SEEDnews

International seed magazine

Year XXIV - #5
September | October 2020
ISSN 1415-0387

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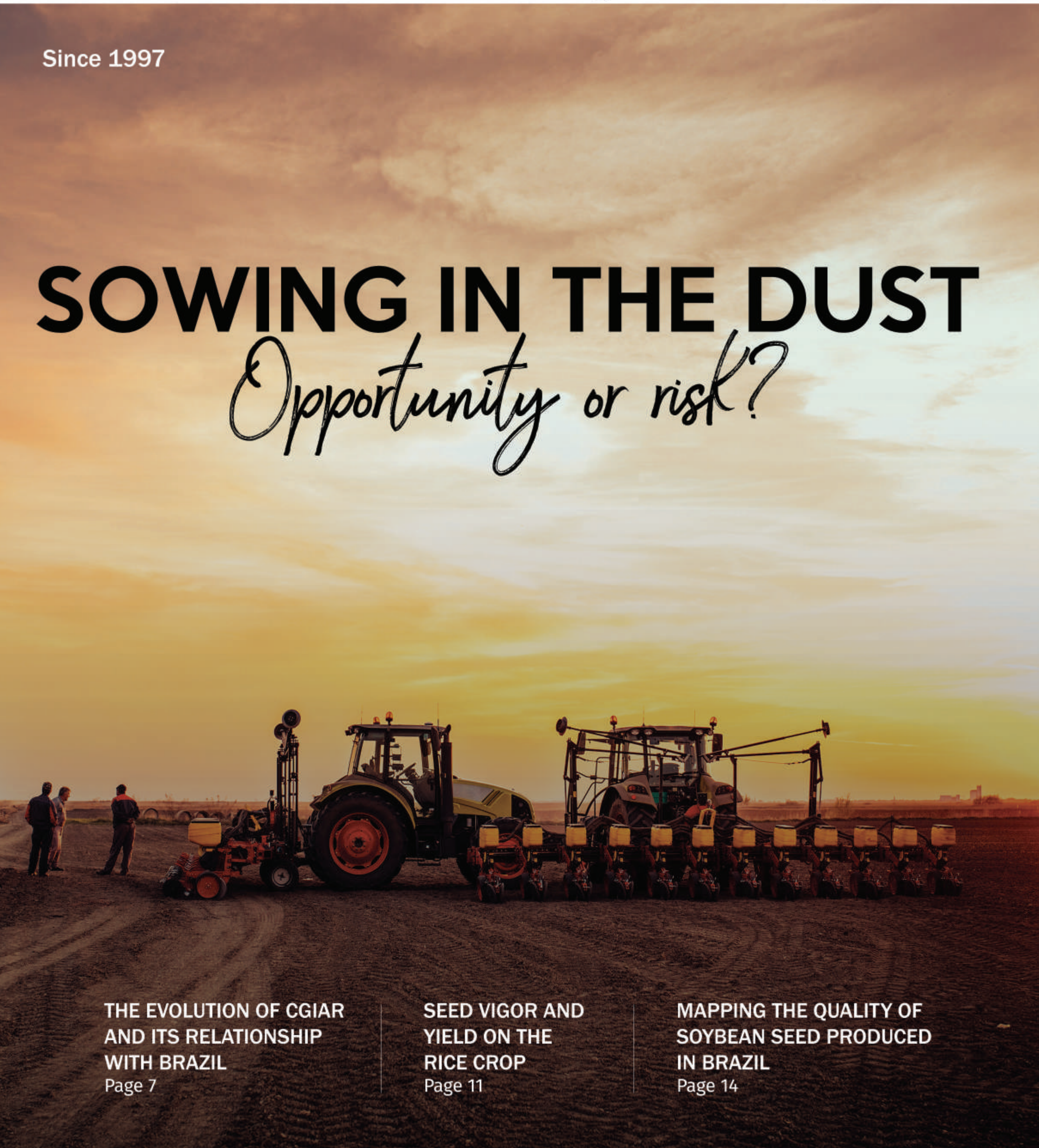

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summary

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SEEDnews Magazine
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CNPJ: 01.919.204/0001-93
+55 53 3225-2255 | +55 53 3272-2099
www.seednews.com.br

Year XXIV #5
September | October 2020

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Bimonthly publication. The opinions and originality of the articles, stories and interviews are the responsibility of the collaborators who sign them.

editorial

The basis of science in risk control and management

Agriculture is inextricably linked to external and climatic factors. The farmer can obtain the highest quality seed, develop the best management practices, carry out the necessary planning, be careful in storage, but even so, it is still subject to the influence of the climate.

In Brazil, only 10% of the agriculture area uses irrigation. Thus, it always leaves a huge expectation in relation to the rainfall level of exclusion. In 2019, the South of the country suffered considerable losses in the harvest due to low rainfall. This year, the month of September (sowing) is approaching and the situation is expected to repeat itself, due to the phenomenon of “La Niña”. In the Matopiba region, there is also a delay in rainfall, while the Northeast is likely to face a long period of drought.

If the rains are slow to arrive, many producers decide to carry out the sowing in the dust, in the expectation of a close return. This practice requires care and certain determinations should be taken into account. This is what the main article of this edition is about, bringing data and information related to sowing in the dust in a soybean crop.

Embrapa Soja’s project “Characterizing the quality of soybean seeds and grains in Brazil” is also featured in the September SEEDnews Magazine, bringing selected data in the research in relation to the physiological, genetic and sanitary quality of seeds. Likewise, the current edition features a profile of the company Biotrigo Genética, talking about its history, infrastructure, current performance fronts and planning defined the future of triticulture.

In addition, this month’s version of SEEDnews brings materials about seed vigor as a major factor in high productivity in rice growing; germplasm banks around the world with their social importance and the development of new genetically improved varieties; and on the importance of startups in the advent of technologies for agribusiness, bringing the case of Agrotis.

Happy reading and see you in the next edition!

SUSPICIOUS

Hundreds of households in the US received, without having requested it, packages with seeds apparently of a vegetable, whose label contained words in Mandarin. The complaints were huge, first because of the non-solicitation and second because of the problems that this process can cause, if the seeds really came from abroad. The US authorities are in the case and recommend not using the seeds. In times of pandemic, the perception of danger changes.


PARAGUAY

The Paraguayan Seed Producers Association (Aprosemp) has just offered a specialization course in seeds to its members, in partnership with the Federal University of Pelotas (UFPEL). This course, which had its inaugural class last July, is the seventh of its kind in which the first was in 1997. Paraguay has a strong seed sector to supply farmers who grow 3.5 million hectares of soybeans a year in addition of a good area with corn, rice, wheat and forage. Photos: Dolia Garcete (executive secretary of Aprosemp and Thiago Pedó, UFPEL course coordinator).

SCIENCE AND TECHNOLOGY

ABRATES in its publication volume 42, of the journal "Journal of Seed Science", presents 12 technical-scientific articles, covering aspects about physiology of recalcitrant and dormant seeds, treatment and vigor of seeds, non-destructive tests and seed health, among others. This year the entity celebrates 50 years and has contributed a lot to the advancement of seed science and technology in the country, being an international reference. Photograph; Francisco Carlos krzyzanowski- President ABRATES

NEW OPPORTUNITIES

Lucia Pajuelo and Suzana Chumbiauca, both with a specialty in seeds and with more than a decade at the head of the INIA - Peru seed program, have just offered a postgraduate course in seeds in partnership with the Agrarian University of La Molina. The course will be made possible by the new digital tools that do not require the physical presence of the participants. Knowledge and experience together provide a good training environment.

GREATNESS

The rate of use of soybean seeds (TUS) in the country is around 65%, which for an estimated area of 38 million hectares, means that 24.7 million are established with commercial seeds, using practically 1,5 million tons of seeds. This magnitude highlights the importance of the Brazilian association of soybean seed producers (ABRASS) so that the farmer does not lack quality seed of improved varieties. Photo: Luciano Vacari, executive director of ABRASS.

EVENTS

XXI CBSEMENTES
March 29 to April 01/2021
Curitiba - PR - Brazil

www.abrates.org.br

ISF SEED CONGRESS
May 17 to 19/2021
Barcelona - Spain

www.worldseed.org

SOY PRODUCTIVITY
The 2019/20 soybean productivity challenge, organized by CESB (Brazil Soy Strategic Committee), showed that the winners used seeds, whose lots had more than 90% germination and more than 80% vigor. This indicates the awareness on the part of the farmer that the physiological quality of the seeds has a close relationship with the productivity. In this sense, soybean seed producers are adapting to meet the growing demand from farmers for seeds of high physiological quality. Photo: João Augusto Pascoalino - Technical and research coordinator -CESB

GMO
Cuba officially opened the door to transgenic crops as a "complement to conventional agriculture" last July. The country imports more than 80% of the food consumed by its more than 11 million inhabitants. The shortage that the Caribbean country has suffered for decades has been exacerbated by the health crisis of COVID-19, which has emptied the shelves of the state's stores. This alternative will be applied to corn and soybeans, among other foods, which could also include sugar cane in search of a variety resistant to the effects of climate change.

PARTNERSHIP
SEEDnews has a strong partnership with the International Seed Federation (ISF) consisting basically of the publication and news of the entity in the magazine, and in return access to the annual ISF congress, which in 2021 will be held in Barcelona-Spain from May 17-19. As SEEDnews magazine is also published in English, some issues will be made available on the ISF website. The predominance of articles published in SEEDnews is timeless and universal, being useful for long periods of time for many places and situations.Photo: Francini Sayoc -Communication ISF and Silmar Teichert Peske - SEEDnews.

FORAGE
Unipasto, in addition to the traceability process started in 2017, also started VEQ - External Quality Verification - where seed lots are sampled in the UBS of Unipasto members and also, in the various resellers in the country, in order to verify the quality of the seeds of the cultivars from the Embrapa-Unipasto agreement and, compare them to the information contained in the Conformity Term. The "Semente Legal" platform has become more robust, dynamic and aligned with the wishes of associates, partners and producers. Photo: Marcos Roveri José, executive manager

BOLIVIA
Paola Román, Seed National Director, is in the process of forming an independent seed program from INIAF, both administrative and technical aspects. The proposal goes back to the previous system that was so successful in seed production, trade, and quality control. Seed producers, farmers' associations, seed importers, plant breeders and government officials are participating in the process. The new structure of the seed program is expected to be soon.

This space is destined for subjects that are under discussion on the seed environment
Use our hashtag #focusonseeds and collaborate with this page through social media

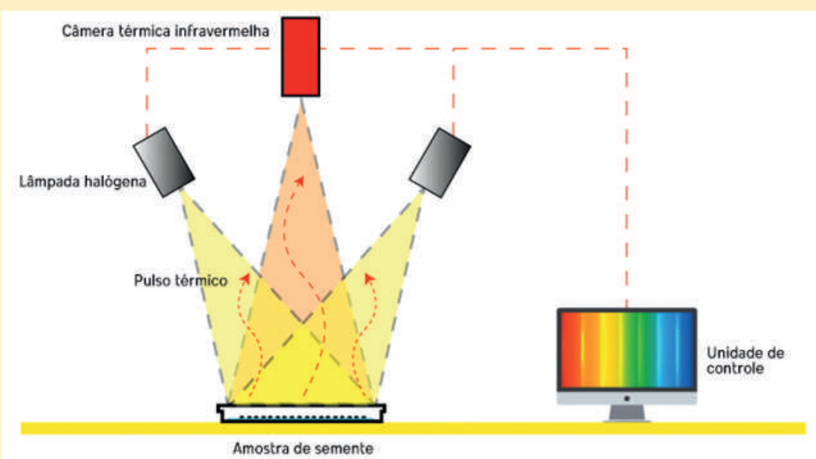
Standardization between laboratories

During a "live" event promoted by Alexandre Levien and Jonas Pinto, both from the "Fundação Pro Sementes", which addressed seed certification, some participants commented that there were cases with high variability in results for the same batch among different laboratories.

In practical terms, variations below 5% on the germination test, and up to 7% on the tetrazolium test, for the same batch, including the same evaluator, are considered normal and expected. However, variations above these levels cannot be accepted by the customer, as they have the potential to impair the company's quality control.

For this reason, there are many laboratories certified by ISTA in Brazil and in the world that participate in proficiency tests to standardize their analysis standards for each species of commercial importance.

As in any sector and market, the customer must always seek service providers renowned and certified by national or even international institutions, who are impartial and competent.



New test for seed vigor analysis by infrared thermography

Recently, an infrared thermal imaging platform was developed to detect high resolution of heat emission in plant tissues, with a spatial resolution of 47 μm. The development of this technology allows rapid and non-invasive testing of seed vigor in modern seed screening.

The study, carried out by academics in China, demonstrated the close correlation observed between the useful life of thermal decay and the vigor of seeds, which facilitates the quantitative forecast of vigor, thus providing time savings and management in future silvicultural research, as well as agricultural research in general.

MAPA publishes list of priority themes for 2020/21

According to the Official Gazette (DOU), MAPA approved the list of topics on the regulatory agenda as priorities for 2020/21. According to the document, there is no hierarchy or order of preference between the themes, with a maximum of 20% substitution possible until the end of the first year and will take effect from September 1, 2020.

Within the field of plant health and agricultural inputs, 18 themes were defined, 12 of which were specific to seeds and seedlings, which are: Production, commercialization and use of seeds (revision of IN nº 9/2005); Production, commercialization and use of seedlings (revision of IN nº 24/2005); National Cultivar Registry (RNC); Standards and norms for the production and commercialization of Sugarcane; Standards and norms for the production and commercialization of grass seedlings; Standards and norms for the production and commercialization of guava seedlings; Standards and norms for the production and commercialization of seeds and seedlings of ornamental species; Peanut seed and field patterns; Standards and norms for the production and commercialization of grape seeds; Protection of cultivars (revision of Law No. 9,456 / 1997 and Decree No. 2,366 / 1997); Standards and norms for the production and commercialization of cocoa seedlings; Standards and norms for the production and commercialization of large crops (revision of IN nº 45/2013).

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The evolution of CGIAR and its relationship with Brazil

The International Centers (CI) of the "Consultative Group for International Agricultural Research" (CGIAR) produced results that influenced global agricultural research, contributing to the growth and strengthening of research institutions around the world. Embrapa, like other research institutions in Brazil, between 1970 and 1990, made use of these international relations by strengthening its research capacity and taking advantage of the exchange of genetic resources. Global changes in policies, institutional arrangements, the generation of science in the priorities for the agricultural sector and the technical evolution of institutions have led to a reduction in donor interest in placing resources in IC, mainly to support more developed countries, such as Brazil. These are some of the reasons that led to the current situation, in which CGIAR's relevance and impact are decreasing.

