



INTERNAL AND EXTERNAL QUALITY CONTROL OF SEEDS FOR MAJOR CROPS, FORAGE AND VEGETABLES IN BRAZIL

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Abstract

Both external and internal quality control of seeds in Brazil aims to ensure that seeds meet established standards in a reliable manner. To this end, physiological, sanitary, genetic and physical quality are assessed to provide control throughout the production process and technologies used in the seeds. External quality control is performed by the Ministry of Agriculture, Livestock and Development (MAPA), which establishes minimum standards for the marketing of seed lots. In internal control, the company itself performs the control, that is, throughout the production process in its laboratory it performs quality analyses of the seeds produced based on the Seed Analysis Rules (RAS), which must be met to market the seed lots. In view of the above, this literature review aims to describe and highlight the relevance of internal and external quality control of seeds in Brazil for major crops, forages and vegetables.

Keywords: seed production; management; trade; seed certification.

Controle de qualidade interno e externo em sementes de grandes culturas, forrageiras e hortaliças no brasil

Resumo

O controle de qualidade externo e interno de sementes no Brasil visa garantir que as sementes atendam aos padrões estabelecidos de maneira confiável. Para tanto, são avaliadas as qualidades fisiológicas, sanitárias, genéticas e físicas para proporcionar controle em todo o processo produtivo e tecnologias utilizadas nas sementes. O controle externo de qualidade é realizado pelo Ministério da Agricultura, Pecuária e Desenvolvimento (MAPA), que estabelece padrões mínimos para a comercialização de lotes de sementes. No controle interno, a própria empresa executa o controle, ou seja, durante todo o processo produtivo em seu laboratório realiza análises de qualidade das sementes produzidas com base nas Regras de Análise de Sementes (RAS), que devem ser atendidas para comercializar os lotes de sementes. Diante do exposto, esta revisão de literatura tem como

objetivo descrever e destacar a relevância do controle de qualidade interno e externo de sementes no Brasil para as principais culturas, forrageiras e hortaliças.

Palavras-chave: produção de sementes; manejo; comércio; certificação de sementes.

Introduction

The internal quality control in seeds carried out by the producer follows internal rules and procedures to reach the minimum standards established by the government and, simultaneously, meet the strictest standards of the company itself, aiming to meet market demands and ensure customer satisfaction (Brazil, 2022). External quality control, on the other hand, involves compliance with laws, normative instructions and procedures defined externally by the state. Both in internal and external control, the Rules for Seed Analysis (RAS) must be followed, ensuring that the results are consistent (Brazil, 2022). The RAS indicate the standard procedures for obtaining samples and for performing physical purity tests, species and cultivar verification, for the examination of harmful seeds, germination, tetrazolium, determination of moisture content, seed health and others, in addition to tolerances (Brazil, 2022).

To be successful in any agricultural enterprise that uses vegetable crops, it is important to require the use of high-quality seeds, with the potential to produce vigorous and productive plants, uniformly and in the shortest possible time. That is why it is necessary for the farmer, when acquiring quality seeds, to obtain a specific cultivar identified for easy recognition, as it provides a guarantee that is developed in quality control programs and aims to supervise the entire process of production and seed technology (Costa, 2023).

The gains in seed performance are accompanied by increases in their cost to farmers, raising the level of demand regarding product quality, which highlights the strategic importance of the quality control programs of seed producing companies and that is why there are two types of seed quality control, being internal and external control that serve all species and cultivars (Cirino *et al.*, 2022).

In view of the above, this literature review aims to describe and highlight the relevance of internal and external seed quality control in Brazil of large crops, forages and vegetables.

Material and Methods

The study of this literature review was performed in November 2024, which includes consulting scientific publications such as journals, articles, books, and other material that allow describing the importance of internal and external quality control of seeds of large crops, forages, and vegetables in Brazil. According to when preparing a literature review, the results of some

discovery, experiment performed, description of a case, description of some phenomenon that occurred are being reported (Pereira *et al.*, 2019).

