

Chapter 2

FT Sementes and the Expansion of Soybeans in Brazil

Francisco Terasawa, José Maurício Terasawa,
and Milene Möller Terasawa

Abstract In Paraná State, research to develop new soybean cultivars began in 1964, at the Experimental Station of Ponta Grossa. Initially, the study included a small number of cultivars introduced from the United States. Later, other American soybean lines were introduced through collaboration agreements with universities located further South and center of the United States, such as the universities of Florida, Mississippi, Georgia, Tennessee, Arkansas and North Carolina, which provided materials with good adaptation to the South Region of Brazil. In 1972, after years working for the Brazilian Federal Government, coordinating research and development of soybean cultivars in South of Brazil, Francisco Terasawa founded FT Pesquisa e Sementes in Londrina, in North of Paraná State. The frost in the coffee region of Northern Paraná, together with better adapted and more productive cultivars, such as Bragg, Davis, IAS-1, IAS-4, IAS-4, IAS-5, Paraná, Mineira and Visoja, accelerated and facilitated the dissemination of soybean crop in Paraná. The cultivar FT CRISTALINA was one of the first releases of FT Pesquisa e Sementes, and, over time, it started to be called by farmers as the “Queen of the Cerrado.” This cultivar was one of the main pillars to make soybean production economically viable in the Brazilian Cerrado between the late 1970s and early 1990s. In addition, FT-ABYARA contributed significantly to soybean farming in the South Region and part of the Southwest region of Brazil, due to its good yield, lodging resistance and wide adaptation. At the time, it was considered the best grain-transforming line, that is, it featured the highest correlation of dry matter weight vs. grain weight. The international success of FT Pesquisa e Sementes has been proven by the wide diffusion of its cultivars in several Latin America countries, such as Mexico, Guatemala, Nicaragua, Paraguay, Argentina, Bolivia, Colombia and Venezuela and also in Africa, including countries like Mozambique, Angola and Ivory Coast. In 1995/1996 Monsanto acquired FT Pesquisa e Sementes’s soybean germplasm bank that was the first soybean germplasm trade transaction in Brazil. In 1997, the Plant Protection Law was approved in Brazil,

F. Terasawa • J.M. Terasawa, M.S., Ph.D. (✉) • M.M. Terasawa, M.S., D.S.
FT Sementes, Ponta Grossa, Parana, Brazil
e-mail: francisco.terasawa@ftsementes.com.br; mauricio.terasawa@ftsementes.com.br;
milene.moller@ftsementes.com.br

which attracted more national and international seed companies to get involved in soybean breeding in Brazil, which generated numerous high-yielding soybean cultivars. Since its foundation, FT SEMENTES launched several non-GMO, glyphosate-resistant and *Bt*-tolerant soybean cultivars. In 2017, FT SEMENTES reached 45 years of history and will continue to work hard to compete in the globalized market of soybean cultivar development, always committed to meeting the farmers' real needs.

Keywords FT Sementes • High-yield soybeans • Cerrado • FT CRISTALINA • FT-Abyara • Soybean breeding

In Paraná, research to develop new soybean cultivars began in 1964, at the Experimental Station of Ponta Grossa. At that time, the station belonged to the *Instituto de Pesquisa e Experimentação Agropecuária do Sul* [Institute of Agricultural Research and Experimentation of the South (IPEAS)], an agency associated to the Ministry of Agriculture and headquartered in the city of Pelotas, RS. During this period, soybean research was coordinated by researcher Francisco Jesus Vernetti, MSc.

Initially, the study included a small number of cultivars introduced from the United States, such as Hill, Hood, Ogden, Arksoy, Roanoke, etc., all of which considered early-cycle cultivars. These cultivars yielded at most 1,800 kg ha⁻¹. Later, other American lines were introduced through technical agreements with universities located further south and center of the United States, such as the universities of the States of Florida, Mississippi, Georgia, Tennessee, Arkansas, and North Carolina, which allowed a good adaptation of the crop in the Southern Region of Brazil.