In the 1950s, the Rockfeller and Ford Foundations began to discuss the creation of research institutes focused on food security issues. The starting point was to work with the most important food crops (rice, corn and wheat), focusing on the poorest farmers in developing countries. The creation of CGIAR was a mechanism to respond to these concerns. Initially, the "International Rice Research Institute" (IRRI) was created in 1960, and then the "Centro Internacional de Mejoramiento de Maíz y Trigo" (CIMMYT) in 1963.

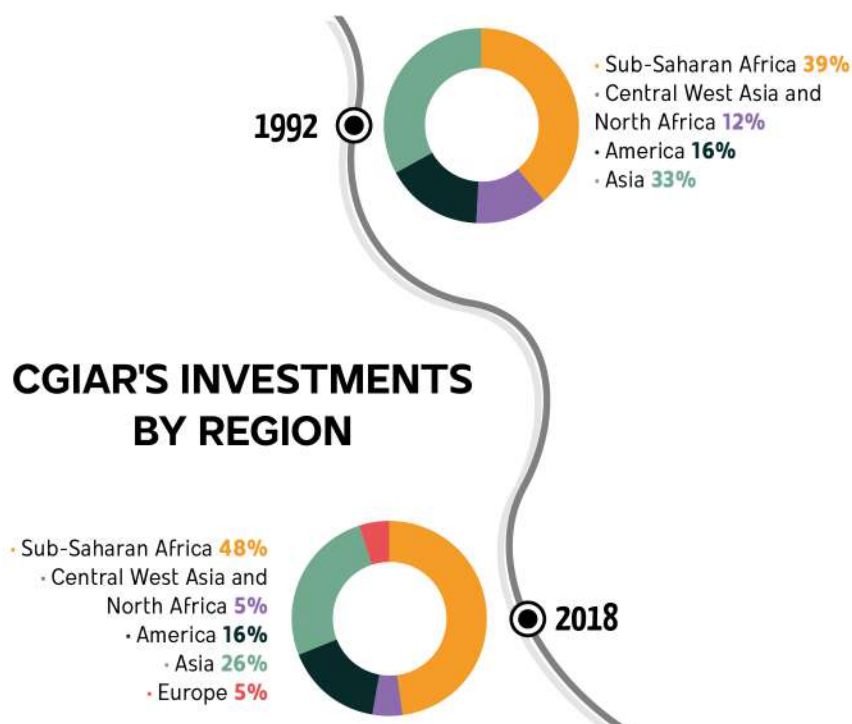
CGIAR, as a global partnership, appeared in May 1971, including the "International Center for Tropical Agriculture" (CIAT) and the "International Institute for Tropical Agriculture" (IITA), both created in 1967. In the next five years (1971 to 1976), seven other International Centers were created (see figure in the text).

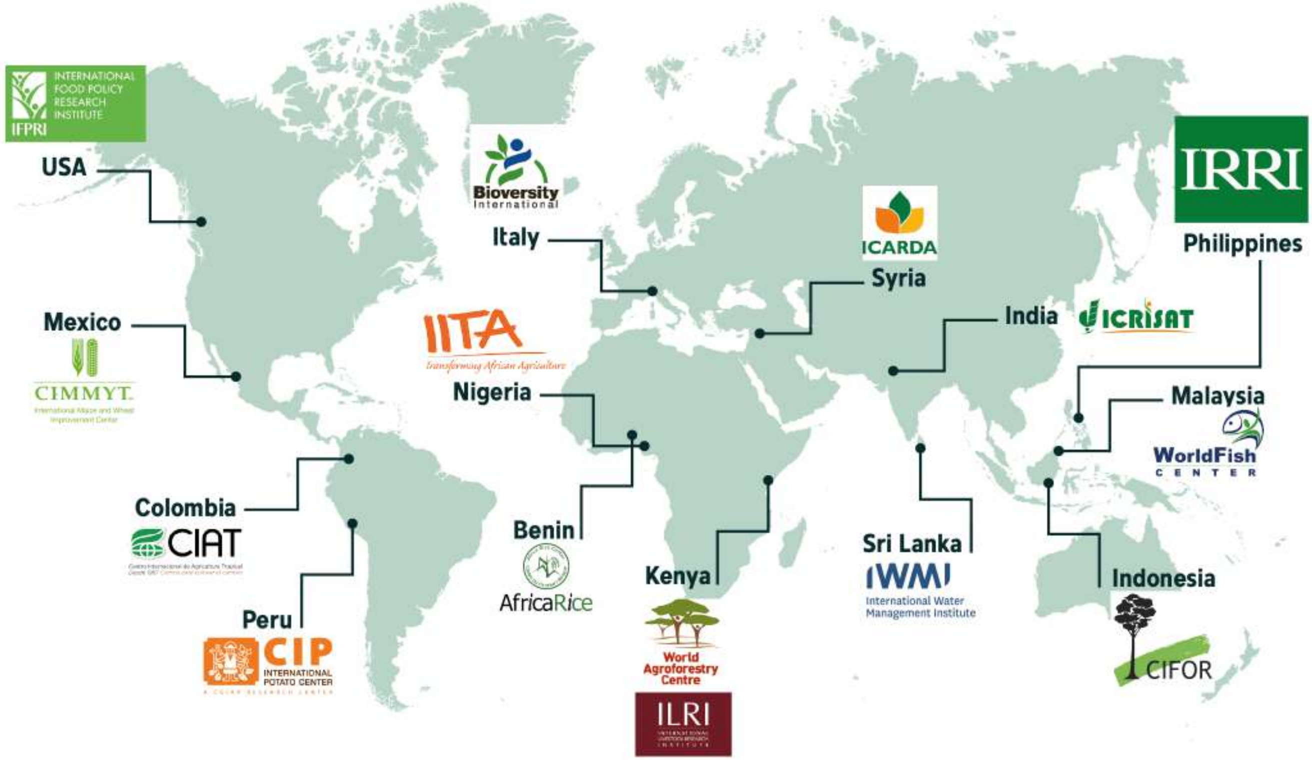
In 1983, the CGIAR brought together 13 CIs. Then, in 1990, there was an expansion, reaching 18. Reforms in the system unified and eliminated Centers, reducing them to 15. The retraction process was stimulated by the decrease in financial resources and the need to focus more on the work of these Centers. On that occasion, CGIAR donors encouraged the group to direct their actions to the poorest regions of the planet. Thus, from the 2000s onwards, Sub-Saharan Africa and Southeast Asia became the focus of donors and resources for CGIAR were allocated to projects with an emphasis on these regions and / or relevant crops to minimize poverty and hunger in these regions.

During the first 30 years of CGIAR's existence, Latin American countries, especially Brazil, were able to take full advantage of the existence of IC in the region. There were a large number of Brazilian researchers who went to these research centers to be trained. In addition, the exchange of genetic materials was intense and the basis for some breeding programs was built with the support of germplasm received through CGIAR. In 1992, the Rio Earth Summit was held and, in 1993, the Convention on Biological Diversity (CBD) came into force. These two events placed rules and limits on the free exchange of genetic resources between countries and, consequently, there was a drastic reduction in cooperation between Brazil and CGIAR, mainly of germplasm for breeding programs. Thus, CGIAR became more relevant in terms of training than in genetic resources.

It is worth mentioning that during this period of expansion and retraction of ICs, national research programs in several countries have been strengthened, not only to solve national problems, but also to contribute with solutions to global problems. Examples include China (Chinese Academy of Agricultural Sciences-CAAS), India (Indian Agriculture Research Institute-ICAR) and Brazil (Embrapa). As part of the changes in the external environment, in addition to the evolution of national programs, the private sector, which has always been away from ICs, took advantage of changes in the system to associate with it and work collaboratively in areas of interest.

The resources received by the CIs were those called "unrestricted", that is, resources that the management of each CI decided in which to invest. From the mid-1990s, the volume of "restricted" resources, those that donors indicated they should be used in, started to increase rapidly, to the detriment of "unrestricted" and, in 2000, represented similar values. Since then, there has been a continuous reduction in "unrestricted" resources and a slight increase in "restricted" resources. These changes have led ICs to follow donor interests far more than the demands of countries and regions.





CGIAR started a stage of changes in the way it works. The CI programming now has Challenge Programs (CP). The idea was to bring the knowledge and efforts of several CIs and partners to work together with global or regional challenges. In this way, three PCs were created, focusing on: water and food; micronutrient content; and plant genetic resources.

This way of operating and financing research added new perspectives to the traditional IC programs, as it stimulated work in broader teams and brought into them the stronger participation of national and international partners, including the private sector. It was a sum of efforts and resources not yet available in the CGIAR system.

As part of this evolution in the CGIAR's operating strategy, there was a detachment of some countries in the System, mainly because the decrease of available resources in the IC made them start to seek support from the countries and, in a way, competed with resources that should go to national programs. Training opportunities decreased and, when they existed, they were tied to resources marked for very specific activities that did not necessarily respond to the demands of countries. The limitation in the exchange of genetic resources, mainly between breeding programs, was another element that distanced national institutions from ICs.

However, this situation stimulated the appearance of interesting initiatives, such as the "Fondo Latinoamericano para Arroz de Riego" (FLAR). This Fund was created in 1995, based at CIAT, in Cali, Colombia. FLAR was designed by institutions and companies from rice-producing countries in Latin America and the Caribbean who felt the opportunity to join efforts and resources together to develop research on genetic improvement and create rice cultivars for their countries. Therefore, the public and private sectors came together and began to contribute resources to maintain, for more than 25 years, the operation of a strong program for the development and management of rice cultivars for Latin America and the Caribbean. It is a successful model of taking advantage of opportunities created by CGIAR to respond to the demands of the productive sector.

It is worth noting that, in the almost 50 years of CGIAR's existence, the world has undergone great changes. The world population went from 3.7 to 7.8 billion people. World commodity and energy prices fluctuated uncontrollably and sent out strong signals that global changes should be included in research agendas. With this sharp change in global research priorities, environmental issues, the sustainability of production systems, the use and exchange of genetic resources, the new and powerful biotechnological tools, the world of digital technologies, became part of these agendas. others. This change in scenario required CGIAR to constantly evolve and adjust to remain relevant to global agricultural research.

In 2008, CGIAR began a major restructuring process to increase its focus on global challenges; improve the relationship between ICs, which, by their mandates, act independently; and increase efficiency in the use of increasingly scarce resources, mainly by joining efforts with public and private partners. In 2010, the CGIAR Consortium of CIs was created, based in Montpellier, France, in order to coordinate and support the work of the 15 Centers, in addition to preparing a common work strategy for all of them. It is worth emphasizing that ICs are legally independent in their operations and legal frameworks.

From this initiative, the "CGIAR Research Programs" (CRP) were born, which, in 2015, were 15, and added to the platform of the banks of genetic resources. Undoubtedly, this new way of functioning stimulated the interaction between CIs and, also, between them and different partners. This strategy never had time to flourish, as the resources sought / promised never appeared in a significant way and the System was adjusted again, this time, with a focus on agri-food systems.

With the implementation of this reform, financial resources started to be distributed to ICs through the CRP. A "window" system started to be used, in which "window 1" was for unrestricted resources, "window 2" for resources marked to a specific CRP and "window 3" to a specific CI. In addition, there were bilateral resources, which were linked to agreements between donors and specific activities or Centers for predetermined activities.

"The limitation in the exchange of genetic resources, mainly between breeding programs, was another element that distanced national institutions from ICs."

For the 2017/21 period, these 16 CRP are now grouped into eight CRP Agri-Food Systems, four Global Integration Programs and four Research Support Platforms.

Following the evolution process of the CGIAR, in November 2019, during the meeting of the CGIAR Council, the document containing the recommendations of the Temporary CGIAR Reference Group for a unified and better integrated structure called "One CGIAR" was accepted considering the Sustainable Development Goals (Challenges of the 21st century). One CGIAR's mission is to end hunger in 2030. By the end of 2020, a management format suggestion should be presented, including the research strategy with fundraising for the next three years.

The CGIAR's changes and adjustments processes, described in this article, show the dynamics of the CI and its quest to respond to changes in the external environment. Their actions responded to changes in the world of donors and their international policies, the process of evolution of world agriculture, the scenario of changes in global priorities and problems and the ability to relate to public and private partners.

In conclusion, taking as an example the mandate cultures of Embrapa Arroz e Feijão and relations with AfricaRice, CIAT and IRRI, we can say that the changes carried out in CGIAR resulted in a significant reduction in the interactions between these CIs and Brazilian research institutions.

THANKS

We would like to thank the contributions and suggestions of the following colleagues: Alexander de Andrade, Andrew Jarvis, Eduardo Jose Graterol Matute, Flavio Breseghello, Frederico Ozanan Machado Duraes, Ivo Mello, Joe Tohme, Luciano Lourenço Nass, Lucimara Chiari, Luis Fernando Stone, Marilia Nuti, Nara Regina Gervini Souza, Osvaldo Vasconcellos Vieira, Pedro Antônio Arraes Pereira, Pedro Luiz Oliveira de Almeida Machado, Plinio Cesar Soares, Sergio Augusto Morais Carbonell and Silvino Amorim Neto. Even with your observations, we emphasize that the analyzes made in this document are the sole responsibility of the author.