Results and Discussion

3.1 Internal Seed Quality Control (CIQS)

This control consists of the records and parameters that the seed producer uses to know the history of each seed lot and obtain quality seeds with a minimum of losses and possible cost (Silva *et al.*, 2022). In addition, internal quality control can be used for different seed species and cultivars and involves seed choice, land selection, crop decontamination, moisture determination, rapid feasibility tests, germination, vigor, equipment efficiency, and various records (Biosognin, 2024).

Seed companies, through a series of systematic activities during all phases of seed production, can verify the quality to identify and correct possible problems to protect the company's good reputation, as well as consumer satisfaction (Smiderle, 2021).

Although it is not required by law, seed producers are increasingly using internal quality control, as they are becoming aware that the additional cost is low compared to the return provided. To this end, seed producers are implementing Seed Analysis Laboratories within their seedbeds, to verify the quality of the seeds produced before sending them to an official laboratory or accredited to Ministry of Agriculture, Livestock and Development (MAPA) (Silva *et al.*, 2021).

To obtain reliable results and quality assurance in the seeds produced, companies adopt measures ranging from the production field, harvesting so that there is no contamination, these measures are often even stricter than those required by law, as a protective measure. To ensure that quality seeds are obtained for commercialization, companies have long been adopting measures such as vigor tests.

Vigor tests become more representative and, even though they are not mandatory, they are adopted by most companies as internal quality control, helping the producer's understanding, as the test takes into account the number of normal seedlings measured, showing results in centimeters per plant, through the length of seedlings through the evaluation of the growth of aerial and root parts and dry mass of these seedlings (Ebene, 2020).

Main Seed Analyses required for commercialization:

Seed analyses consist of the technical procedures used to evaluate the identity and quality of the representative sample of a seed lot, with quality being understood as the set of attributes of physical, physiological, genetic and sanitary analysis in the seeds (Ebene, 2020).

These samples, which represent the seed lots, arrive at the laboratory of the company that was registered and accredited in the National Registry of Seeds and Seedlings (RENASSEM), has a

technical responsible (RT), who is also registered in the RENASEM, to coordinate the analysis of the seeds within the laboratory (Brazil, 2022). The analyses that must be included in the analysis bulletin are:

Purity analysis: Aims to determine the percentage composition by weight and the identity of the different seed species and the inert material of the sample and by inference that of the seed lot. All seeds and/or dispersal units belonging to the species under examination, declared by the applicant, or as being the predominant one in the sample and must include all botanical varieties and cultivars of the species, are considered pure. In addition to the whole, mature and undamaged seeds of the species, the seeds should be included as pure seeds (Brazil, 2022). The purity standard is found in IN 45, in Law No. 10,711, of August 5, 2003, for the largest seed of *Brachiaria* species it is 60%, for *Panicum* 40%, and for the rest of the crops the purity should be around 98% to 99%.

Determination of Other Seeds by number: From a work sample, as prescribed in the RAS for each crop (Brazil, 2022), where the number of seeds of other species present in the work sample is verified, considering as seeds of other species those not belonging to the sample under examination, including seeds of another cultivated species, wild seeds, harmful tolerated and harmful prohibited. Each species has its standard quantity required.

Germination: Determine the maximum germination potential of a seed lot, which can be used to compare the quality of different lots and estimate the value for field sowing of both large crops, forages and vegetables.

Laboratory analysis methods under controlled conditions, of some or all external factors, have been studied and developed to allow a more regular, rapid and complete germination of seed samples of a given species. These conditions, considered optimal, are standardized so that the results of the germination tests can be reproduced and compared, within the limits tolerated by the RAS (Brazil, 2022). For the germination test according to Law No. 10,711, of August 5, 2003, the germination percentage for forage seeds is around 70%, while for large crops such as soybeans the germination percentage is above 90%.

Verification of other cultivars: The objective is to verify the number of seeds of other cultivars present in a working sample, with a weight equal to that of the purity analysis and to verify what percentage of seeds of average sample is in accordance with the cultivar indicated by the sender. In Brazil, this verification is required by MAPA, through IN 45, of September 17, 2013, only for beans and cowpeas, conducted together with the purity analysis and the result expressed by weight of the working sample

In addition to these analyses, which are the main ones described, necessary for the commercialization of seeds, other tests and analyses of seeds can also be done, such as:

Moisture Grade Determination: Determine the moisture content of seeds by greenhouse methods. The water contained in the seeds is extracted in the form of steam by applying heat under controlled conditions. The recommended methods have been developed to reduce oxidation, decomposition or the loss of other volatile substances, while ensuring maximum water removal, as much as possible (Brazil, 2022).