One of these lines introduced, called N-45-2994, received from North Carolina, presented good performance in the southern region of Paraná, and it was developed the cultivar named Campos Gerais (Terasawa and Vernetti 1973). Its adaptation greatly contributed to the development of soybeans in the Mid-South region of Paraná and, especially, in the municipality of Guarapuava, at the *Cooperativa Agrícola Agrária* [Agrária Agricultural Cooperative], a highly technified colony of German immigrants. Cultivar Campos Gerais was planted for more than 30 years with excellent yield performance.

In 1968, IPEAS was dismembered in the state of Paraná and part of the state of São Paulo, now known as *Instituto de Pesquisa e Experimentação Agropecuária Meridional* (IPEAME). Two agricultural stations were transformed into Experimental Stations and received the name of *Estação Experimental de Londrina* and *Estação Experimental de Maringá*. At that time, Paraná was the state with the largest coffee production in Brazil. Its crops covered the hottest region of the state and occupied specially high-fertility soils.

In 1969, agronomist Francisco Terasawa was transferred from Ponta Grossa to Londrina, with the responsibility of coordinating experimental works on soybeans, wheat, and cotton from the two Experimental Stations, as well as acquiring an area

for the implementation of the great North Paraná station. In the meantime, the government of the state of Paraná also showed interest in the creation of its own agricultural research institute in the northern region of the State of Paraná. The state government was faster than the federal government, and in 1972 it inaugurated the *Instituto Agrônômico do Paraná* [Agronomic Institute of Paraná (IAPAR)], in Londrina, first CEO of which, agronomist Raul Juliatto, had previously been president of IPEAME.

When the task for which he was appointed ended, in 1972, Terasawa resigned from the Federal Public Service and started a new endeavor, to which he has dedicated till today, that is, the private breeding of soybean cultivars. At that time, there was no copyright protection law in enforced for breeders and no intellectual property guarantee. Therefore, there was no guarantee of economic return to breeders. For this reason, when Terasawa sought advice from his colleagues, they unanimously advised against his pioneering initiative to create the first private soybean research company in Brazil. Such was his desire to produce a more productive soybean cultivar and better adapted to Brazilian conditions that, in 1972, Francisco Terasawa founded FT Pesquisa e Sementes in Londrina, in the north of Paraná. At that time, there were four main company goals (Terasawa 1982)

- To contribute in the best way possible to Brazil through agricultural research.
- To offer safety to farmers by recommending new cultivars, that is, that featured greater productivity and stability in all environments.
- To search for new successions of crops and economically viable techniques.
- To assist in the technical training of new researchers-breeders, making them aware of their future practical-scientific leaderships.

While Francisco continued his activities as a farmer, growing soybeans, wheat, and coffee, he also provided services such as plowing, harrowing, and harvesting. In order to pay for his research activity, he carried out the first experimental works of FT Pesquisa e Sementes at Serrana Farm in Londrina. Also included in his plans was an associative work model with cooperatives and seed producers, in which these entities would make available agricultural technicians and agronomists, with exclusive dedication, to assist in the agricultural experimentation and for the development of soybean cultivars of FT Pesquisa e Sementes. In those days, such initiative was something really unprecedented. His greatest difficulty was to demonstrate and also prove that soon these producers and cooperatives would be the first to receive the basic seed of the new soybean cultivars for multiplication.

It should be noted that, then, FT Pesquisa e Sementes belonged exclusively to Francisco Terasawa. In the beginning, the experimentation work was entirely manual: opening of furrows, fertilization, sowing, seed coverage, harvesting, and threshing. Although laborious, the manual harvesting of the plants was very valuable, for it allowed to observe the plant root system. This method contributed greatly to the selection and obtaining of plants with the best root system, cycle after cycle of cultivation. Once harvested, plants were placed in used coffee bags, hand threshed, and then sieved, just as one would do with coffee beans.

At that time, 3 years of testing were required for soybean cultivars to be officially recommended, one of which was a preliminary test and two for tests or final evaluations in the official experimental network, conducted in ten different environments, and required a good performance of the lines, in accordance with preestablished rules. Once these requirements had been met, farmers were allowed to use them, and official rural credit was granted to those who cultivated them. Thus, the breeding entity would produce the basic seed, the sale of which happened only once.