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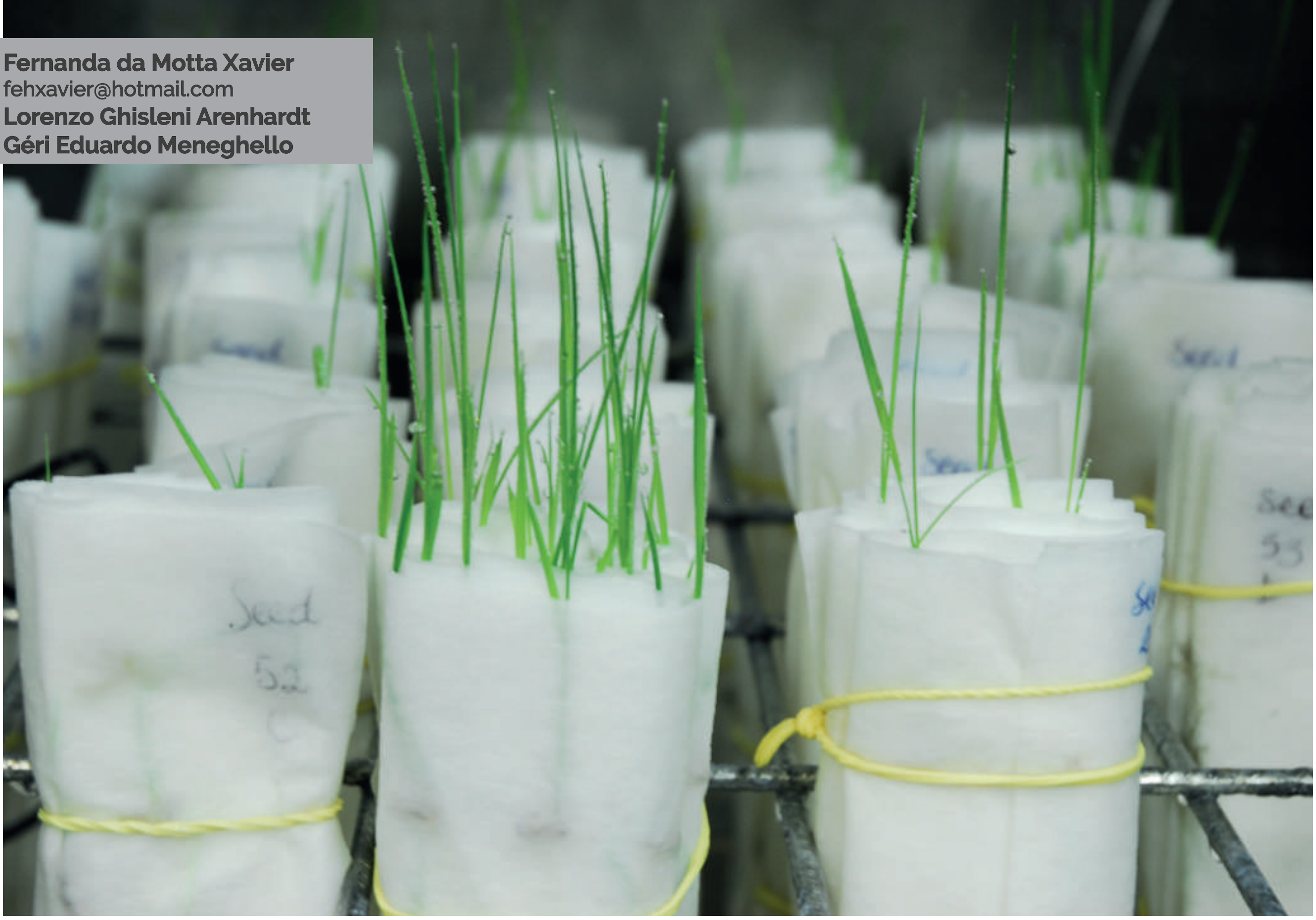


Seed vigor and yield on the rice crop

Rice is the most important agricultural crop with the largest area of extensive cultivation in the world, considering direct consumption by man, being produced in more than 100 countries and regularly consumed by more than 3.5 billion people, which represents about half of the world population. Rice is mainly produced and consumed in the Asian region. In Brazil, it is the third most produced grain, being surpassed only by soybeans and corn.

Due to its importance as an energy source in the food of almost half of the world population, it is essential that the supply of rice is sufficiently high and stable. Although rice productivity has increased in recent years, it has not been sufficient to meet the growing demand. In addition, the supply of rice varies with each harvest, due to the fact that the plants are exposed to the occurrence of unfavorable conditions, from the implantation of the crop to the harvest, which can generate stress in the crop and reduce productivity.

In the case of increases in the productivity of the rice crop, an important fact occurs through the use of high quality seeds, as these can represent a productivity differential, since they present greater vigor and germination, in addition to purity. This is reflected in well-established crops and with an adequate plant stand, even with lower sowing densities.

Several advances in seed production technology have been occurring over the years, aiming at increasing crop yields, and among these advances is the quality of seeds used in crops. Studies developed at the Federal University of Pelotas and other research institutions have demonstrated over the years that the germination of seeds and the vigorous and uniform growth of seedlings at the beginning of the development of the crop are essential factors to guarantee the maximum productive potential contained within.

However, once the seeds are sown in the field, they are exposed to various biotic (pests and diseases) and abiotic (climate) factors that can interfere with their genetic and physiological performance, affecting germination and changing the seedling emergence uniformity, among others.

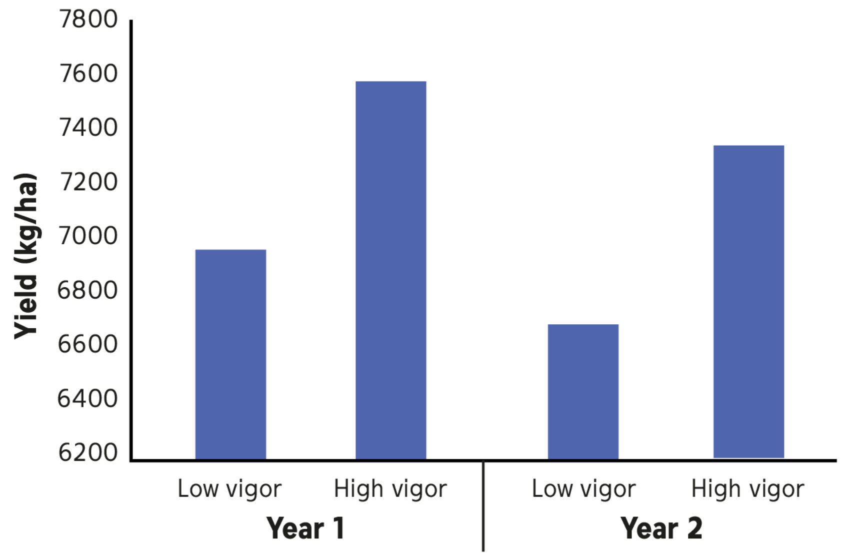
In this scenario, to obtain a successful crop it is necessary to use high quality seeds. Which must present excellent physiological and sanitary characteristics, such as high levels of vigor, germination and health, as well as guarantee of physical and varietal purity.

Germination, purity and sanity are three accepted quality criteria and determined by analysis in seed analysis laboratories. However, they are not the most efficient. The seed lots approved by the analyzes should, besides being of high quality, have a high emergency capacity in the field, which, however, may not occur.

Seed vigor appeared as a fourth quality criterion, mainly with regard to field behavior. The term seed vigor has been used for many years, but only in recent decades has it been recognized as a definable quality factor and its effects on the behavior and emergence of seed in the field have been understood.

However, we believe it is important to clearly define what seed vigor is. It is nothing more than the sum of attributes that give the seed the ability to germinate, emerge and quickly become normal seedlings under environmental diversity. Thus, its importance for agriculture is observed, which is the rapid and uniform establishment of the adequate population of plants. The performance of seeds in the field is the major determinant of success in the field. The vigor of the seeds modifies the vegetative development and is often related to the productivity of the crop and several researches show the influence of the vigor of the seeds also in the yield of the mill.

Rice yield in relation to seed vigor in two crop years
(Adapted from Höffs e Shuch)



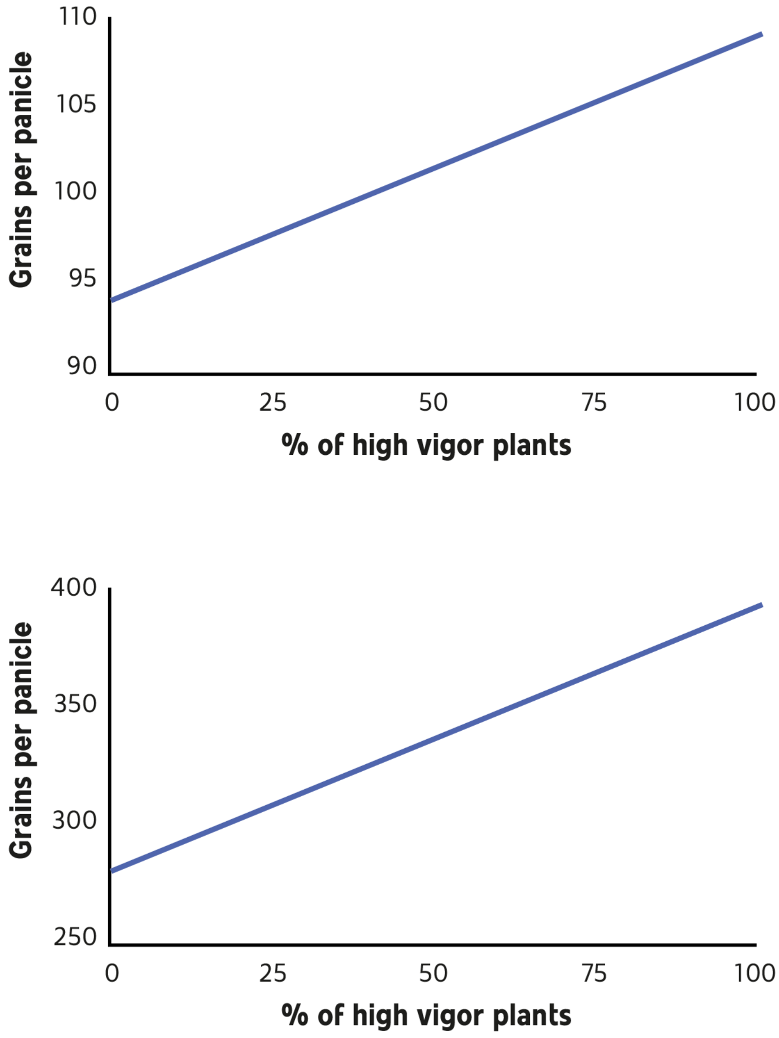
The use of low vigor seeds may result in an inadequate plant stand, as the seeds will have reduced speed in germination and emergence, producing plants with smaller initial size, resulting in less dry matter production, less leaf area and reduced rate of growth, which may affect the establishment of the crop, its performance throughout the cycle and cause losses in the final economic yield.

This situation is aggravated under unfavorable cultivation conditions, when appropriate sowing conditions are not provided, such as speed, depth and the most appropriate sowing time, which are the most unfavorable abiotic conditions, especially in the south of Rio Grande do Sul. sowing in the first half of September and the rice growers open it quickly so that the peak of solar radiation occurs in the reproductive stage of the crop, however in many regions the soil temperature is below the recommended level, there is a significant delay in emergence, coupled with the low seed vigor, resulting in weak seedlings, where some do not survive, reducing the crop stand, which may cause reseeding of areas.

On the other hand, seeds of high vigor can excel in this unfavorable abiotic condition. In these cases, the seedlings emerge quickly and show superiority in the metabolic processes, since they start the photosynthetic process earlier, favoring the growth of the aerial part and the root system. The figure shows the increase in the number of seeds per panicle, per plant, and consequently in the productivity of the rice crop as a function of the seed vigor.

Within a plant population, competition usually takes place for light, nutrients and water. Thus, by associating plants originating from seeds with different levels of vigor, probably the plants with the highest growth will affect the intensity and competition for light incident on the plants with the least growth in the plant community and, consequently, this will reflect on individual development and production of these plants. Thus, it is expected that plants from the most vigorous seeds provide greater and faster shading of the soil surface, causing a better closure of the spaces between the rows and favoring the control of invasive plants.

Grains per panicle and per planto from a rice crop with different proportion of high and low vigor seeds
(Adapted from MIELEZRKI and collaborators)



In view of the above, it is of fundamental importance that rice growers are aware of the importance of seed vigor and not only take into account the percentage of germination issued in the seed analysis bulletin.

It is important to note that there are several tests to assess seed vigor. Some focus on physical aspects, others evaluate physiological activities, there are those that take into account biochemical changes associated with vigor, and finally, there are stress tests, which assess the behavior of seeds under unfavorable conditions. For the case of rice, the test that has been most used to assess vigor has been the Accelerated Aging test, keeping the seeds for 96 hours at 42°C.

Fortunately, rice growers are increasingly aware of the importance of using high quality seeds, as they have identified the relationship that exists with the productive potential of crops. This change in scenario allowed the reduction of the amount of seeds used per hectare. In the 1980s, about 240 kg / ha were used, whereas currently the recommendation is 80 kg / ha.

The use of high quality (vigorous) seeds provide greater productivity with a better initial establishment of the crop, increasing the efficiency of fertilizer and correctives use, reducing the losses caused by competition with weeds by ensuring the adequate population of rice plants and for preventing the dispersion of weed seeds and diseases.

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Mapping the quality of soybean seed produced in Brazil

Embrapa Soja conducted the Project "Characterization of the quality of soybean seeds and grains in Brazil", in which four production harvests have already been evaluated: 2014/15 to 2017/18. During this period, 2,532 seed samples were collected and evaluated from 81 municipalities, 58 microregions from 13 Brazilian states: RS; SC; PR; MS; SP; MT; GO; MG; BA; TO; PI; BAD; and AL. Sampling of this material would not be possible had it not been for the support of more than 55 institutions, composed of cooperatives, universities, companies and associations of seed producers and state research companies.

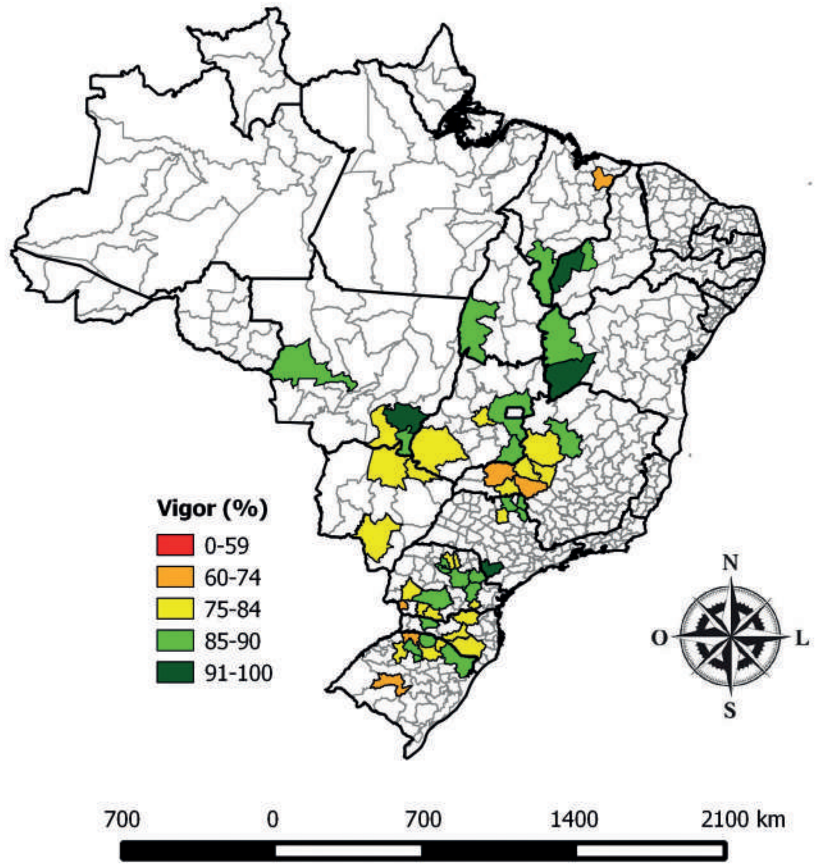
Regarding soybean seeds, 23 quality parameters were evaluated, of which some were selected regarding physiological quality, such as germination, vigor, viability, mechanical damage index, moisture deterioration and bed bug damage, in addition to quality genetics and health of the seeds, which will be reported here, with emphasis on those of the 2017/18 crop, comparing them to those obtained in the three previous harvests. All evaluated samples were collected from soybean seed producers in the months of August / September, after having passed through at least five months of storage, that is, very close to the time of delivery and sowing them.