Tetrazolium test: Biochemical test that can be used when seeds need to be sown soon after harvest, when they are dormant or to solve problems found in the germination test, such as the presence of many abnormal seedlings. It can also be used to evaluate vigor, determine the viability of seeds after pre-germination treatments, drying, insect and moisture damage, as well as to detect mechanical damage from harvesting and/or processing (Brazil, 2022).

In pre-harvest, this tetrazolium test is very important because producers collect soybean pods daily at random in the field, five to seven days before harvest. The pods are manually threshed, and the seeds are evaluated for physiological quality by the tetrazolium test in soybean seeds, as it provides an estimate of the damage caused by stink bugs and deterioration by moisture in the seeds (Nascimento *et al.*, 2020).

According to IN 44, November 22, 2016, forage seeds of the species *Lolium multiflorum* L., annual ryegrass may be marketed based on the feasibility results obtained through the tetrazolium test, according to methodologies established by MAPA.

Accelerated aging test: There are a series of tests to evaluate seed vigor such as accelerated aging that simulate adverse environmental factors raising temperature and humidity, that is, they provide adequate conditions for the advance of seed deterioration (Ebone, 2020). In this sense, after the seed goes through a stress process, it is put to germinate, thus obtaining an estimate of the potential for storage and maintenance of a uniform stand in the field.

The combination of these two factors associated with the exposure time of these seeds is important for the efficiency of the test and can be conducted at temperatures of 40 to 45°C, but several authors recommend the use of 41°C (Guedes *et al.*, 2011; Marcos-Filho, 2020).

Cold test: It consists of subjecting the seeds to low temperatures and high humidity for a prolonged time, to quantify the differences present in the seeds, where lots with seeds with the best performance in the cold test are the most vigorous. Thus, it is necessary to make use of vigorous seeds, so that the plants originating from these seeds do not interfere with the establishment and development of the crop (Marcos-Filho, 2020).

Emergence in beds: Helps to obtain information on the performance of the lots delivered and determines the vigour of the seeds. The conditions for carrying out the test, appropriate to the species in question, regarding the sowing time, spacing between rows and between plants and

recommended sowing depth for each crop, allows an estimate of the potential of the lots to establish a stand in the field (Ebene, 2020).

3.2 External Quality Control (CEQ)

This control is carried out by an entity outside the power of influence of the seed producer or trader and can also be by a private entity or by the government is an essential element of a seed program, as it helps the researcher, producer and farmer (Peske *et al.*, 2019).

The breeder benefits from the External Quality Control (CEQ), which provides him with the means to develop a system to take newly developed cultivars from the experimentation fields to the farmers, they are benefited by the availability of seeds and ensure a minimum of quality and this is done through the seed certification system is characterized by a control of the generation of the seeds produced and by the inspection of the seed trade that is nothing more the seed offered for sale (Silva *et al.*, 2021).

The CEQ, in general, takes place in two ways:

- a) Seed certification system: This production system is mainly characterized by having a control of the generation of seed produced and monitoring the entire technological process involved in obtaining each batch of seeds produced.
- b) Supervision of the seed trade: This CEQ is done on the seed offered for sale. A special team different from the one that works in seed production acts in the inspection. This team verifies the documentation and seed quality.

3.3 Seed certification

Seed certification is the process controlled by a competent public or private body, through which it guarantees that the seed has been produced in such a way that its genetic origin can be known and that it complies with the pre-established physiological, sanitary and physical conditions (Silva, 2021).

In addition, it is an important component of the seed industry, since it operates in all its elements, participating in production, processing, marketing and providing services to farmers. It is the only method that allows the seeds of the superior cultivars to maintain their genetic purity and all the qualitative characteristics that may be interesting to the farmer, make them acquire and sow them (Brazil, 2020).