Confident in the potential of FT research and development, even before cultivars had been officially recommended, three entities signed a technical agreement with FT Pesquisa e Sementes: Cooperativa Agropecuária Mista do Oeste Ltda. (COOPAGRO), Sementes Dois Marcos, and Granjas Unidas.

The 1972 frost, in the coffee region of Northern Paraná, together with better adapted and more productive cultivars, such as Bragg, Davis, IAS-1, IAS-4, IAS-4, IAS-5, Paraná, Mineira, and Viçosa, accelerated and facilitated the dissemination of soybean farming in Paraná. After the frost of 1972, Francisco Terasawa received seeds of a line called Mutasoja, from Mr. Thomas Owens, of Itaporã, State of Mato Grosso do Sul, MS. At the beginning of August 1972, he sowed this line at Serrana Farm in Londrina. In this advance, he selected 42 plants with distinct traits of the Mutasoja line, which presented higher height, longer cycle, and pubescence and different flower colors. This soybean planting in Londrina during the winter was groundbreaking in Brazil, with its cycle reduced due to the photoperiod. If that first winter crop in 1972 had been completed one month later, all the work would have been lost due to the severe frost that occurred in July 1972, and, thus, the history of soybean in the Cerrado would have been different. Francisco later seeded the 42 selected plants, now during the normal summer planting season, and each plant was individually named M-1, M-2, M-3, and so on, to M-42, the letter “M” being one reference to the original line. This Mutasoja line was later recommended as a cultivar and was named UFV-1. From that time, the purpose with those lines was to evaluate them in the Brazilian *Cerrado* environment, in order to determine the behavior and the individual traits of each one of the lines, in order to identify better adapted materials and with traits of interest for the central region of the country.

As a pioneer and trailblazer, in November 1973, Terasawa arrived at Unaí, in the state of Minas Gerais, bordering the city of Cristalina, in the state of Goiás, and, in a pasture area, he prepared the place for experimentation with the 42 lines and used the cultivar IAC-2 as a comparative standard. In the transversal direction of the sowing, agronomist Terasawa evaluated different formulas of fertilizers as well as micronutrients. The soil analysis showed that those soils were extremely acidic and chemically limited, not very suitable for cultivation, similar to the soils of Campos Gerais in Paraná, and even poorer in organic matter.

Terasawa was assisted by Sementes Trisol, of Mr. Luiz Souza Lima, a farmer and seed producer in the region of Leópolis, Paraná. This work, in partnership with Dr. Pedro Moreira da Silva Filho, was quite promising, especially for line M-4, whose productivity was higher than that of control IAC-2. In November of 1974, already in Goiás, at Vereda Farm, acquired by Mr. Souza Lima, the tests were

repeated, and, again, the highlight was M-4. After 1975, M-4 started to be called FT CRISTALINA, in tribute to the municipality of Goiás (Terasawa 1982).

The soybean cultivar FT CRISTALINA was one of the first launches of FT Pesquisa e Sementes, and, over time, it started to be called by farmers as the “Queen of the Cerrado.” The pompous character of the denomination has its *raison d’être*, ratified by the facts. This cultivar was one of the main pillars to make soybean production economically viable in the Brazilian Cerrado between the late 1970s and early 1990s. By extension, it was a valuable component for the feasibility of agriculture in the Midwest. In the agricultural year 1978/1979, for example, the cultivar yielded, in experiments, 4780 kg ha⁻¹, at Vereda Farm, in Cristalina, according to data of the Embrapa Cerrados Agricultural Research Center, associated to the Ministry of Agriculture and Supply (Gilioli et al. 1988).

Cultivar FT CRISTALINA is described as the most used in the region of Cerrados of Central Brazil; it occupies about 95% of the area currently cultivated with soybean in the geo-economic region of the federal district. It is widespread in São Paulo, Minas Gerais, Mato Grosso do Sul, Goiás, and Rio Grande do Sul. This cultivar has few limitations, and due to its excellent qualities, it still tends to expand in Brazil (Terasawa 1983). As previously mentioned, FT CRISTALINA derives from a segregating plant found in the winter multiplication of UFV-1. The cultivar has determined growth habit, purple flower, gray pubescence, bright light yellow seed integument and light brown hilum. It is resistant to the frogeye spot (*Cercospora sojina*), to bacterial pustule (*Xanthomonas campestris* pv. *glycines*), and to wildfire (*Pseudomonas syringae* pv. *tabaci*) and moderately resistant to bacterial blight (*Pseudomonas syringae* pv. *glycineae*) and mildew (*Peronospora manshurica*).

