Features of conducting audits of grain suppliers for the flour mill

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Abstract. The human impact on the environment has led to the contamination of food raw materials and food products with toxic substances of various origins. A large global problem for the production of crop and livestock products was production and consumption waste, which are toxic to the environment and humans. Therefore, the global development of food production has a clear tendency to ensure its safety. Currently, special attention is being paid to the issues of production and sale, quality control and high-grade food products. This is one of the priority issues for introducing new systems for managing product quality and food safety. In the most general sense, food safety is the absence of possible damage, harm. Such a definition is relative and probabilistic, i.e. at the moment there is no threat, but it may arise in the future, or there is no mortal danger, for example, for a person, but there is a danger to his health. Therefore, when assessing suppliers of raw materials, a risk-based approach is often used based on an assessment not only of the actual condition of the enterprise, but also on further risks from the supplier. The goal of reducing the risk of diseases caused by the consumption of pollutants has been identified as one of the most important food safety issues in the country and around the world. Grain processing products are one of the main types of raw materials for the processing industry. Therefore, it is strategically important to consider the risks of wheat entering the mills. The article provides an overview of modern criteria for assessing suppliers of grain for the production of flour, taking into account global trends in the development of crops, as well as methods for assessing them.

1. Introduction
One of the main sectors of the agro-industrial complex of Russia is the milling industry. It provides raw materials not only for the bakery, confectionery, and pasta industries, but also serves as a link in the product traceability chain from field to counter. Therefore, ensuring the production of safe products free
of physical, chemical, biological, radiological, allergenic and GMO factors is the most important task of a flour mill.

Significant amounts of substances hazardous to the human body can enter the human body with food [1–4].

The demand for grain and products of its processing, the ability of its long-term storage and transportability determine the leading role of this type of raw material in supplying the population with food products, and animal husbandry - with feed [5–8].

2. Material and methods. Grain and products of its processing. International Standard Research Methods and Product Management and Safety Standards

The need for assessing grain suppliers is also due to verification of the requirements of CU TR 015/2011 “On grain safety”, CU TR 021/2011 “On food safety”, Federal Law FL No.206 of July 21, 2014 “On Plant Quarantine”.

3. Research results

Grain mass at all stages of distribution, from sowing to its processing at the plant, is a living system that constantly requires compliance with processing, storage and distribution.

It is necessary to control the quality, volumes and condition of grain and prevent risks arising at the stages of production and sale of grain at all stages of production and consumption (figure 1).

It is known that the grain mass contains various components: fusarium grain (a favorable environment for the development of deoxynivalenol, zearalenone), a harmful admixture (for example, ergot), residues of plant protection products (pesticides), microorganisms, grain pests, etc., which are harmful not only for the human body, but also the further grain distribution chain.

![Figure 1. Causes of adverse food safety factors in the grain.](image-url)
Due to the high requirements of flour processors for the safety of raw materials, flour mills need to tighten requirements for grain suppliers. Compliance with the rules of these legal documents is the minimum criterion in assessing a grain supplier.

Enterprises should be guided by Global G.A.P international standards for assessing grain growing farms and relevant Directives of the Council of the European Communities from international practice [13–15].

Basically, the assessment of grain suppliers is carried out according to the following scheme (figure 2).

![Figure 2. Supplier Selection Algorithm.](image_url)

The process of evaluating and monitoring the suppliers of basic grain can be carried out by the following methods:

A) Request for official information – this method includes collecting and analyzing information from the supplier on the quality and safety indicators of the delivered goods, reports of inspections of state bodies, providing photographs of the infrastructure, providing certificates for food safety and quality management systems and other documents confirming the supplier’s ability deliver a safe and quality product;

B) Questioning - the method is based on filling out a questionnaire for the supplier and their self-assessment; in this case, the questionnaire includes questions critical for the flour mill, for example, about the content of GMO and allergens in grain, the residual amount of pesticides, information about the residual substances used and undeclared in the Technical Regulations, used in processing fields from pests;

C) Statistical monitoring - based on an analysis of records of incoming grain quality control from the supplier in question for previous periods and/or monitoring of supplier data on the websites of the Federal Accreditation Service, the Federal Service for Veterinary and Phytosanitary Surveillance/experience of other leading flour mills;

D) The on-site audit of the supplier is a reliable method of obtaining objective evidence regarding the safety and quality of the supplied grain. It can be carried out together with the customers of the flour mill in the chain “from the field to the counter”.

Grain suppliers should be evaluated on an ongoing basis. Supplier assessment planning can be carried out in the form of audit schedules, analysis of requested documents on grain safety and quality during the grain harvesting period, laboratory quality control of samples taken from farms or directly upon receipt of grain at the flour mill.

A list of approved grain suppliers is compiled based on the assessment and audit of grain suppliers, which is provided to interested parties upon request [16–18].
Practice shows that on-site inspection of farms engaged in crop production is an effective way to increase the safety of grain supplied.

As a rule, a test questionnaire is compiled for further data analysis and inclusion in the approved list of grain suppliers for this purpose.

For example, we give a part of the questions drawn up on the basis of international experience, the Global G.A.P standard and the Technical Regulations of the Customs Union (table 1).