The seed certification process is solidified based on the quality of the seeds, allowing the certification systems, in addition to verifying and guaranteeing the genetics and purity of the plants, to participate in the evaluation of quality control through the classes and categories of seeds (Silva, 2021).

3.4 Seed classes and categories

Seeds are identified, according to the production process, by the following classes: genetic, basic, certified (C) and non-certified (S). Classes are made up of categories. These are classification units that consider genetic origin, quality, and the number of generations. As an example, there are certified seeds of the first and second generation (C1 and C2) and the non-certified seeds of the first and second generation (S1 and S2).

- **Genetic seed:** reproduction material obtained from a plant breeding process, under the responsibility and direct control of its breeder or introducer, maintaining its characteristics of identity and genetic purity.
- **Basic seed:** material obtained from the reproduction of genetic seed, carried out in order to guarantee its genetic identity and varietal purity.
- **Certified first-generation seed (C1):** plant reproductive material resulting from the reproduction of basic seed or genetic seed.
- **Certified second-generation seed (C2):** plant reproductive material resulting from the reproduction of genetic seed, basic seed or certified first-generation seed (C1).
- **First generation non-certified seed (S1):** plant reproductive material resulting from the reproduction of genetic, basic or certified seed of categories C1 or C2.
- **Second-generation (S2) non-certified seed:** plant reproductive material resulting from the reproduction of S1 non-certified seed.
- **Seed for own use:** any individual or legal entity that uses seeds for the purpose of sowing must acquire them from a producer or trader registered in RENASEM. The user may, for each harvest, reserve part of his production as "seed for his own use", which must comply with Annex XXXIII, of Normative Instruction No. 9 of MAPA:

1º The reserved seed must be used only on his property or on property whose possession he holds and exclusively in his next harvest.

2º The amount of seed reserved must be compatible with the area to be sown in the following harvest, observing the parameters of the cultivar in the RNC and the area intended for sowing, to calculate the amount of seeds to be reserved.

3º The seeds must come from areas registered with the MAPA and Supply, when it is a protected cultivar.

3.5 The attributes of seed quality

The attributes of seed quality are characterized and divided into four attributes, which are:

Seed legislation

According to Law No. 10,711, of August 5, 2003, regulated by Decree No. 10,586, of December 18, 2020, with regard to the production and marketing of seeds and seedlings, it also

determines that seed production includes certified and non-certified classes (Brazil, 2020). Certified seed is one that is produced under supervision and technical monitoring at all stages of production, by individuals or legal entities enrolled in RENASEM (Brazil, 2020).

RENASEM is the single registry, whose purpose is to qualify before the MAPA, professionals and companies that carry out the activities of production, processing, repackaging, storage, analysis or trade of seeds or seedlings and the activities of technical responsibility, certification, sampling, collection or analysis of seeds or seedlings provided for in Law No. 10,711, of 2003 (Brazil, 2020).

The law determines that the seed reserve must be made in an amount compatible with the area to be sown, considering the recommendation for sowing the cultivar, in addition to the fact that the processing and storage of these seeds must only occur on the property of the farmer who made the reservation (Brazil, 2020).

Patent Law

The processes involved in obtaining events from genetically modified organisms are patentable in Brazil, this protection goes up to the industrial product. It is a much broader protection that is contemplated in the Plant Variety Protection Law (LPC), this patent protection makes it possible to charge a technological fee even to the farmer who used his seed, while the farmer who saves and uses his own seed is exempt from paying something to the breeder of the cultivar (Brazil, 2020).

However, the producer who saves his seed to plant in the next harvest, the producer needs to comply with a series of rules and procedures that are described by Law 10.711/2003, in Ordinance 538/2022 of the MAPA, which are:

- The number of seeds saved must be compatible with the area to be planted and can only save around 20% to 30%.
- The sale of saved seeds is prohibited.
- The producer must declare the use of the seeds at the time of planting.
- The producer must communicate the final weight of the seeds reserved for planting within 90 days after harvest.
- The producer must register the seed field if the varieties are protected by the Plant Variety Protection (PVP).
- Go to the Unit of the MAPA of your nearest municipality or municipality, fill out and sign the registration form for the area to produce your own seeds and present an Invoice for the seed purchased and a document that proves the area of the property.