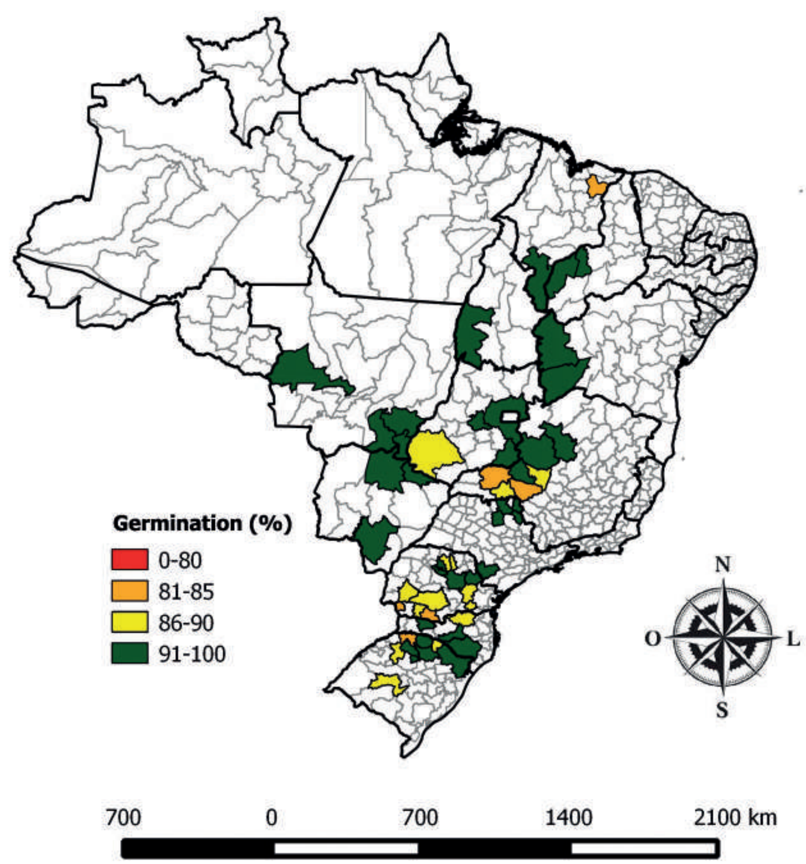
In this sense, an extremely positive aspect was verified in relation to the physiological quality of the seeds. There were significant advances in the seed vigor parameter, as determined by the tetrazolium test: the national average index for this parameter increased from 77.6% in the 2014/15 crop to 84.6% in the 2017/18 crop. The main reasons that contributed to this improvement in quality were the reduction of mechanical damage in the harvest and the damage caused by stink bug, the high sanitary quality and the low occurrence of storage pest insects.

Still, in relation to vigor, in the 2017/18 harvest, the highest values were observed for the seeds sampled in SP, MT and BA, with values of 90.3%, 87.6% and 87.5%, respectively. The lowest average value was found for seeds from MG with 78.4%. The others had values close to the national average. For the viability determined by the tetrazolium test and for germination, the national average was 92.5% and 91.5%, respectively, that is, very similar to each other. Based on these numbers, it was possible to verify the maximum and minimum vigor potentials found, concluding how much it is still possible to improve the quality of seeds in each Brazilian micro-region.

In all evaluated harvests, the mechanical damage, as determined by the tetrazolium test at level (6-8), was shown to be the factor that most affected the quality of the seed produced in the 2017/18 crop, which was 3%. However, this value was lower than the 6.8% observed in the 2014/15 harvest. Higher rates of mechanical damage were found in the state of PR with 5.6%. Mato Grosso stood out for presenting the lowest values of mechanical damage (3.0%), followed by São Paulo (3.1%), Bahia (3.2%) and Mato Grosso do Sul (3.6%).

Still, in relation to mechanical damage, its main source of occur-





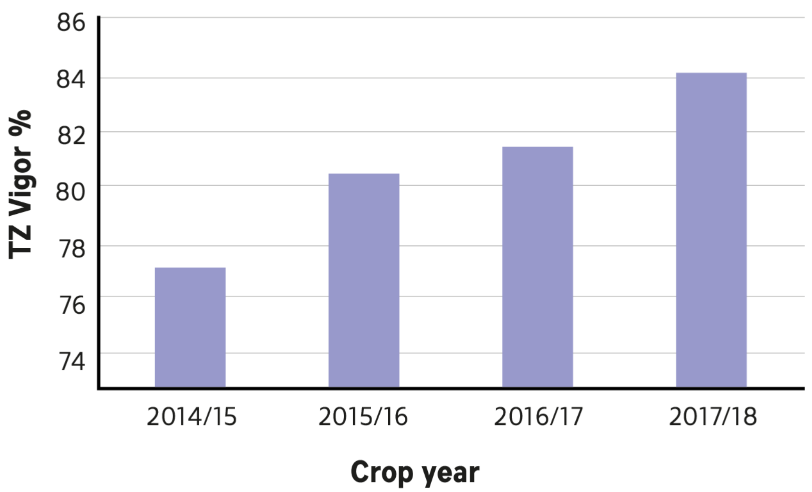
rence is in the trail operation, during the harvest. Therefore, it is extremely important and a priority that soybean seed producers invest in intensive training, aiming to reduce the occurrence of this type of problem during the harvest, which will favor the production of seeds with better vigor and germination rates.

It is interesting to mention that in the four years of the study, a linear reduction was found in the average levels of mechanical damage in soybean seeds in Brazil.

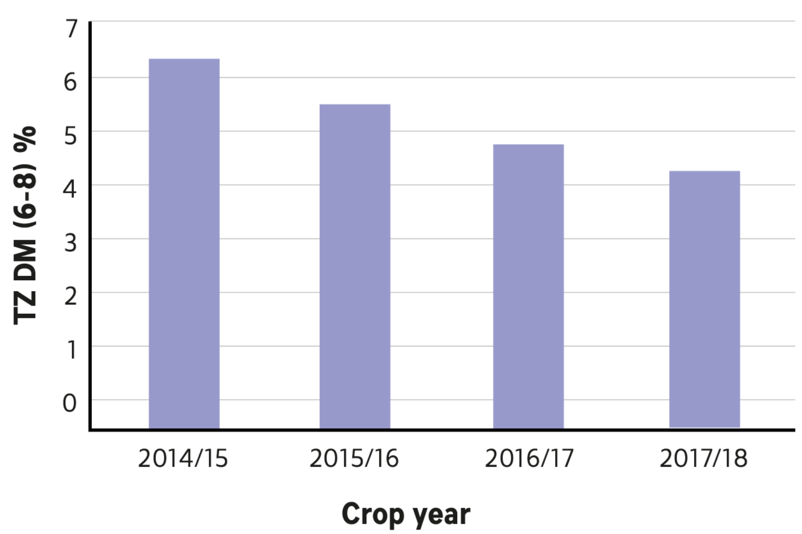
Regarding the rates of mechanical damage caused by microcracks, detected by the hypochlorite test, it was found that its national average value for the 2017/18 crop was 5.7%, slightly lower than the 6.8% found in the 2016/17 crop, which are indexes below the maximum damage limit for seed, which is 10%. The highest rates of occurrence were observed in the states of MA with 10.1% and MG with 7.3%. It is important to monitor this type of damage during the harvesting operation, to verify that the trail systems are well adjusted. In addition, this test, when detecting the micro cracks in the seeds, also serves as an important tool to predict whether or not the flock will be more prone to have imbibition damage during the germination and emergence processes and also during the industrial treatment of the seeds; seeds with high levels of micro-cracking may have reduced germination in these operations.

The damage caused by moisture deterioration, which is usually the result of pre-harvest rainfall, was the second most important parameter that affected seed quality, with a national average in the 2017/18 harvest of 2.7%, a figure slightly lower than the 3.0% recorded in the 2014/15 harvest. The highest rates of this type of damage were found in the states of MA (5.3%) and MG (4.9%). On the other hand, the lowest rates of this problem were found in the state of SP (0.6%). High numbers of moisture deterioration are related to the management of the sowing time of the seed fields, as well as the delay in the beginning of harvest and / or the delay in the start of drying, or storage of seeds with high degrees of humidity (above 13% water). These aspects should receive special attention, aiming at the production of seeds with lower moisture deterioration rates.

Evolution of soybean seed vigor from 2014 to 2018 crop years



Evolution of mechanical seed damage on soybean seeds from 2014 to 2018 crop years



The national average value of bed bug damage was 0.5% in 2017/2018 while the highest was 2013/14 with 1.3%. The highest values were found in seeds from the states of MG with 1.2%, while the lowest index was found in seeds from TO with 0.1%. These values can be considered relatively low and are the result of the constant dedication of producers of seeds in relation to integrated management for the control of sucking bugs.

> **“(...) with the implementation of appropriate technologies at all stages of the soybean seed production system, whether in the field, harvesting, drying, processing and storage, it is possible to raise the level of quality of these seeds in all regions assessed in this survey.”**

In general, in relation to the quality of soybean seeds produced in the states of MA, TO and PI, despite the dominant tropical climatic conditions, it was observed that it is possible to produce seeds with high quality in these regions.

Some extremely positive facts should be highlighted in the 2017/18 crop: 41.6% of the samples evaluated showed viability determined by the tetrazolium test equal to or greater than 95%; among these, nine samples showed 100% viability, produced in the microregions of Erechim (RS), São Joaquim da Barra and Itapeva (SP), Dourados (MS), Parecis and Alto Araguaia (MT), Surroundings of the Federal District (GO) , Pirapora (MG) and Rio Formoso (TO).

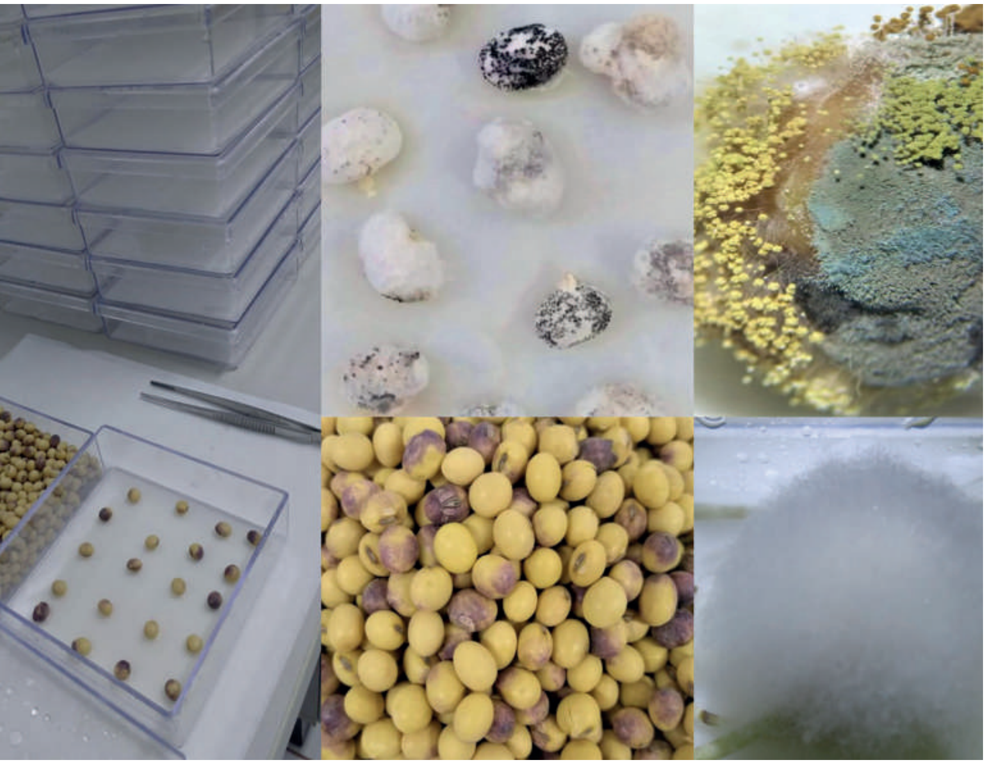
Still, according to the tetrazolium test, 32.4% of the samples showed very high vigor (> 90%), with 6.4% having vigor> 95%. In 4.8% of the seed samples, the occurrence of mechanical damage (level 6-8) was 0.0%, as determined by the tetrazolium test. Minimum rates of 0.0% of moisture deterioration (level 6-8) were detected in 34.5% of the seed samples produced in all the states evaluated; and minimum rates of 0.0% of damage caused by bedbugs (level 6-8) were detected in 71.1% of the samples produced in all evaluated states.

This demonstrates that with the implementation of appropriate technologies in all stages of the soybean seed production system, whether in the field, harvesting, drying, processing and storage, it is possible to raise the level of quality of these seeds in all areas. regions assessed in this survey.

As for the sanitary quality of the seed produced in the 2017/18 harvest, in general it was very good. The storage fungus, Aspergillus flavus, had a very low occurrence, with an average index of 0.1%. It was evidenced that the pathogen with the highest frequency of occurrence in soybean seed lots in Brazil is Cercospora kikuchii, the causal agent of purple seed spot, with an average rate of 0.5%. This pathogen was detected in seed samples from all micro-regions. The fungus survives in the cultural remains, infecting the plants and, together with Septoria glycines, can cause the so-called “DFC´s” (end of cycle diseases). In the seed, however, the fungus does not cause problems and is easily controlled by the fungicides commonly used in seed treatment. Colletotrichum truncatum, the causal agent of anthracnose, which has been attributed to a large part of the phytosanitary problems that occur in crops, is of little importance in the seed, due to its low occurrence; in this harvest the average was 0.1%. Phomopsis sp., The main pathogen of soybean seeds, had a very low incidence, with an average of 0.1%, with the highest incidence being 3.5% in Santa Maria da Vitória, BA. Fusarium pallidoroseum (syn. Semitectum or incarnatum) has a behavior similar to Phomopsis of stem and pod dryness and seed rot, in relation to impairing the germination of seeds, when carried out on a paper roll substrate. Only one sample from Alto Parnaíba Piauiense, PI, presented 15.5% of infection.

Finally, as in the previous three harvests, the occurrence of bacteria considered saprophytes, normally associated with seeds that have already deteriorated physiologically, was quite high in some lots in all states. However, the national average of occurrence in seeds was only 3.2%, due to the high quality of most seed lots.