In the agricultural year 1977/1978, for the first time, FT Pesquisa e Sementes soybean lines were evaluated in official trials in the state of Paraná. After presenting excellent results in 3 years of testing in the experimental network, in 1980, the first line identified as PR8104 was raised to the category of variety and named FT-1. Thus, FT Pesquisa e Sementes initiated its contributions to the Southern Region of Brazil with the cultivar FT-1, which in addition to presenting 5.6% higher yield than that of the cultivar Paraná, had as its main trait the tolerance to the root-knot nematode (*Meloidogyne javanica*) (Terasawa 1982). The cultivar is resistant to the frogeye spot (*Cercospora sojina*), to bacterial pustule (*Xanthomonas campestris* pv. *glycines*), and to wildfire (*Pseudomonas syringae* pv. *tabaci*) and features moderate resistance to bacterial blight (*Pseudomonas Syringae* pv. *Glycineae*) and moderate resistance to mildew (*Peronospora manshurica*) (Terasawa 1983, 1984).

Then, a new cultivar, FT-2, was recommended, and its tolerance to drought was remarkable when compared to other lines (Terasawa 1982). Such extremely desirable trait is the result of its deep and aggressive root system, even in soils with moderate levels of aluminum. FT-2 featured another relevant trait for the time, since its closing point was completed with extreme brevity, that is, its leaf development is fast, which reduced the distance between lines, making it difficult to develop invasive plants.

That trait was very important, as the conventional cropping system adopted at that time did not have many alternatives for chemical control of weeds. This cultivar maintained a very good performance in all trials conducted, and its average yield in Paraná trials was 12% higher than that of Bossier cultivar and 15% higher than that of BR-1. Cultivar FT-2 is the result of a selection of cultivar IAS-5, a widely used cultivar in the Southern Brazil. IAS-5 is the result of Hill's artificial crossing with D52-810, conducted at the University of North Carolina. Based on the cultivar stability analysis method of Eberhart and Russel (1966), according to Dr. José Francisco Ferraz, cultivar FT-2 remains stable and with high yields in the most representative environments with this crop. The cultivar features resistance to the frogeye spot (*Cercospora sojina*), bacterial pustule (*Xanthomonas campestris* pv. *Glycines*), and wildfire (*Pseudomonas syringae* pv. *tabaci*) and tolerance to bacterial blight (*Pseudomonas syringae* pv. *glycineae*), to brown spot (*Septoria glycines* Hemmi), to mildew (*Peronospora manshurica*), to the common mosaic virus, and to the purple seed stain (*Cercospora kikuchii*) (Terasawa 1982, 1983).

After 1974, FT Pesquisa e Sementes has initiated the artificial hybridizations program. The difficulty in obtaining parental seeds in Brazilian governmental institutions, coupled with the contacts that Terasawa had with researchers in several foreign universities, caused the majority of the seeds of the parents used in the crossings to be derived from other countries, especially from the United States.

FT Pesquisa e Sementes breeding program could have contributed much more to the development of soybean farming in several states of Brazil, but, unfortunately, there was delay in the recommendation of the cultivars in some locations, due to the strong governmental obstruction and aversion to private research at that time.

The state research institutions that regulated, conducted, and standardized the evaluations of the new cultivars did not allow the inclusion of new soybean lines from FT Pesquisa e Sementes in official tests. As an example of such difficulty, in the state of São Paulo, the company had to wait for 5 years for a vacancy for the line test in the official trials of that state.