**Table 1.** An approximate list of questions when assessing a grain supplier.

| №  | Question/Statement                                                                 |
|----|-----------------------------------------------------------------------------------|
| 1  | Farms must adhere to agricultural practices appropriate for the region.            |
| 2  | Farms should conduct regular crop inspections and record the results of these inspections. It is necessary to monitor and record pest control, for example, using the results of test traps. Weather conditions should be monitored and recorded |
| 3  | The varieties used must be certified                                               |
| 4  | Cultivated varieties must be resistant to pests and diseases causing major economic damage |
| 5  | Farms should have a specific grain storage strategy, monitor and record the temperature and condition of stored grain. Measures should be taken to eliminate any increase in temperature, water ingress, which should be recorded |
| 6  | The stored grain must be conditioned and have a humidity and temperature suitable for the storage period. There is access to a hygrometer and a temperature sensor |
| 7  | Training documentation should be available                                         |
| 8  | The list of telephone numbers that can be used in case of emergency should be located next to the telephone, as well as written information about the location of the farm |
| 9  | Fire safety measures should include restricting access to buildings and the safe use and storage of combustible materials |
| 10 | Organic fertilizers contaminated with heavy metals or other chemicals that may be harmful to human health must not be used |
| 11 | A properly equipped first aid kit and eye wash products should be available in all areas of the manufacturer and made available to employees |
| 12 | Contamination of fresh food with manure, biological solid or other natural fertilizers is strictly prohibited |
| 13 | Pesticide workers must be trained or able to demonstrate their competence and knowledge of how to handle pesticides properly |
| 14 | After the application of pesticides, the intervals prior to harvesting must be strictly observed and cannot be ignored under any circumstances. This also applies to the use of any storage chemicals, such as shoot growth inhibitors. For crops that have been continuously harvesting for some time, a plant protection plan should be developed that does not jeopardize the intervals before harvesting, for example, using field markers to clearly distinguish plants ready for harvest from other crops |
| 15 | A system or procedure should be used to avoid contamination of harvested and stored crops with fragments of glass and hard plastic. This is, for example, a policy of demonstrating glass and transparent plastic, a reporting and investigation procedure |
| 16 | Crop products should be traceable to the farm and lot of origin. Each batch of planted grain at the moment when they enter the field must be assigned a unique identification number or mark. This identification number must accompany the product to be sent to the manufacturer so that the production history of this product can be traced back to the farm of its origin |
| 17 | A risk assessment analysis should be carried out to determine the need for a residual pesticide testing program. Testing laboratories must be accredited. The results of the presence of pesticide residues should be traceable to the manufacturer and the batch. Action plans should be developed in case of exceeding the maximum permissible residual levels |
Records of the use of pesticides after harvest must accompany the goods leaving the place of production, and they must contain information on the time of disposal (the interval between processing and consumption), which must be observed. 

Cereals and other products transported from the farm should be covered after loading and during transportation, and the trailers used should be clean, in good condition and prevent product contamination. If they were previously used to transport any waste, metal, etc., they must be washed with a machine wash. 

Access and keys to the pesticide warehouse should only be given to employees who have been trained in the use of pesticides. 

Seeds purchased must have accompanying documentation containing the name of the variety, batch number, name of the supplier, data on the certification of seeds and their processing. Information must be kept for 2 years. 

Warehouses should be clean and prevent contamination by foreign substances or wild animals from outside. All facilities for storing or accepting grain must be cleaned and treated with an insecticide before use, and residues from previous crops must be removed. Cleaning information must be retained. 

When filling each storage bin and/or silo, test samples must be taken and stored. They must be selected and stored from each batch exported from the holding. It is necessary to get a quality certificate for each batch. 

Farms should keep records of grain and be able to trace the product through post-harvest operations before transportation to the customer. Batch products must have a unique identification at all stages and must not be mixed incorrectly. 

An emergency plan should be developed in case of injuries, fires, floods, accidents in the power system, freezing, problems with water supply, leakage of chemicals or waste. 

Genetically modified (GM) crops should be stored separately from other cereals. 

Before using any new plot of land for growing crops, it is necessary to conduct a study on the subject of previous use of the land in order to find out its history, the presence of local landfills, chemical diffusion or the burial of any potentially hazardous materials. 

The farm should use a system for recording the history of crops and agronomic activity in each field or on a plot of land. 

Field maps should be drawn up for farms to help crop rotation and optimize the use of plant protection products and fertilizers. 

A written Waste management plan and map showing risk areas and demonstrating ways to eliminate the risk of pollution should be available for all sites. Areas to which it is necessary to pay attention: 1. The use of fertilizers, pesticides. 2. Disposal of containers, plastics, used disinfectants, silage wastewater, obsolete drugs, used needles, metals and other waste. 3. Storage of fuel, fertilizers, pesticides, disinfectants, medicines and other substances that can cause environmental pollution. 

Only pesticides licensed for use in the EU or local law may be used. Pesticides used in the manufacture of products intended for export must comply with the legislative objectives of the importing country. 

Farms should have a plan reflecting the intended use (substance and quantity) of pesticides for the coming year and actual use in previous years. Records must be kept for 3 years. 

Crop protection from pests, diseases and weeds should be achieved using minimal pesticides (volume) and with minimal environmental impact (specificity and type of composition). 

Recognized pest management technologies must be used in pest control. Non-chemical pest control methods are preferable to chemical treatment. 

Soil analyzes for nitrogen, phosphorus and potassium should be carried out every year when harvesting to make the correct types and quantities of fertilizers.
4. Conclusion
Thus, the assessment of grain suppliers according to food safety criteria should take into account the regulatory requirements of local and international legislation, which provides for a system for monitoring the cultivation and distribution of grain according to critical indicators.

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