In relation to genetic quality, or varietal purity, it is through this parameter that the farmer has the guarantee that the establishment of the crop will begin with the cultivar recommended for him. However, in 2013, Brazilian legislation eliminated the need to carry out the test to verify the presence of seeds of other cultivars (varietal mixture) during the execution of the analysis of purity



Health analysis

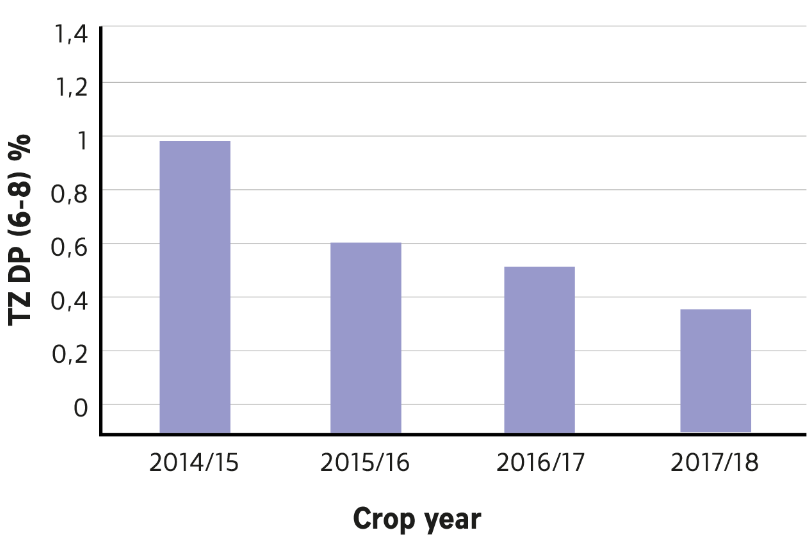
of soybean seeds (IN 45, September 2013). Since then, the control of the genetic identity of the commercialized cultivar has been guaranteed only in field surveys, according to methodologies and standards established by the legislation. Through the analyzes of varietal purity carried out in the project, it was found that this parameter of genetic quality deserves concern and should be treated seriously and with norms and standards to be established and standardized again.

It was found that in all states, in some harvest, worrying levels of genetic contamination were found, represented by the number of atypical seeds in each sample, which showed that there is an urgent need for the implementation of additional tools for quality control related to genetic purity of materials. In this sense, it is envisaged the adoption of analyzes that complement the morphological evaluations (morphological descriptors), including also molecular analyzes, with the use of molecular markers. For this, much still needs to be discussed and agreed upon, but the availability and access to these tools is essential for the sector.

As for storage pest insects, some species were found in the seed samples, such as Ephestia sp., Sitophilus sp., Cryptolestes ferrugineus, Rhyzopertha dominica and Liposcelides bostrychophila. Insect parts were also found in several samples, indicating that a pest infestation occurred in the seed. Most of the seed samples (81%) did not show any insect pests, which indicates good control of pests in storage.

More detailed information on these quality surveys of soybean seeds produced is found in the publications "Quality of commercial soybean seeds and grains in Brazil", 2014/15, 2015/16, 2016/17 and 2017/18 harvests, which can be accessed directly from the Embrapa Soja website (www.embrapa.br/soja), accessing in "Publications" and then in "Seed technology".

Evolution of the level of damage caused by sucking bugs, detected by the tetrazolium test (% - level 6-8) in soybean seed lots, produced in several Brazilian regions



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Technology and innovation at the service of the producer: the Agrotis case

The advent of new technologies can be considered a powerful driving force in the social transformations seen over the centuries. From the control of fire by the first human beings, the emergence of electric energy, the discovery of penicillin, the internet, among many other important facts in history, all offered a paradigm break and a new reality.

Agriculture also fits this same spectrum. A long way has been taken since the Neolithic period, of rudimentary techniques, until current practices were achieved. And, as in other areas, research remains steadfast in search of new technologies, new options that can bring more benefits and a higher quality of production, reduction of errors and problems.

In agribusiness, the development of new ideas is increasingly accompanied by a new market niche: startups. Innovation is the flagship of these small companies, which generally rely on financial support from angel investors or are developed inside an incubator until it is possible to keep on their own feet. And dealing with innovation in agriculture is automatically dealing with automation, robotization and artificial intelligence, themes that are unanimous in thinking about the future and that seek to offer new directions to agriculture, changing forms of production, planning and management.

Automation, also called smart farming in the agricultural environment, seeks to offer higher yields in production, higher quality in actions and greater efficiency in general, automating the processes of planting, harvesting, planning. Combined with artificial intelligence (AI), which brings all the robotics and seeks to reduce the human part of the work,

with autonomy in decision making for systems and machines, with monitoring of every detail that happens in the field.

A pioneer in the development of systems related to information technology in Brazilian agribusiness, Agrotis, a company based in Curitiba, appeared in 1991 bringing software that sought to facilitate the process of issuing revenues. Thus, the agronomic prescription appeared, gaining strength and good acceptance by producers, bringing consolidation to the company and placing it on the map of the agribusiness. Since then, Agrotis has produced platforms and systems for producers and companies, bringing the technology in a way that is beneficial and profitable to customers.

Manfred Schmid, creator and current director, recalls that the beginning of Agrotis refers to the university, at the beginning of the 1990s, in the agronomy course, when the informatics part was still in its infancy. Noting this deficiency, he combined his passion for technology with his passion for agribusiness and, allied with some colleagues, created the embryo of what would become the company. "At the time it was not called a startup, there was not even that term", he recalls.

If there was little appeal for the development of technologies, automation and artificial intelligence in the 1990s, 30 years later, the picture is completely different in Brazil. The incentive has changed dramatically, illustrated by several startup development and incubation programs, such as the TechStart Agro Digital program, an initiative by Embrapa in conjunction with Venture Hub that brought together more than 90 national startups, and the Digital Agro Connection, created by Frisia, selecting 12 startups for development. These programs that offer a mentoring and improvement process for entrepreneurs are essential in the return that these technologies bring to the market.

Above all, looking to the future of agriculture has never ceased to be a reality in the country. If in the 1980s, 1990s it was the development of cultivars, advancing agribusiness in Brazil, taking large flights in productivity, the scenario now turns to the Internet of Things (IoT), precision agriculture and management by sensors and monitors, as is case of the project with investment from the national government in partnership with the European Union called SWAMP (Smart Water Management Platform), an initiative that seeks to make precision irrigation viable, reducing water expenditure and optimizing the process, meeting the specific needs of each plot in terms of water.

Manfred welcomes the incentive for the development of startups, but ponders that new businesses need to offer important solutions, bring something really innovative, and setting goals in addition to just receiving good esteem.

"It is very good to see ideas and creations coming up, but, in general, there is an exaggerated stimulus in the startups market, bringing many good and necessary ideas, but also several with little use. The creativity part does not dispense with entrepreneurship, they are two distinct areas, but necessary in the startups movement".

The specificity of the sector can never be forgotten. It is necessary to know the challenges that really affect rural producers and where technology can make sense in an attempt to offer a service that brings better results. Being aware of the target audience of your service can be the difference between an open and a closed door, and this is what Manfred supports his initiatives at Agrotis: to understand the needs of the producer.

"At Agrotis, we have always been concerned with bringing solutions to the producer, who is on the other side. We have 23 agronomists hired, because it is necessary to understand the process to then develop the software", he points out. "More recently, we adopted the UX (User Experience) policy, a way to improve the software, be easy to understand and really solve its problem. We analyzed the user's behavior a lot, how he receives a new screen and what we can improve, which generated

Manfred Schmid (Agrotis diretor) in a cotton field managed by smart farming and internet of things.

doubts. It really is getting out of my chair and putting myself in the user's shoes, imagining myself as him, this is our differential", he commented.

That is how Agrotis developed its current products and will develop future ones. The seed platform created by the company is an example. The system offers the producer five modules (Planning, Fields and Seeds, Warehousing, Processing and Laboratory), in addition to ERP (Enterprise Resource Planning), which optimizes the entire process, from planning to sales and inventory, covering the path between the two points and bringing ease to the producer.

In the planning part, it is possible to align your production objectives and the necessary actions to guarantee the result. "If I want to produce 150 bags of cultivar 'x', he calculates considering the efficiency within the UBS, the storage and processing part, efficiency or losses in the classification, harvests and losses in the field, reaching the area necessary to safely produce the 150 desired bags, based on standard productivity ", explains Manfred. Next, the fields and seeds module offers georeferencing of the area, fields and seed fields. It is also integrated with Sigef (Land Management System), controlling technical visits via software, being able to adjust expectations and harvest date for each inspection, also sending this information so that those who are at UBS can plan accordingly.

In the storage part, one of the major bottlenecks in seed production, the system brings hardware developed to receive information from road scales and meters and already transmitting to the cloud, where the software reads the data, avoiding possibilities of error and fraud in the reception. In the beneficiation module, Agrotis software automatically generates the lots and brings the specific methodology of each user in the seed quality control. Artificial Intelligence enters to produce the general quality index of each batch, treating all the data received, managing the results so that the producer can differentiate the batches of maximum quality. The process ends with the laboratory module, automating everything from the receipt of the samples to the analysis, reaching the ERP that controls sales, inventory and billing.

Access to information, Big Data, opens up a giant range to transform forms of production, management, treatment of seeds and plants. Precision agriculture brings efficiency in the use of inputs that leads to more productivity and profitability.

"I have always been passionate about technology, and it is not just software, it is hardware, it is automation and it is robotization too, and the scenario is that more and more this is going to invade agribusiness. Today, with the improvement of the images, the introduction of the infrared part, in addition to the RGB we see, makes it possible to analyze plant-by-plant agriculture. That is, weed only the weed, not the entire population, with fungicide, treat the plants that really have the disease, not the entire crop, with fungicide. The biggest revolution in agriculture is in images, especially when you go in the infrared, looking at much more than just our human eye". - Manfred Schmid.

Today, Agrotis focuses on improving the portability and connectivity of its platforms. "That it is possible in a field where there is no internet signal, to collect information and, as soon as there is a connection, this data will be thrown in the cloud", says Manfred. Necessary features in a country as vast as Brazil, where in many places the lack of connection prevents better services on farms and crops, in addition to slowing down the arrival of 4.0 Agriculture in these locations. Although Brazil is already pointing in this direction, initiatives and companies, such as Agrotis, which bring innovation to facilitate the life of rural producers in the countryside, are essential for Brazilian agribusiness to continue its growth process.

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SOWING IN THE DUST
Opportunity or risk?

Sowing is one of the most important processes when it comes to farming, generally involving a small window for completion, as it is a function of season, crop cycle and environmental conditions for the seed to germinate, among other aspects.

This year, the weather forecasts already announce that the month of September will be dry in practically the whole country, in addition to a month of delay in the beginning of the rain in regions like "Matopiba". There are indications that the Northeast will once again face a strong drought period, while Rio Grande do Sul will have a repeat of last year, when the neutral condition of "La Niña" will reduce the rains for the beginning of the Rio Grande do Sul harvest.

In view of this scenario, many usually farmers decide to take a risk when carrying out early sowing prior to rain, even though there is no full ideal condition for planting.

In order to trigger the germination process, a non-dormant seed needs liquid water, adequate temperature, oxygen and a substrate. In this article we will emphasize the requirement of moisture by the seed and the risks of sowing in the dust.

Seed moisture

The seeds, in general, are stored at 12-13% humidity for a period of 6-8 months before sowing. Thus, when they are placed in the soil, they

need to absorb water up to 30-35% moisture for corn and 50-55% for soy. Each species has a critical degree of humidity to trigger the germination process, with a close relationship between the degree of humidity of the seed at its point of physiological maturity and the percentage of moisture to trigger the germination process.

The trend of water absorption by the seeds follows a classic quadratic curve until a certain point at which the hydration level for germination is reached. In this way, when the soil moisture is adequate, the absorption speed is fast initially after decreasing, due to the increased pressure of the cell walls.

In the case of soybeans, in conditions of adequate humidity of the substrate, in 16 hours of soaking, the seed already reaches 50% humidity to trigger the germination process. After this time, the seed slows down the water soaking for a while and then increases again, depending on the establishment of the seedling structures.

Soil moisture

The availability and movement of water in the soil is crucial for seed germination and seedling emergence. These factors are largely influenced by soil moisture and texture, hydraulic conductivity and soil-seed contact area. In this sense, the pressure wheels of the commonly used seeders increase the contact between the parts and assist in the diffusion of soil moisture. In the cultivation of irrigated rice, it is common to use a heavy roller to assist in the absorption of water from the soil by the seeds.

In relation to the hydraulic conductivity of the soils, this has a great influence on the water absorption by the seeds, since seeds are able to "seek" humidity only around 1 cm away, which decreases as the soil texture increases, that is, in sandy soil is less.

Soil moisture can be expressed as a percentage or in bars, which is a unit of water potential in the soil. In terms of bars, it was agreed that -0.3 bars is the field capacity of a given soil, while -15 bars is the permanent wilt point (PMP). It should be noted that in a sandy soil, for example, in PMP, the percentage of moisture can be less than 5.0%, while in a clay soil, it can be more than 10%. Thus, to compare performance, bars are used.

There are differences between species and cultivars within species as to the optimal water potential for germination and emergence, however the range is from - 0.3 to -6.6bar. Forage species and some vegetables stand out for their ability to trigger the germination and emergence process with soil moisture close to the PMP.

Studies show that even in the PMP for the vast majority of species such as soybeans, corn and others, the seeds can soak up enough water to germinate, if they have enough time to soak. In this way, in soil moisture in the field capacity up to -1 bar, the seeds absorb enough moisture to germinate in less than 24 hours (soybeans) while in PMP this time is more than 100 hours. Low soil moisture is one of the main reasons for the decrease in germination speed and seed emergence. Temperature and physiological quality of the seeds are the other main reasons.

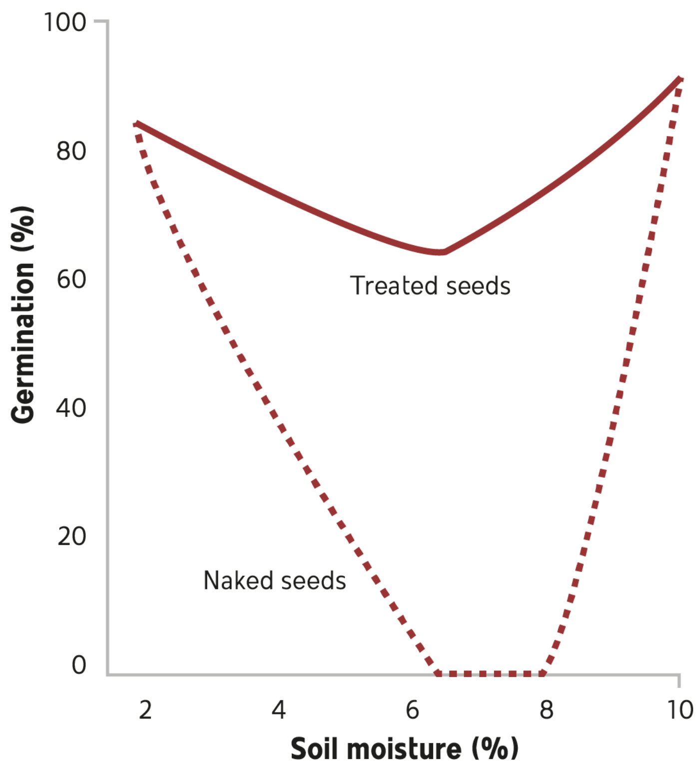
Seeding in the dust

Considering that farmers have little time to sow at the right time, there are occasions when it is carried out with little moisture in the soil in anticipation of a nearby rain (sowing in dust).