In the 1980s and early 1990s, the company had already developed 102 cultivars, including FT CRISTALINA, FT-1, FT-2, FT-3, FT-4, FT-5, FT-6, FT-7, FT-8, FT-9, FT-10, FT-11, FT-12, FT-13, FT-14, FT-15, FT-16, FT-17, FT-18, FT-19, FT-20, FT-21, FT-100, FT-101, FT-102, FT-103, FT-104, FT-105, FT-106, FT-107, FT-108, FT-109, FT-110, FT-111, FT-2000, FT-2001, FT-2002, FT-2003, FT-2004, FT-2005, FT-2006, FT-2007, FT-2008, FT-2009, FT-2010, FT ABYARA, FT MANACÁ, FT IRAMAIA, FT SARAY, FT SIRIEMA, FT JATOBÁ, FT COMETA, FT ESTRELA, FT GUAÍRA, FT BAHIA, FT CANARANA, FT MARACAJU, FT CANAVIEIRA, etc. (Terasawa 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990).

As previously pointed out, it was through partnerships with cooperatives and seed companies that they built an infrastructure that allowed the regional targeting of breeding work as well as the possibility of training and maintenance of a specialized team in the area. Two examples of regionalization of the scientific work were the creation of the soybean cultivar FT GUAÍRA, to meet the specific demands of Paraná and São Paulo, and the development of the variety FT SARAY,

specially created for Rio Grande do Sul. Featuring an early cycle, with higher yield, cultivar FT GUAÍRA was perfectly integrated to the rotation system of soybean and corn crops (Terasawa 1988), whereas the FT SARAY variety was recommended in the 1993/1994 crop as a high-yield option with high potential for resistance to common diseases in the state of Rio Grande do Sul. As an example of the importance and proportion of that work, in those days there was an expressive number of entities partnering with the FT Pesquisa e Sementes breeding program. At that time, in 1988, the company's staff included 25 agronomists and five agricultural technicians allocated by 35 partner entities (Terasawa 1988). FT Pesquisa e Sementes has expanded the scope of its research work, both nationally and internationally.

Always innovating in research, one of the cultivars indicated for farming was FT COMETA, in 1988, the result of diligent plant breeding work, aiming at early maturity group soybean for Brazilian conditions (Terasawa 1988). The work to obtain this cultivar was carried out in Londrina, PR, in 1978, as a result of the hybridization between genotypes Williams and FT420. In official evaluations, coordinated by EMBRAPA National Center for Research on Soybean, this line was identified as FT81-1866. FT COMETA was the first indeterminate growth habit early maturity group cultivar in Brazil. FT COMETA cultivar features white flower, brown pubescence, bright light yellow seed and black hilum. The cultivar is tolerant to the root-knot nematode (*Meloidogyne javanica*), resistant to the frogeye spot (*Cercospora sojina*), bacterial pustule (*Xanthomonas campestris* pv. *glycines*), and to wildfire (*Pseudomonas syringae* pv. *tabaci*), and features moderate resistance to bacterial blight (*Pseudomonas syringae* pv. *glycineae*), to mildew (*Peronospora manshurica*), to septoriosis (*Septoria glycines*), to the purple seed stain (*Cercospora kikuchii*), and to the common mosaic virus. Its yield, at the time, was always equal to or superior to that of cultivar Paraná.

Another cultivar, FT ABYARA (Abyara is a Tupi-Guarani word that means something exceptional, unusual) contributed significantly to soybean farming in the South Region and part of the southwest of Brazil, due to its yield potential and lodging tolerance (Terasawa 1988). At the time, it was considered the best grain-transforming line, that is, it featured the highest correlation of dry matter weight vs. grain weight. This cultivar was a market leader, and the first variety to exceed 5000 kg ha⁻¹. Such top yields were achieved in the north, west, and southwest regions of Paraná, in high-fertility soils. The cultivar FT ABYARA is the result of the artificial hybridization between genotypes União and Sant'Ana. It is a cultivar of the medium-maturity group, and its cycle is similar to that of cultivars Bossier and FT-2, around 126 days in the state of Paraná. Its phenotypic features are purple flower, brown pubescence, medium intensity bright light yellow seed integument, and brown hilum. Its growth habit is determined, with good resistance to pods' dehiscence and physiological quality seeds. As mentioned above, one of the most relevant traits of this cultivar is its high lodging tolerance. In relation to diseases, it is resistant to the frogeye leaf spot (*Cercospora sojina*), bacterial pustule (*Xanthomonas campestris* pv. *glycines*), and wildfire (*Pseudomonas syringae* pv. *tabaci*) and moderately resistant to bacterial blight (*Pseudomonas syringae*

pv. *glycineae*), to mildew (*Peronospora manshurica*), to septoriosis (*Septoria glycines*), to the purple spot (*Cercospora kikuchii*), and to the common mosaic virus.

