grapes must be transported as quickly as possible to the winery in order to avoid extended waiting, especially for grapes with a high proportion of juice.
- It is important to clean containers after each load, especially in the case of harvests where the containers may have been used to harvest grapes that may be rotten.

4. TREATMENT AT THE WINERY

Under conditions with a risk of OTA contamination, it is recommended to measure the level of OTA in the musts to be used in winemaking.

4.1 Pre-fermentation operations and treatments

- Avoid skin maceration in the case of OTA high-risk harvests or carry out short maceration.
- In the case of a significant contamination of red grapes, evaluate possibility of carrying out rosé winemaking.
- Adapt pressing rate to the health status of the grape; in case of contamination, carry out small volume, low pressure quick pressings. Avoid continuous press.
- In the case of contaminated grapes, avoid using pectolytic enzymes for racking must or maceration. Quick clarifications with must filtration, centrifugation and flotation are preferable.

- Avoid post-harvest heating treatments and aggressive and prolonged macerations.
- In the case of contamination by OTA, it is preferable to treat the grapes and the musts with the lowest possible and most effective doses of oenological charcoal in order to avoid possible loss of aromatic and polyphenolic compounds when the treatment is carried out on wine.

4.2 Fermentation treatments

- Carry out, as far as possible, fermentation and maturing in smooth walled containers to avoid sources of contamination linked to previous fermentations or maturing and in order to facilitate cleaning.
- Dry active yeasts or inactive yeasts can help reduce the OTA level.
- For alcoholic or malolactic fermentations, use yeasts or bacteria which have adsorbent properties for OTA; ensure that these characteristics are guaranteed by the supplier. Note that the usage of these products only enables a partial reduction of OTA.
- It is recommended to introduce, as quickly as possible, following fermentation treatments.

4.3 Maturing and clarification treatments

- Maturing on lees can help in reducing the OTA level. The risks of this technique related to the organoleptic quality of wine must be evaluated.
- Current clarification products (organic or inorganic fining agents) have variable levels of efficiency for reducing the level of OTA:
  - Oenological charcoal is the most effective.
  - Certain cellulose and silica gels associated with fining with gelatine only enable a partial reduction.

  Before use:
  - Become informed of effectiveness of product used and application technology.
  - Carry out trials with different dosages to ascertain sensory repercussions and application rate.

5. GENERAL CONDITIONS FOR FOOD CONTACT MATERIALS

Food contact materials used during harvesting, transport and production in the winery should not give rise to contaminant migration or cross-contamination which can endanger human health.

6. CONCLUSION

These recommendations are based on current knowledge and can be updated according to the findings of research to be pursued.

Preventive measures are essentially carried out in vineyards and treatments undertaken at the wineries are solely corrective measures.