It is estimated that more than one million hectares are sown with

Soyben seed germination after 9 days in soil with moisture bellow the permanente wilting point

NAKED SEEDS		TREATED SEEDS	
Soil moisture	Germination	Soil moisture	Germination
10.0	90.0	10.0	90.0
8.0	Zero	8.0	70.0
6.5	Zero	6.5	70.0
2.8	85.0	2.8	85.0



*10,1% - Permanent wilting point

soy in the dry soil in anticipation of rain, and more than 500,000 hectares are just to enable the cultivation of safrinha cotton. Other examples could be used.

In this sense, a study was designed to verify the effect of this process of "sowing in the dust", in the establishment of a soybean crop (Peske and Delouche, 1983). For this purpose, a clay-type soil was used, prepared with various humidity levels lower than the PMP and placed in them naked soybean seeds and treated with fungicide (Captan) at 30oC. After nine days in these conditions of low soil moisture, the experimental units received enough water to trigger the seed germination process, and the evaluation was carried out seven days after the addition of water. In this same study, the percentage of moisture in the seeds placed at different soil moisture levels was determined.

The results showed that even in the PMP, the seeds absorb enough water to trigger the germination process as long as, after nine days in these conditions, they receive enough water to produce a normal seedling. In the study, 10.1% of soil moisture was the PMP (see figure in the text).

Regarding the seed moisture in dry soil with less humidity than the PMP, it was evidenced that at 9 days in these conditions, the seeds in the PMP had 60% humidity, being enough to trigger the germination process, in which even some seeds had radicle protrusion. On the other hand, as the soil moisture decreased in relation to the PMP, the seeds reached a lower degree of humidity, being 28-42% when the soil moisture was between 6.5 and 8%, the germination of the seeds presented zero %. However, in soil moisture below 6.5%, the percentage of seed germination increased as the soil moisture decreased, reaching 85% with soil moisture of 2.8%.

On the other hand, relating the soil moisture in the humidity range between 8.0 and 10.1% with the germination of the seeds, the figure in the text shows that there was a 20% increase in the germination percentage for each 0 , 5% increase in soil moisture, showing the great role of water in the germination process.

It is worth mentioning the fact that only some of the seeds germinated, since the exposure to humidity was uniform for all seeds. One possible explanation is that the quality of the seeds in a batch is not uniform among all seeds, that is, with different stages of deterioration due to uneven maturation, mechanical damage and contamination by microorganisms, among other causes. A 20 ton soybean seed lot contains more than 80 million seeds that have a certain degree of difference between them, explaining the percentage from zero to 100 in seed germination.

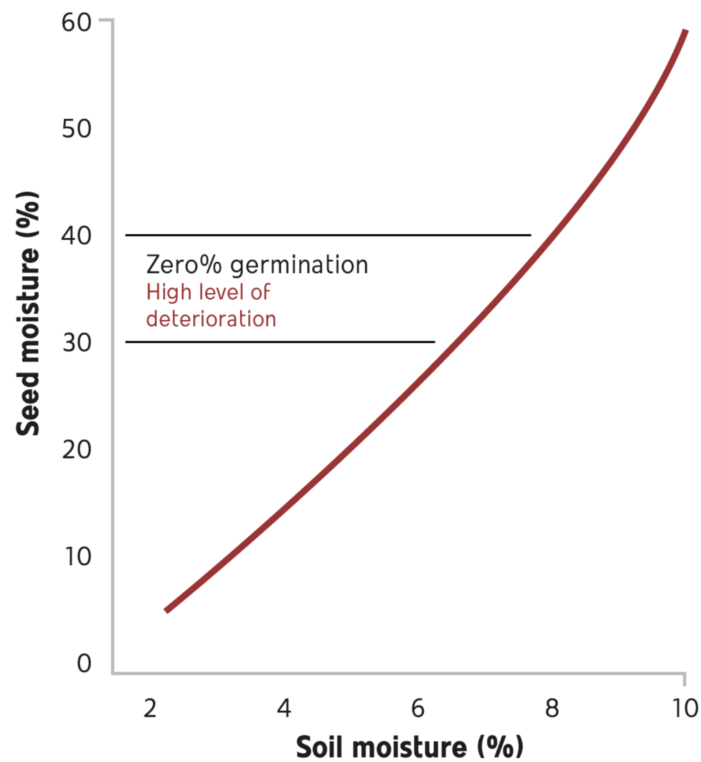
In the study, in addition to the bare seeds, seeds treated with fungicide were also used, whose tendency of performance in dry soil less than the PMP, was similar, however with a different magnitude. In the soil moisture where the seeds had zero germination, the seeds treated with fungicide, still had 60% (see figure in the text), showing the beneficial effects of treating the seeds with fungicide.

Seed moisture plays a fundamental role in germination and deterioration, among other processes, thus examining seed moisture, it can be seen from the figure in the text that above 42% moisture, some seeds within the population had already reached the critical point to trigger the germination process (humidity 50-55%). This is increasing. On the other hand, seeds with less than 28% moisture increased their germination percentage as the soil moisture decreased. It is registered that in the experimental unit with the lowest soil moisture (2.8%), the seeds even lost water, presenting less than 8% moisture after 9 days in dry soil.

The performance of seeds placed on dry soil without conditions to germinate, seems similar to the results that occur with conventional seed storage, that is, the loss of the ability to germinate decreases, as the seed moisture, temperature and seed time increase. storage. Therefore, seeds placed in "dry" soil without conditions to germinate, are literally stored in the soil until rain or irrigation occurs. The soil, even with low humidity, is not a good place to store seeds.

Seed moisture contente after 9 days in soil with moisture bellow the permanente wilting point

MOISTURE (%)			
Soil	Seed	Soil	Seed
2.8	7.9	8.0	42.2
5.1	17.0	9.4	54.0
6.8	30.0	10.0	60.0



*10,1% - Permanent wilting point

Considerations

1. Seed treatment with fungicide increases the survival of seeds in dry soil in a few days, while waiting for a rain. Fortunately in Brazil, more than 90% of soybean seeds are treated with fungicide;

2. By the dispersion of germination data, in which some seeds have protrusion of the root even in the soil moisture in the PMP, it can be inferred that seeds of high physiological quality minimize the effects of "sowing in the dust". In this sense, many companies offer lots of soybean seeds with a minimum of 90% germination and 80% vigor;

3. The title of the article is "sowing in the dust" in reference when sowing is carried out in soil that has been worked and gives off dust, when dry, at the time of sowing. However, it is estimated that more than 80% of soybean sowing is carried out in the no-tillage system, without conventional soil preparation, which practically does not give off dust. In these conditions the soil is able to retain more moisture, and thus assist the seeds in the germination process;

4. There is a risk of not obtaining a stand with sowing in powder, as the soil is not a good place to store the seeds, on the other hand, as the seeds can soak water even with low soil moisture, this avoids the known damages the rapid imbibition of "dry" seeds during rain moments after sowing; and

5. If the farmer decides to do the "sowing in the dust", make a good insurance, using high quality seed treated with fungicide.

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Germplasm banks: safety and development

Nowadays, in the midst of the COVID-19 pandemic, one of the biggest social concerns is related to food security. Not letting the population feel a lack of food is a duty of all the nations of the globe, and directly involves agribusiness, a fundamental part of the production chain. Thus, several actions were taken aiming at the continuity of the production processes, since the activity falls into the category of essential services to society.

Trying to prevent the most different situations that can influence the economy, production and all social spheres of each country, contingency plans are prepared. Thus, in the event of a catastrophe, tragedy, or any situation that puts life in society at risk, previously determined actions offer options to overcome the problem in question.

In agriculture, one of these plans is the storage of seeds in germplasm banks, serving as a backup of cultures and species of the most varied plants. The system is similar to banks, the only difference being that the property is well protected. Instead of money, seeds occupy the place, allowing the maintenance of crop production in the event of a global catastrophe. However, in addition to their function related to prevention, germplasm banks are also an important part in the development of new varieties, contributing to the process of genetic improvement. In other words, they are more like a supermarket serving the agribusiness base than a museum!

Worldwide, there are more than 1000 storage banks. Countries like the United States, China, the United Kingdom and Brazil itself have germplasm banks in their territory. In a global character, located in the archipelago of Svalbard (Norway), is the Svalbard Global Seed Vault, characterized by its internationality and for containing accesses of various nationalities.

The initiatives for the conservation of genetic samples in the most diverse countries demonstrate the importance of the process. An example that illustrates this feeling well is that of the tragedy that occurred at the Pavlosk Experimental Station, a Russian seed vault, located in the city of St. Petersburg, previously called Leningrad. During the German offensive against the city in World War II, scientists at the Pavlosk Experimental Station locked themselves in the germplasm bank to prevent both starving Russian city dwellers and German invaders from putting their hands on plant species contained therein. The devotion and dedication of the scientists was so great that some succumbed to hunger, dying of starvation, without using the species of the bank for their food.

The maintenance of genetic integrity and seed longevity are two of the main factors in storage. The samples are usually kept in artificial cold chambers, after testing the initial germination viability of each plant and undergo dehydration at levels of 3% to 7% for better conservation. Aluminum or glass materials, in general, are used for placing seeds in cold chambers.

Soybean seed samples and the storage in the active germplasm bank of Embrapa

Germplasm banks around the world

As already mentioned, several countries have germplasm banks in their territories, understanding the importance of these initiatives for the maintenance of life on the planet in extreme cases, but also serving for the development of research, helping in the process of genetic improvement.

In the United States, the Fort Collins Seed Vault, officially called the National Laboratory for Genetic Resources Preservation, under the command of the American Department of Agriculture, is the largest germplasm bank in the country. Located in the state of Colorado, all new seed patents produced in the U.S. must have a backup copy stored there, with the total number of accesses exceeding 500,000. Through the materials present there, several studies and researches were developed, making it possible to obtain resistance to diseases by several species, such as, for example, wheat resistant to the Russian aphid.

China has the Germplasm Bank of Wild Species, located at the Kunming Institute of Botany in Yunnan province. With its project started in 2004, the Chinese germplasm bank started its work in 2008, and today it is the largest in the Asian country. The United Kingdom is not far behind, with the Millennium Seed Bank, in Sussex, one of the largest in the world, with more than 38 thousand different species of plants in its accesses.

But when it comes to germplasm banks, the Svalbard Global Seed Vault stands out. Its history dates back to 1986, when scientists from the former Nordic Gene Bank, today NordGen, decided to innovate in the storage model, taking advantage of the local climatic conditions and its soil, called permafrost.

The central idea of the initial experiment (1986) was to monitor the longevity of the seeds when they were deposited under these permafrost conditions, and thus, to acquire data on this type of conservation. Researchers also wanted to study the transmission of plant pathogens in seeds. Thus, 41 seed lots of 17 common species from the Nordic environment were separated for storage.

The initiative evolved and took on global proportions. In 2008, the bank was renamed Svalbard Global Seed Vault, and today has almost 1 million seed samples from various parts of the world, including Brazil. Named "ark of the end of the world", the Svalbard germplasm bank offers unique security, being designed to withstand the most diverse climatic catastrophes, promising to stand up to offer vital information about the species contained therein. In addition, several studies of genetic improvement are conducted there, offering important research material for the development of world agriculture.

In addition to the aforementioned seed banks, there are several others with the same premise, to prevent and anticipate any problem that may affect society, and to contribute to genetic improvement. With the uncertainties surrounding the global future in the midst of the COVID-19 pandemic, it is important to look at initiatives that were planned precisely for moments like this, and germplasm banks fall into this category.

EMBRAPA and Brazil

Why are some soybean plants more productive, others have a higher protein content and there are still those that are resistant to different types of diseases? This is because they have different genetic characteristics and these differences are important to produce specific varieties for different challenges encountered in the field.

In order to preserve genetic variability, Embrapa Soja maintains a collection of approximately 55,000 accessions (types of soybeans) introduced from the collection in the United States and other countries in Africa, Europe, Asia, the East Bank of Germoplasm (BAG) Middle and Oceania. "The more different and characterized accesses, the better they will be used in breeding programs for the development of new varieties," explains researcher Marcelo Fernandes.

Embrapa's BAG has wild species, with specimens of those grown in China for more than five thousand years, even seeds used commercially in Brazil. Glycine max, today one of the most important commodities in the world, is very different from its ancestors that gave rise to it. According to Fernandes, the evolution of soybeans started with the appearance of plants from natural crosses, which were domesticated and improved by scientists from ancient China.

Created in 1976, Embrapa's BAG has undergone several changes and expansions and today is the third largest soybean seed bank in the world. In the case of Embrapa, access to these characteristics was instrumental in completely modernizing the genetics of the BRS cultivars portfolio. "Today our portfolio is the most complete on the market, because we have soy to meet the different needs of the producer, such as precocity, indeterminate habit, reaction to new diseases and high productive potential", he celebrates.

To maintain these seeds, Embrapa Soja has a structure that was remodeled in 2011 and is fully automated. The seeds are kept in a cold chamber at 5ºC, with 25% humidity, which guarantees their survival for long periods. "It is a national heritage, which guarantees the development of better cultivars and makes Brazil more productive", explains Fernandes.

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The International Seed Federation, Asociación Nacional de Obtentores Vegetales (ANOVE) and Asociación de Empresas Productoras de Semillas Selectas (APROSE) warmly invite you to the ISF World Seed Congress 2021 in Barcelona, Spain from 17-19 May. Barcelona, the cosmopolitan capital of the Spanish region of Catalonia, is a melting pot of cultures and famous for its art and architecture. Enjoy its dynamic spirit while living the ISF World Seed Congress experience.

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Biotrigo Genetics: we believe in wheat and people

The company "Biotrigo Genética Ltda" was founded by André Cunha Rosa and Ottoni Rosa Filho, having started its work with six employees. Today we have more than 75 employees, focused on research and the evolution of the wheat chain. Our team has a great responsibility in the wheat chain, after all it supports a market share of over 80% in Brazil.

The company was founded in 2008 through the partial spin-off of another company, where André and Ottoni were partners and breeders. Thus, the start of Biotrigo's wheat breeding program was based on a 20-year selection program. We currently have four regional programs: Rio Grande do Sul, Paraná, Cerrado and Argentina, conducted by different breeders, focused especially on each environment.

Infrastructure

Our research center is located in Passo Fundo (RS). In this place we have 10 greenhouses and screens to carry out the crossings, evaluate new genotypes for diseases, advance generations and multiply seeds. We have several laboratories to support breeding activities, such as Seeds, Quality, Phytopathology and Biotechnology.