The international success of FT Pesquisa e Sementes has been proven by the wide diffusion of its cultivars in many Latin American countries, such as Mexico, Guatemala, Nicaragua, Paraguay, Argentina, Bolivia, Colombia and Venezuela and also in Africa, including countries like Mozambique, Angola and Ivory Coast.

An example of the success of the company in Brazil is the fact that FT varieties were spread over all Brazilian states that produce this legume. In the 1993/1994 crop season, data released by CONAB (2016) evidenced an average participation of 52% of the cultivars developed by FT Pesquisa e Sementes in 11 Brazilian states, whose percentages can be checked in Fig. 2.1.

The cultivars that stood out the most in the south region and in the state of São Paulo were FT10-PRINCESA, FT5-FORMOSA, FT ABYARA, FT COMETA, FT SARAY, and FT JATOBÁ. In the other regions of the country, the varieties FT SERIEMA, FT ESTRELA, FT104, FT106, as well as the super-varieties FT CRISTALINA were the ones to have contributed decisively to the consolidation of soybean farming at the Brazilian Cerrado (Terasawa 1988).

In 1994, in Brazil, 850 companies produced and marketed soybean seeds. Out of this total, less than 0.5% developed new varieties. The large majority, therefore, only invested in the reproduction of soybean cultivars without recognizing the copyrights of the breeders of cultivars. Of this total of companies working with soybean seeds, only 35 had some type of agreement with FT Pesquisa e Sementes. Specific legislation on this matter was required to protect the technology generated by the few breeding companies at the time. Many attempts took place, all of them,

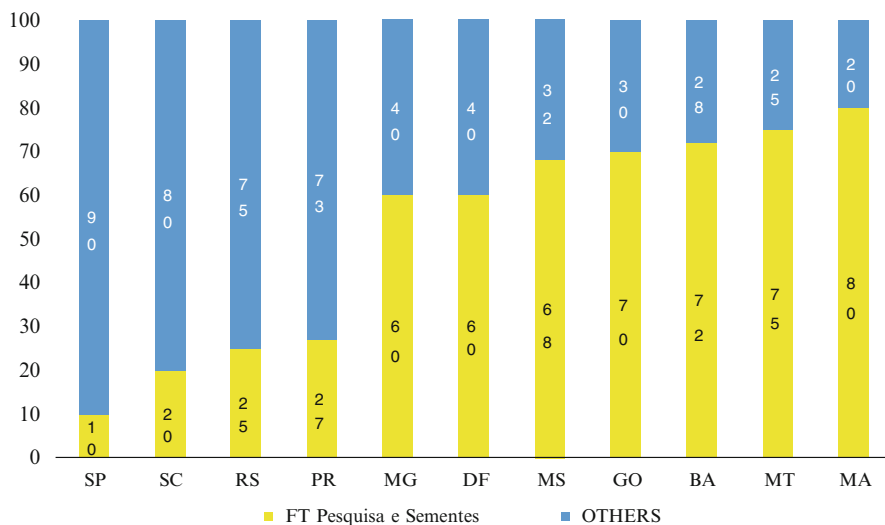


Fig. 2.1 Market share of the cultivars developed by FT Pesquisa e Sementes in the 1993/1994 harvest in 11 units of the federation. Fonte: Adapted from CONAB (2016)

however, unsuccessful. At the time, researchers and breeders, for the most part, were either federal or state civil servants and understood that research would be something exclusive to the government. Also, the seed producers, in their entirety, did not agree to pay a small fee to breeders because they believed such additional cost would render their activities unfeasible and would not provide an adequate financial return. At the time, seed producers were not convinced of the benefits that a more productive and resistant new crop could generate for both the seed market and producers.