For the producer who acquired his seeds from a company, he pays royalties, this payment by the seed producer who licenses the cultivar, while the licensing of a patented event is the

Technology Fee, paid by the seed producer or farmer if he uses his grain as seed. The Technological Fee can be collected in two moments: at the time of purchase of seeds and at the time of sale of the grain to that farmer who did not buy seeds (Biosognin, 2024).

In general, the commercialized materials protected by the Patent Law include several patents, such as the method of gene introduction, type of transformation, inhibitor, vector, molecular marker, gene silencer, among others (Nascimento *et al.*, 2020).

3.6 Seed production

The seed is the input with the highest added value, as it contains the genetic constitution of the variety. The maximum potential for agricultural productivity is determined by genetic potential. Commercial seed is produced within strict quality standards that guarantee the producer the best performance in the field, maximizing the benefits of other inputs, such as fertilizers and pesticides (Cirino *et al.*, 2022).

The choice of the seed category depends on the category to be produced, as the planting must always be of a higher category, according to the legislation that establishes generation control to preserve the genetic quality of seeds (Normative Instruction No. 45, of MAPA, of September 17, 2013).

The following categories can be produced: genetic seeds, base seeds, certified seeds of the first generation – C1, certified seeds of the second generation – C2, seeds of the first generation of certified seed – S1 and seeds of the second generation of certified seed – S2. At the discretion of MAPA, the production of seeds of classes S1 and S2 that are not certified, without genetic origin, if there is no technology available to produce their genetic seed.

It is important not only to choose the category of seeds, but also to cultivate, because the producer must know the most favorable agronomic characteristics, as the genetic improvement program of research companies offers producers a series of options. Among the desirable characteristics of a cultivar, the following stand out: disease tolerance, especially resistance to lodging, high productivity, good industrial quality, commercial classification, among others (Santos, 2020).

It is worth mentioning that the choice of the area where the seed production field is indispensable, as the history must be analyzed and the predecessor crop must be considered, such as the previous crop where the field must not have been cultivated with the same species in the previous harvest, except if it is of the same cultivar. This care is justified by the fact that seeds that fall to the ground survive from one year to the next or, sometimes, for more than a year, and can cause varietal contamination (França Neto *et al.*, 2016; Bisognin, 2020).

Other problems related to the previous crop are diseases and pests, since their crop residues can constitute a source of contamination for the current crop, in addition to wild species, the

knowledge of weeds helps in the choice of the area, as it can be predicted the difficulty of its control, according to the degree of infestation, and the removal of harmful and wild seeds in the processing process (Marcos Filho, 2020). An example is the case of the presence of red or black rice, which can compromise the quality of the field for rice seed production and lead to the condemnation of the entire seed lot.

3.7 Influence of sowing on seed quality control

The appropriate sowing time is determined by a calendar from the MAPA and by favorable weather conditions for good production. The equipment used in sowing deserves special prior care in its cleaning, to avoid the presence of seeds of other species or cultivars and, thus, preserve the varietal purity of the field (Brazil, 2020).

The correct regulation of the seeder and the appropriate sowing speed are essential for a homogeneous distribution of seeds and fertilizer, which provides uniform emergence and development of the plants. Smaller spacings determine increased productivity, but increase the risks of diseases, lodging, and water stress in upland cultivation (Nascimento *et al.*, 2020).

To produce certified seeds (category C2), seeds of the basic or certified first generation category (C1) are used. Under these conditions, it is recommended to use low sowing densities, so that each resulting plant produces more seeds (Brazil, 2020).

The soil must be well prepared so that the seeds have adequate depth for the subsequent development of the plants, with reflections on the emergence and uniformity of the stand. The planting systems used for seed production are conventional, no-tillage, minimum tillage, pre-germinated system and seedling transplantation. Fertilization, crop treatments and irrigation should follow the same guidelines given for a commercial production crop (Fernandes *et al.*, 2018).