New genotypes are evaluated by the Experimentation sector, with yield tests in more than 50 locations in Brazil. All of these tests are collected and sent to Passo Fundo,

for weighing and evaluations. We still have many trials in Argentina, Uruguay, Paraguay and Bolivia, together with our international partners.

In parallel, new genotypes are multiplied so that, when the new variety is found, we have seeds in quantity and quality (purity) for the production of Genetic seeds.

Commercial

Our business model, in a simplified way, can be summarized as follows: we create and register new wheat cultivars, multiply the genetic seeds and pass them on to the partners "Sementes Butiá", "Sementes Vedovati" and "NBN Sementes". These, produce the basic seeds of the new wheat, which will be sold to companies producing wheat seeds, which then sell seeds to the growers. The remuneration for the research comes through the sale of certified seed, where a part of the value feeds into the research.

Biotrigo has the commercial sector divided into 4 areas: South (RS and SC), North (PR, MS and Cerrado), Animal Nutrition and New Business. Regional North is based on the "Campo Mourão" (PR) branch, designed to serve our clients in Paraná, MS and Cerrado. The states of Santa Catarina and Rio Grande do Sul have the support of the team that is based in the headquarters. The New Business sector, as the name says, seeks to develop new market niches. In this sector, for example, we developed the mixtures of wheat for silage Energix 201 and 202 and the wheat cultivar for grazing, Lenox.

The commercial sector is also responsible for the licensing of wheat cultivars, where some companies receive exclusive cultivars. As an example, we have the FPS Certero, licensed to Fundação Pró-Sementes, to cultivate Roos Inova, to Sementes Roos, and TBIO Referência, to Cooperativa Agrária, from Guarapuava (PR).

Partners

We have a strong partnership with Sementes e Cabanha Butiá, which produces most of the basic seeds and has been at the heart of Biotrigo's improvement program for 30 years. The other partners, NBS Sementes (RS) and Sementes Vedovatti (PR), also support the production of basic seed in different locations, aiming at security in the face of some climatic adversity and logistical ease.

The search for innovation is in Biotrigo's DNA. Our partnership with BASF enabled the recent launch of the first Clearfield wheat in Brazil: an excellent and innovative tool for wheat growers in weed control. This technology guarantees wheat the ability to tolerate the application of herbicides, helping in the management of some important weeds in wheat, such as ryegrass, oats and turnips.

In Argentina, we are partners of GDM (Grupo Don Mario). We have a strong breeding program in Chacabuco, Buenos Aires, aimed at launching cultivars for Argentina and Uruguay. Several cultivars that in this 2020 harvest make up the wheat area of Argentina were generated in this program: DM Ceibo, DM Ñandubay, DM Sauce and TBIO DM Audaz. Today, 20% of the seed released on Argentine soil carries the TBIO genetics.

We serve Uruguay via our partners Barraca Erro and GDM, with the launch of several cultivars for that country. The company Erro has extensive experience in conducting wheat cultivation, storage and export fields.

In Paraguay, we are partners of Brava Tecnologia. Paraguay has characteristics similar to the West of the South region of Brazil, having received the genetics already recognized by Brazilian farmers and mills. Among the highlights launched in the neighboring country are TBIO Audaz, TBIO Sonic and TBIO Toruk.

Composing the international partnerships, we ended with Bolivia, where ANAPO, the largest cooperative in the country, receives Biotrigo genetics to select the best genotypes for its reality, very different from the South of Brazil.

The sum of participation in these markets allowed Biotrigo to assume the number one position in wheat genetics in Latin America, a job that carries a lot of responsibility, but that has been helping to make culture feasible in these regions.

Tendencies

Looking at the numbers of consumption and wheat production in Brazil, we believe that wheat growers have an important space to occupy in this market. Without considering the exchange rate issues, which today favor national production, there are two main reasons that support the growth of the area in Brazil: agronomy and industrial quality.

Agronomically, there are many reasons for sowing wheat in winter, such as system fertilization and invasive control, and wheat can contribute to soybean productivity in all the wheat regions of Brazil: from RS to Cerrado. It is still necessary to consider the importance of administrative issues, where winter enters as a partner of soy in the dilution of fixed costs of property. After the harvest, we believe that Brazilian wheat has evolved a lot in terms of industrial quality recently, being today extremely competitive.

These factors make us believe that the wheat area in Brazil has a growth trend, both in the medium and long term, which motivates Biotrigo to continue investing in the crop. These investments can be in the form of equipment for the various laboratories, new greenhouses / screens, agricultural machines, among others. Biotrigo's expansion to the Cerrado with a local program is proof that we believe in this.

Wheat in the Cerrado

From the point of view of genetic improvement, we believe that the Cerrado has a lot of potential. But what does it mean? In a simplified way, it means that there are several cultivars that offer some important agronomic characteristics, such as resistance to Brusone, aluminum tolerance, industrial quality, drought tolerance, among others, but these genes have not yet been combined in a single cultivar or group of cultivars. Therefore, based on the genetic progress already achieved, a good program can offer cultivars that combine these characteristics and make Cerrado wheat highly competitive. The history of soy in the Cerrado was not very different. It happened through the combination of high performance characteristics with local adaptation. But this requires investments, staff and the use of certified seeds by farmers, to ensure the continuity of genetic improvement.

> **"There are two main reasons that support area growth in Brazil: agronomy and industrial quality"**

Human capital

Team: this is our strong point. We believe that through an excellent team, organized in different sectors, motivated and involved with the essence of our activities, we are able to combine the genes necessary to obtain and deliver more productive wheat cultivars that offer strong security to farmers and excellent quality to the milling sector.

We believe in wheat and in people

The work developed by Biotrigo Genética has the clear objective of making the wheat production chain evolve. Dialogue between all its members is essential and, in this sense, we have been mediating this important discussion forum. Our seed multiplier partners take all the technology we develop into the hands of farmers who have been evolving in handling and realizing that the final consumer - which is all of us - determines the direction of all these activities. It's the people who make the gears turn. The seed is on the ground and you can only harvest what you plant, so let us make the best choice by always looking at the next link in this chain.

Researchers resort to editing the CRISPR genome to produce cassava without cyanide

Cassava has a drawback, which is the presence of cyanide. In that sense, IGI researchers in collaboration with the Danforth Plant Science Center are using the CRISPR genome edition to block cyanide production. The biosynthetic pathway of this compound is already well understood in cassava, and this provided the team with a roadmap for editing the genome. In addition, other researchers have shown that it was possible to interfere in this pathway through RNA interference (RNAi) and measurably reduce cyanide levels.

“Genome editing is cleaner than RNAi. This provides a complete knockdown and causes a change in the genome that is stable and heritable”, says Lyons. Conventional breeding techniques could, in theory, remove cyanide - although that hasn’t happened in over 7,000 years of domestication.

Source: news release from IGI

The interaction of OsABCI7 and OsHCF222 stabilizes the rice thylakoid membrane

The thylakoid membrane is a highly complex membrane system in plants and has vital functions in the development of parts of the plant used for photosynthesis. However, the genetic factors involved in the development of the chloroplast and its connection with intracellular metabolites remain unclear. Thus, Yan He and his team conducted a study to investigate this relationship.

Through a chlorotic and necrotic rice leaf 1 (cnl1) mutant and map-based cloning, it was revealed that a single base substitution followed by a 6 bp deletion in the ATP binding cassette carrier, member of the 7 family (OsABCI7) resulted in chlorosis and necrotic leaves with degradation of the thylakoid membrane, breakdown of chlorophyll, interruption of photosynthesis and cell death in cnl1. It was also shown that OsABCI7 expression was induced at lower temperatures, which strongly impacted the development of the cnl1 chloroplast, and the cnl1 seedlings grown in the absence of light were unable to recover to a normal green state when transferred under light conditions. In addition, the application of ascorbic acid reduced the yellowing of the leaves, increasing the chlorophyll content and reducing the stress of reactive oxygen species in the cnl1. Unlike cnl1, the suppression lines mediated by CRISPR-Cas9 OsHCF222 showed chlorotic leaves, but were lethal.

Source: Plant Physiology

Researchers map the largest and most complex CRISPR system

Researchers at the University of Copenhagen have mapped and analyzed the largest and most complex CRISPR system in a new study.

The researchers studied Cmr’s role in the immune system and investigated the mechanisms behind its immune response against phages and how it is regulated. “Our findings highlight the various defense strategies for type III complexes. We also identified a unique subunit called Cmr7, which appears to control complex activity, and we still believe it can defend against potential anti-CRISPR viral proteins”, says co-author Nicholas Heelund Sofos.

The Cmr system mapped by the researchers in this study can, among other things, remove single-stranded RNA and DNA, although it is very difficult to use for gene editing, such as CRISPR-Cas9. It is very large and complex. However, in the future, it may still be a key to understanding the immune

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response of bacteria and may be of some use in the fight against antibiotic resistance.

Source: University of Copenhagen

Genes that encode characteristic for height in plants are decoded

The scientists were able to identify two major genes responsible for the height of the plant in the rice crop. First, the internode stretching accelerator (ACE1) that turns on when the deepwater variety is covered by water and stimulates cell division in the stems, causing the plant to grow. This was found to be mutated in the shallow water variety. The second is the internode elongation decelerator (DEC1) which suppresses stem growth. This was found to be active in the shallow water variety even when the plant was submerged in water, but it stopped expressing itself in the deepwater variety when exposed to flooding.

Source: Nature

Study of 100 varieties reveals hidden mutations of tomato

Researchers led by Zachary Lippman at the Howard Hughes Medical Institute (HHMI) have identified hidden mutations in the genomes of 100 types of tomatoes, including a wild plant with orange extract from the Galapagos Islands and varieties normally processed in ketchup and sauces. The team's analysis is the most comprehensive assessment of such mutations, which alter long sections of DNA for any plant and can lead to the creation of new tomato varieties and the improvement of existing ones. Lippman says that a handful of mutations that his team has identified alter key characteristics, such as taste and weight.

The study, conducted in collaboration with Michael Schatz of Johns Hopkins University and others, identified more than 200,000 structural mutations in tomatoes using a technique called long reading sequencing. Most of the mutations they found do not alter genes that encode traits, but many of these mutations alter mechanisms that control gene activity.

Source: HHMI News

Gene editing leads to high yield and aroma enhanced in rice

Researchers at Guangxi University and the University of Agriculture in South China have successfully developed high-yielding rice with improved aroma. This was achieved using the CRISPR-Cas9 gene editing tool, as reported in the journal Plants.

Increasing grain yield and quality is generally difficult to achieve because the mechanism for changing both characteristics is antagonistic; however, both improvements are vital. Previous research has identified some genes linked to the cytochrome P450 family that control the growth of rice organs, however, its role in regulating grain production was unclear. Thus, the research team used CRISPR-Cas9 to simultaneously edit three cytochrome P450 counterparts (Os03g0603100, Os03g0568400 and GL3.2) and OsBADH2. The rice mutants were evaluated using RNA sequencing and proteomic analysis.

The results showed that the high mutation efficiency was achieved and the mutations that occurred were mainly deletions without mutations outside the target. Increases in grain size and aroma composition were achieved without affecting other agronomic characteristics.

Source: Plants

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A topic of national interest

Often what is obvious to some is not obvious to others. Therefore, the expression "the obvious needs to be said" makes sense. Agribusiness seems to be part of these obviousities. Consequently, it is necessary, in a very objective and direct way, that the country definitely understands the role that this sector has for itself.

It needs to be clear, once and for all, that agribusiness is no longer just a matter for agribusiness, agricultural production, the environment, agribusiness or even investors. The country needs to understand that agribusiness has for some time gained recognition as a topic of national interest, of the country, and not just of a particular sector.

A sector that accounted for 43% of exports in 2019, is responsible for practically 22% of GDP, employs 20% of the total employed population and still feeds more than 1 billion people worldwide every day cannot be relegated to a resounding unknown to most of the Brazilian people.

AT THE HEART OF THE DEBATE ON FOOD FOR THE WORLD

In this sense, Brazil was already considered a great and respected player in the international game. But given its unequivocal demonstration of competence during the pandemic, demonstrated by its delivery capacity, supported by a robust governance system of the links that make up the sector, it was lifted to an indelible position.

It is worth remembering that in many other important countries in the area, agribusiness stopped for some time in the pandemic. Not here. We even created "#oagronaopara", setting the tone for our vitality and ability to fulfill contracts, largely due to the tenacity of its agents, but also by the leadership of a ministry of agriculture committed to the moment we live in.

This situation put Brazil at the center of the debate on food for the world, no longer in the future as expected, given the monumental increase in population expected, but now, immediately.

FAO itself, the UN food arm, has already stated that given the scenario of 9 billion people living on the planet in 2050 and the scarcity of options for increasing food production around the world, Brazil is expected to be able to supply at least 40% of the additional supply required by this population increase.

FOOD SAFETY AND FOOD SECURITY

But first of all, it is important to make it clear that Food Safety and Food security are not synonymous. It is worrying in this regard that several professionals in the sector use them as similar concepts. They are not.

Food security concerns the strategic guarantee of access to food. A country, state or region needs to have its safeguards designed and operationally aligned so that its population does not run the risk of perishing due to the lack of access to food.

Food safety, on the other hand, concerns the guarantees that food can offer to consumers, especially in the aspects of health inherent in the product itself, usually considering good manufacturing practices among other processes that seek to give high levels of reliability to the consumer market.

All of these issues have been on the agenda for a long time, but with the advent of the pandemic and the market developments of the main players, both consumer and exporter markets, have raised the bar of these levels of demand.

In this scenario, Brazil was raised to one of the most, if not the most important player, coincidentally in both areas: both in its capacity to contribute decisively in the supply of food in significant quantities, and in allowing security guarantees in the food offered. This makes our country a decisive player in this game and agribusiness is a sector of prominent importance.

ENVIRONMENTAL ASSETS AND RHETORICAL BRAVADO

A third theme, the environmental issue, touches and intertwines with the two previously mentioned. And in this regard, unfortunately, we have not been able to respond properly on the international stage.

Just as we need to understand that agribusiness is a matter of state, environmental sustainability is no longer an issue between consumer and producer, and has also become a relevant issue for investors. Nobody wants to put money where it is frowned upon.

Although Europe is no longer our main export market, superseded by China, it is still the market that gives the upper hand on trends. On this issue, Europeans have self-imposed very strict rules on environmental issues (with a strict implementation of the audacious plan) and the rest of the world tends to follow them, especially if they can still take some commercial advantage from them, whether through tariff barriers or not.

Our history needs to serve as an important learning experience. Brazil assumed this level of competitive capacity in the agribusiness thanks to two interrelated issues: the high level of historical exposure to competition (while the majority enjoyed or still enjoys generous subsidies) which made the remaining producers highly competitive. Consequently, it generated great technological leaps, placing us in the condition of securing the market, in theory, that we were able to meet the demand for food that FAO expects from Brazil, without the need to cut down even one tree. But, unfortunately, for the time being, this bravado has only remained rhetorical.