FT innovated once again. For the first time, a soybean breeding bank was traded. The multinational Monsanto acquired FT Pesquisa e Sementes's soybean germ-plasm bank, in 1995/1996. According to Londres and Almeida (2009), Monsanto made a high investment in Brazil, by buying important companies not only in the soybean segment but also in the segment of corn and cotton seeds. As a result, in 1995 Monsanto became the largest sowing company in the world, and, currently, it is a leader in the production of GM seeds. In 1997, the Plant Protection Law (Brazil 1997) was approved, which allowed the entry of more national and international research companies in this market, which generated and continue to generate numerous high-yield soybean cultivars.

In 2006, FT resumed its soybean breeding activities with a new structure and team under the name FTS SEMENTES, under the command of Terasawa's son, agronomist José Maurício Terasawa. Since then, several cultivars have been launched with RR technology, released for farming in Brazil in 2003/2004 crop season. Among them the highlights are FTS GRACIOSA RR, with multiple resistance to Soybean Cyst Nematode (SCN) and to Root-Knot Nematode (RKN), FTS TRIUNFO RR with resistance to 11 cyst nematode races and low reproduction factor to *Pratylenchus sp.*, FTS MASTER RR with resistance to 11 cyst nematode races, and FTS PARAGOMINAS RR and FTS CAMPO MOURÃO RR, both with tolerance to high levels of aluminum in depth and with good tolerance to high temperatures and water stress (Grupo Cultivar 2016).

Soybean is the agricultural crop that has shown the greatest growth in the last decades. Currently, soybean farming corresponds to 49% of grain area planted in Brazil (MAPA 2016). Such significant increase is associated with the technological advances that the crop has presented. Always following the latest trends and technologies available to farmers, FTS SEMENTES has invested in the integration of several traits originating from biotechnology, such as Monsanto's Intacta Technology, and incorporated into its portfolio cultivars of various maturity groups, adapted to all macro-regions of Brazil.

According to Monsanto (2016), Intacta RR2 PRO provides protection against caterpillars due to the presence of *Bt* protein (*CryIAc*), which is highly effective against the velvetbean caterpillar (*Anticarsia gemmatalis*), the soybeans looper (*Chrysodeixis includens* and *Rachiplusia nu*), the soybean budborer (*Crociosema aporema*), the tobacco budworm (*Heliothis virescens*), lesser cornstalk borer (*Elasmopalpus lignosellus*), and corn earworm (*H. zea* and *H. armigera*). Moreover, tolerance to glyphosate is provided by Roundup Ready (RR) 2 technology, which makes it easier for farmers to manage weeds. In the 2015/2016 crop season,

Table 2.1 Number of cultivars of FTS SEMENTES registered with the RNC (National Register of Cultivars) between 2005 and 2016

Year	Conventional	RR ^a	I ² PRO ^b	Total
2005	3	–	–	3
2006	1	–	–	1
2007	4	12	–	16
2008	2	–	–	2
2009	–	3	–	3
2010	–	5	–	5
2011	–	3	–	3
2012	–	11	–	11
2013	–	–	–	0
2014	–	–	–	0
2015	–	4	1	5
2016	–	–	5	5
Total	10	38	6	54

Source: Data adapted from RNC (2016)

^aRoundup Ready (Trait GTS-40-3-2): Genetically modified soybean tolerant to glyphosate herbicide

^bIntacta RR2PRO: MON87701 × MON89788: Genetically modified soybean, insect resistant and tolerant to glyphosate herbicide

FT SEMENTES launched its first Intacta cultivar called FTR 4160 I²PRO. Since 2005 till presently, FT SEMENTES has featured in its portfolio several cultivars registered with National Register of Cultivars (RNC), with ten conventional cultivars, 38 RR cultivars, and six cultivars featuring Intacta Technology (Table 2.1) (FT Sementes 2016). In 2017, FT SEMENTES will complete 45 years of history and will continue to work hard to compete in the globalized market of soybean cultivar development, always committed to meeting the farmers' real needs.

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