The contamination of a seed lot is characterized by the presence of seeds of plants of the same species, but of other cultivars, seeds of other crops, seeds of wild plants and seeds containing pathogenic agents, which makes field isolation essential, since the contamination of a seed lot can be of genetic or physical origin (Henning *et al.*, 2020).

It is the most commonly employed procedure and the most efficiently applied by the seed producer, as it controls the distance of the seed production field from other sources of pollen contamination and carrying out the spacing and barriers that aim with a minimum isolation distance can be reduced if the sowing of edge plants is executed, which will constitute plant barriers (Cirino *et al.*, 2022).

We also have the issue of atypical plants are those that differ from others of the same species by one or more characteristics, such as type of plant, branches, hairy stems or leaves, color, shape, size, pollen-releasing plants, weeds, inseparable seeds, and there is also the issue of roguing for the eradication of unwanted plants (Santos, 2020).

Roguing is done during the multiplication phase of the genetic material, any and all individuals that are out of tune with the population, such as wild plants, plants of other cultivars and atypical plants, must be eliminated (roguing) and, thus, preserve genetic, varietal and physical purity (Costa, 2023).

3.8 Inspections in production fields

The purpose of periodic inspections in the seed production field is to compare the quality of the field in relation to the standards established by the standards (Normative Instruction No. 45, of MAPA, of September 17, 2013).

The number of inspections for each crop represents the minimum acceptable, however, additional inspections may be performed. Inspection periods shall be verified at the following stages of crop development:

- **Preflowering period:** comprises the entire period of vegetative development that precedes the flowering of the plants. For the purpose of field inspection, it covers from seedling emergence to the beginning of flowering.
- **Flowering period:** This period is characterized by the phase in which the flowers are open, the stigma is receptive, and the anther releasing pollen. In this phase, it is possible to identify differences in agronomic and morphological characteristics between plants.
- **Post-flowering period:** in this period the receptivity of the stigma and the release of the pollen grain from the anthers will have ceased. The egg must already be fertilized and developing into a seed.
- **Pre-harvest period:** in this phase, the seed becomes harder and reaches physiological maturity. This is the most important period for decontamination, as various types of undesirable plants and varietal mixtures can be identified easily.
- **Harvest period:** in this phase, the seed is physiologically mature and sufficiently dry, allowing an easy and safe harvest; or, alternatively, physiologically mature and moist, although it can be harvested and dried artificially for storage.

It should be noted that, in the seed certification process, it is mandatory to carry out at least two inspections, which must occur during the flowering and pre-harvest periods.

3.9 Harvesting the seeds

Among the agricultural operations that play an extremely important role in the production of the crop, this operation influences both the quantity and quality of seeds (Lopes *et al.*, 2011). The harvest must be very careful to avoid varietal mixtures and mechanical damage to the seeds, so in the case of soybean seed, it is possible to perform the hypochlorite test that aims to quickly determine the percentage of mechanical damage to the seed (tegument rupture) (Smiderle, 2021).

Attention should also be paid to the cleaning of the harvester and all equipment involved in the operation to prevent mixing, especially when cultivars change (Santos, 2020)

When the seeds arrive at the Seed Processing Unit (UBS), they are usually found with a moisture content that does not allow their storage. With this, it should dry immediately. The storage of seeds with high moisture content generates heating in the grain mass, through fermentation and the development of fungi, which will compromise the physiological quality of the seeds (Fernandes *et al.*, 2018).

After harvesting, the seeds are not in a condition to be marketed. As a result, they are sent to the UBS for the removal of impurities, undesirable materials, to favor drying, storage, as well as standardize the seeds for planting (Smiderle, 2021).

It is important to note that the quality of a seed lot is a direct function of the production conditions, that is, the seed is made in the field and not in the UBS. No matter how efficient the processing is, it will not be able to correct problems in the process that occurred previously (Santos, 2020).