For this reason, investing in new technologies that intensify the use of natural resources with sustainability, with integration-crop-livestock-forests, irrigation, more modern and intelligent pesticides, among others, seems to be the way.

THE SPEECH NEEDS TO CHANGE

This means that agribusiness and the country need to understand that preserving the Amazon, for example, is a strategic issue, both from a commercial, market, and production point of view.

One concerns the image and the generous space to be loyal and the other the necessary balance that it brings to the rainfall regime on which we are largely dependent, reminding us that less than 10% of our agriculture uses irrigation in its water systems. production. Therefore, it is possible to calculate the damage that takes a week less, for example, in the window of optimum planting or harvest of a certain crop. We already have data that prove that we worked on this hornet.

Finally, I believe that we need to stop fighting the tug of war to identify who is right, and the true agribusiness must recognize, assuming the issue of the environment as a great asset, without romanticism, capable of fighting for its effective remuneration.

To the next.

BIOTECHNOLOGY

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The challenges on the development of GM plants with new characteristics (traits)

GM crops have been widely used in Brazil and worldwide and occupy most of the area cultivated with soy, corn and cotton, the main commodities in which the technology has been inserted. After RR technology, Bt plants appeared, which comes from Bacillus thuringiensis, a bacterium that has been used for decades in agriculture for insect control, and from which, with the advent of genetic engineering, it was possible to isolate the gene responsible for the toxin that kills insects and insert it into plants to make them resistant.

The new transgenic soybean varieties to be launched in these next harvests are additional tools for the control of weeds and pest insects. Bayer maintains the expectation of commercial launch of Intacta 2 Xtend® soy in Brazil in 2021, with sowing in the 2021/2022 harvest. This technology combines genetics of caterpillar resistance with tolerance to glyphosate and dicamba herbicides. For resistance to caterpillars, in addition to the current protein (Cry1Ac), two new Bt proteins (Cry1A.105 and Cry2Ab2) were added, which result in additional protection to Helicoverpa armigera and Spodoptera cosmioides caterpillars. Also, for the 2021/22 harvest, Corteva announced the launch of the SistemaEnlist ™ / Conkesta ™. In soy, the technology called Conkesta E3®, combines the Enlist ™ technology that gives tolerance to three herbicides (2,4-D, glyphosate and ammonium glufosinate), with Bt proteins (Cry1F and Cry1Ac), which provide protection against main caterpillars that attack the soybean crop.

Despite the advantages that transgenic varieties provide to the producer, what is observed is that in most cases, the technologies incorporated by transgenics have been restricted to these two characteristics: resistance to herbicides and tolerance to insects.

Although there is a lot of speculation on the subject, especially by critics of transgenics, who point out as one of the main reasons for companies to invest in this type of technology the "sale" with the herbicide, the truth is that in addition to the commercial question, there are biological factors that hinder the generation of technologies that incorporate other characteristics, such as, for example, tolerance to abiotic stresses such as drought and waterlogging, or even characteristics aimed at seed quality, such as vigor and longevity, or even, productivity.

From a genetic point of view, the characteristics present in living organisms can be classified as qualitative, which are those controlled by one or a few genes, such as herbicide tolerance, or, quantitative, which as the term suggests, are those controlled by a large number of genes, which include tolerance to abiotic stresses, seed quality and productivity. The greater the number of genes that control a trait, the more difficult it is to manipulate, either via transgenics or even by classical genetic improvement.

> **"The greater the number of genes that control a trait the more difficult it is to manipulate"**

Although it is difficult to work with this type of characteristic, many studies have shown that the use of biotechnological tools for this purpose is promising. At "Embrapa Soja", researchers have been developing long-standing studies in partnership with Jircas (Japan International Research Center for Agricultural Sciences), aiming at the development of drought-tolerant soy plants. The strategy is based on the insertion of regulatory genes, called transcription factors, which control the expression of a large number of genes and, thus, obtain more promising individuals to develop strains with complex characteristics of tolerance to abiotic stresses.

Despite the process of obtaining transgenic plants with drought tolerance being of great complexity, GM corn seeds with such characteristic, such as the Genuity® DroughtGard® event (Monsanto, currently Bayer), are already commercialized in the North American market. In Brazil, a novelty is drought-tolerant soybeans, expected to be launched in the 2022/23 harvest. The transgenic technology was developed by the American company Verdeca, a joint venture between Arcadia Biosciences and Bioceres Crop Solutions. This soybean was approved by CTNBio in 2019 and is being developed in Brazil by Tropical Melhoramento & Genética (TMG), which was also responsible for the deregulation of technology in the country.

Constant advances in the field of genomics and the development of genome editing tools, coupled with biosafety legislation that accompanies scientific advances, may accelerate the discovery of new genes and expand the character options to be incorporated by biotechnology.

QUALITY

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Evolve to minimize losses in seed production

Revolutionary changes in contemporary agriculture have brought innovations to the agricultural chain as a whole. In a special way, science and technology have been carriers of great transformations in genetics of species of economic importance and reflecting in productivity that earns income and moves the surroundings leading to progress.

Today's technological advances make processes go more abruptly and, with this, we often need to revisit our modus operandi to make a difference and put projects into practice, seeing the potential future of agribusiness in an increasingly promising scenario.

Climate change is postulated, in addition to other trends that also compel us to think responsibly in the universe of production. It is about the increase in the world population and the need for food security. Brazil has a vocation to be the breadbasket that will do much to mitigate the world's hunger. We need to be prepared.

In the production of seeds, the main center of the solution will reside and the great challenge is to produce on a large scale in a country of continental dimensions that presents a wide environmental diversity. The need for seed quality arises here, which has been properly defined as "the sum of all genetic, physical, physiological and health attributes that affect the ability of this seed to originate plants with high productivity".

It is known that climate change interacting with modern genetics has the power to affect quality, especially physiological, impacting the entire production.

The time is coming to rethink our way of doing things and take into account the consequences in some situations, of our automatisms acquired over a time when everything was softer. Redirect understandings from crops, post-harvest, storage, seed analysis and their interpretations. We must force our minds to adopt evolution towards comprehensive perspectives of a general context, to see differently, with the processes oriented to the real and swift world that is set, without a doubt.

The seed translated into a technological product, has attributed to the evaluation of its quality, a pace as fast as the processes that are transforming it. In short, it prescribes an urgency to see more and thoroughly about the tests we perform, which we are familiar with and automated. Do the genetics of species distributed in the most diverse producing states, with very varied climatic types, tropical and subtropical, behave in the same way? Do they exhibit similar behavior when performed in routine tests in seed analysis laboratories?

I believe that when we analyze the causes-effects, in general, it becomes clear that we are facing an urgent need for changes to innovative tests, or even, to apply tests with methodologies described for a long time, but that have never been worked hard, for several reasons. which include equipment costs, specific training needs, execution time, etc., without forgetting of course, the comfort zone that also fits. Remember the words of educator Débora Dias Gomes “Before, the big ones swallowed the little ones. Now the fast ones arrive before the slow ones”.

Currently, seed analysis laboratories are being required to perform tests in time as instant as the technologies are being disseminated. There are priorities in rapid testing for decision making. But, at what moment can we count on security and assertiveness of this quality? Or do results reverberate after the storage period, no longer responding as at the beginning of the tests and, thereby, frustrating expectations? Are they taking into account the history associated with the test information? Did the sampling arrive correctly? It is only a small portion of a whole that is subjected to analysis. Sometimes it is also the case that the analyst is not so well prepared to detect or perceive factors that subtly represent the possibility of harmful causes to the lots, if not, in insufficient numbers for the volume produced. He may present difficulties in interpreting the data, he does not know how to apply tolerance tables to explain variations that follow. Guilty alone? No way. It is worth reflecting on such important issues, in a sector of such technical, commercial, logistical, financial and expressive consecutive scope, as previously mentioned.

“There are priorities in rapid testing for decision making.”

It has brought a lot of discomfort and hardly any feedback about what happened during the formation and development of the crop, which is where the quality of the seed is produced and, even more serious, no link is established with the procedures in the reception, transport phase, drying and temporary storage of these materials, the famous post-harvest.

As recommended by research, seed is a living organism and responsive to the conditions in which it is exposed. Unfortunately, at a later time, conditions come to the fore, and then we will distribute other questions: is the infrastructure sufficient for the intended volume? Is the technical-operational team being trained enough to understand the complexity of producing today, or is what they have learned in the past still being the basis for strategic decisions? How long will such considerable losses continue, be it for the seed company that discards volumes at a crucial commercial moment, or for the customer who has his crop malformed due to bad physiological potential? Isn’t it time for advances and high-level discussions to solve these problems that generate many others? How to evolve, keep up with technological advances, meet market demands and minimize losses in seed production?

In dilemmas, I always remember the lyrics by Lulu Santos and Nelson Mota “Nothing that was will be the way it once was ...” and the message written on the facade of the home of singer Charles, in Congo: “When you want to go up climbing on a tree, does not start from the top”.

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50 shades of green: agriculture and its nuances

Today's agriculture is rich in shades, forming a veritable mosaic of productive activities. I refer to the enormous range of environmental conditions, annual and perennial crops, pastures, creations and technological levels, as well as the social and agrarian aspects involved.

We started from our well-known extensive cattle ranching in the south of Rio Grande do Sul, through the integrated production of pigs and poultry in western Santa Catarina, to the orange areas in São Paulo, to the huge cotton, soy and corn farms in the Cerrado region and even to buffalo farming on the island of Marajó, Pará.

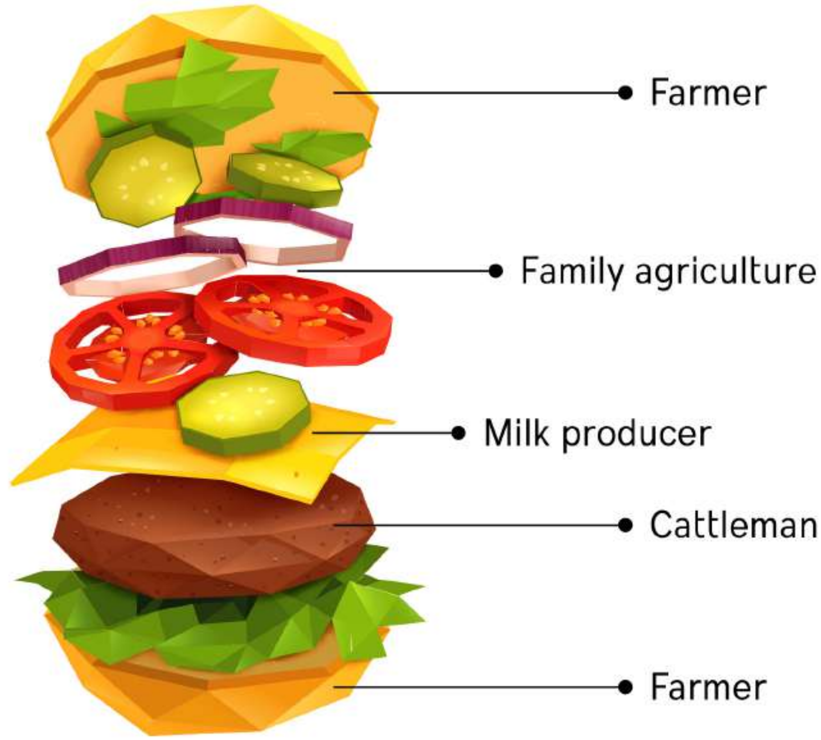
The coexistence of different productive systems in the same region or in different regions of a country is essential, as it brings the possibility of a resilient, diversified agriculture, capable of offering a wide diversity of food and non-food products throughout the twelve months of the year. This is something that Brazil is able to contemplate through our quality, safety and sustainability.

Family farming is carried out in small areas, with predominantly family labor. The main activities are: organic farming, vegetables, fruits, milk production, cheese, honey, tobacco, sheep, goats, handicrafts, among many other activities. The production is diversified, that is, different species are cultivated and raised in the same area. Thanks to sectorial public policies aimed at family farming (EX.PRONAF, PAA, PNAE), there has been an important evolution in terms of technology and technical assistance in the last 20 years.

According to the Itamaraty, family farming in Brazil represents a central axis in food production and rural employment, comprising around 4.3 million productive units (84% of the total rural units) and 14 million employed people, which represents around 74% of activities in the field. In addition, it is responsible for the production of some of the most important products for the Brazilian daily diet: beans (70% of the production is estimated to be from AF), milk (54%), cassava (84%), corn (49%), poultry and eggs (40%) and pigs (58%). There are also several successful examples of artisanal, certified organic products, collective brands and special stamps on products exported to demanding markets such as the European Union and the USA, with high added value.

Within the MAPA portfolio, the family agriculture and agrarian development secretariat was recently created to deal with issues related to family farming.

The so-called entrepreneurial agriculture, on the other hand, is carried out in medium and large farms, with intensive technological use and with the hiring of external collaborators. In addition, the main focus is on export crops (commodities). Commodities are products traded on a scale, in the raw state, that is, without going through industrialization, and which have great international trade value, their prices being quoted on an international exchange, such as soybeans, corn, cotton, ethanol, sugar and the meats. They are products aimed at food, animal feed and bioenergy, most of which are exported.



In agriculture, there is not always a dividing line between productive systems. Large properties, but managed by a family, are self-described family members, although they do not fit the agrarian criterion. There are also successful cases of integration between business and family farming, such as in the tobacco chain, in integrated poultry and pork production and in large retail chains. In the latter case, the small producer supplies vegetables, ornamental plants, colonial and organic products to retail. A simple and delicious hamburger "depends" on the existence of a grain farmer, milk producer, meat producer and horticulturist. Just pay a little attention to your surroundings and you'll see it more often.

Therefore, different types of agriculture can not only but must coexist in harmony. Yes, there are problems in business agriculture, as well as in family farming and in other systems, but there are no saints or demons, but selfless producers with varied profiles, needs and conditions. Obviously, the state must treat different conditions differently, applying the necessary public policies for the sector. Brazilian society, on the other hand, needs to understand that agriculture is one, but with varied productive nuances necessary to offer everything from meat to hydroponic lettuce, from sugar to an organic cherry tomato, from a high-yield hybrid corn to rustic Creole corn. Nature stimulates biodiversity and in agriculture we depend heavily on it.

In a country of enormous dimensions, with diverse environments and different producer profiles, only different types of agriculture can provide diversified products, with quality, in quantity and safety to demanding consumers. Regardless of the production system, we always hope that the common sense and competence of the professionals involved in the agribusiness will always guarantee us different products, which have quality, are healthy and safe to take to our homes. Brazil needs all agricultural profiles. The agro has 50 tones, maybe much more.

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