Identification of lots received at the seed processing unit

Identification comprises the following procedures:

- **Registration of the opening of the lot:** it must be carried out to define the moment from which the seed physically exists and ensure the individuality of that number of seeds that is arriving at the UBS.
- **Name of the producer or cooperative:** it is known that the conduct of the individual, producer or cooperative, interferes with the quality of the monitoring of the production crop.
- **Production site:** it will provide information that makes it possible to map the edaphoclimatic conditions during production.
- **Gross weight:** informs that the scale is closely linked to the "box" of the UBS, where we have the entry of the product.
- **Field number:** it is forbidden to have seeds from fields that have not been previously registered with the Certifying Entity, in this case the MAPA.
- **Date of receipt:** provides information on the environmental conditions during the final stage of maturation and harvesting of the seeds.
- **Indication of the species and cultivar:** contributes to avoid or minimize varietal mixtures during the handling of seeds at the UBS.
- **Category:** the category should be noted because it is possible that there are fields of the same cultivar registered in different seed production categories.

- **Moisture content:** informs about the following aspects: need for drying, storage potential before processing, susceptibility to mechanical damage and discount of the moisture content to be used in the purchase of the product that is above the established values.
- **Physical purity of the lot:** it will inform about the following aspects: loss in processing, machines to be used and contamination by seeds of tolerated and prohibited harmful plants.

3.9.1 Seed sampling

Seed sampling, according to Law 10.711, of August 5, 2003, aims to obtain a representative sample of adequate size, aiming at carrying out tests for quality assessment, certification and inspection (Brazil, 2020). To carry out these seed samplings, there are standards and procedures established by the MAPA, which are prescribed through Normative Instructions such as the RAS and the International Seed Testing Association (ISTA, 2018), which regulates the international trade of seeds.

According to the RAS, in order to obtain a sample of the appropriate size for the tests, it is important that the same components of the seed lot are present and in similar proportions, because the amount of seeds analyzed is generally very small in relation to the lot it represents, and the main tests are purity, determination of other seeds by number and germination (Brazil, 2020).

In order to obtain uniform and precious results in seed analysis, it is necessary that the samples are taken with great care and in accordance with established methods, that the technical procedure employed in the analysis, the results can only indicate the quality of the seeds contained in the sample submitted for examination, consequently, all efforts must be made to ensure that the sample sent for analysis represents, correctly, the composition of the lot in question (Brazil, 2022).

3.9.2 Types of sampling

Sampling is fundamental in all stages of seed quality assessment, from seed quality, production, receipt process, processing, analysis to trade inspection, since the characteristic of a volume or lot of seeds is based on sampling performed according to previously described procedures. Next, it will be presented how the seed sampling process is classified according to MAPA (Brazil, 2022).

- **Simple sample**

It is a small portion of seeds taken from a point in the lot.

- **Composite sample**

It is the sample formed by combining and mixing all the simple samples taken from the batch. This sample is usually much larger than that required for the various tests and usually needs to be adequately reduced before being sent to the laboratory.

- **Average sample**

It is the composite sample itself or a subsample thereof, with a minimum size specified in these RAS. It is the one received by the laboratory to be submitted to analysis in a laboratory accredited to MAPA.

- **Duplicate sample**

It is the sample obtained from the composite sample and under the same conditions as the average sample and identified as "Duplicate Sample". It is obtained for the purpose of monitoring the production and trade of seeds, in case of the need for a reanalysis.

- **Work sample**

It is the sample obtained in the laboratory, by homogenization and reduction of the average sample to the minimum required weights and never lower than those in Table 1.2, for the tests prescribed in these RAS.

- **Subsample**

It is the portion of a sample obtained by reducing the working sample, using one of the equipment and division methods.

When the samples arrive at the seed laboratory, the samples will be homogenized and divided in the conical divider, this depends on the shape of the seeds, to obtain the working sample according to the recommendations of the RAS and then determine the purity analysis, determination by numbers of other seeds and germination as previously commented to be able to market these seeds.

Conclusions

As mentioned above, it can be concluded that both the external and internal quality control of a seed, being seeds of different species and cultivars, involve special technology and must follow the RAS, registrations, certifications and investments in infrastructure, equipment, all this to obtain a quality seed. and thus, stay longer in the market.

Because a seed that requires high costs to produce also offers a high potential return, costs more, and has high quality.

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