
GENERATING VALUE
IN THE SOYBEAN
CHAIN THROUGH
ROYALTY COLLECTION:
AN INTERNATIONAL
STUDY



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Abstract

The principal objective of the present study is to analyze the effectiveness of different royalty collection systems in soybean. This project has been carried out by a Working Group comprised of members of the International Seed Federation's Field Crops Section.

Soybean is the "king of beans" and is produced in both temperate and tropical areas of the world. The United States, Brazil, and Argentina together produce about 80% of the world's soybeans. Soybeans were originally grown in Asia, mainly for preparing a large variety of fresh, fermented and dried food products, but today the majority of the soybean crop is processed into oil and meal. Derived products include margarine, cooking oil, salad dressings, industrial paint, varnishes, caulking compounds, linoleum, printing inks, lecithin, and soybean flour for human food or incorporation into animal feed.

Soybean is the most widely planted biotechnological crop in the world. Glyphosate-tolerant soybeans (RR1) were introduced to the market in 1995, and the RR1 gene has since been bred into many different soybean varieties. Today almost 100% of the soybean cultivated area in Argentina, United States, Paraguay and Uruguay contains the RR1 gene or other biotech developments.

Most of the soybean varieties cultivated in the world are protected through a Plant Breeders' Right (PBR) derived from the UPOV Convention, but protected varieties can also contain patented traits or technologies. The latter may be transgenic events, or inventions related to other plant breeding innovations. With soybeans, as is the case for wheat, current legislation, the structure of the seed business and prevailing farming practices in each country have an important influence on the type and effectiveness of the local royalty collection systems. Soybean differs from wheat however, in the presence of patented traits within varieties. The consequence of this is the coexistence of property rights, which potentially opens new ways to collect royalties. In the case of soybeans, the potential exists to base any royalty collection system on Plant Breeders' Rights, Patent Law, the Civil Code, Contract law, or any combination thereof.

This study i) reviews the various mechanisms for protecting IP in soybean, ii) analyses the different systems for collecting royalties and iii) considers the legal, political and practical farming factors that influence the efficiency of the royalty collection process.

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Market data and information from eleven countries have been assembled by members of the Working Group. The relationship between the efficiency of royalty collection and the number and type of IP protection mechanisms and enforcement measures in place is analyzed for each country included in the study. A discussion of the results and key influencing factors is presented for each country examined.

| RANK | COUNTRY | HECTARES |
|---|---------------------------------|--------------------|
| 1 | United States of America | 33,613,960 |
| 2 | Brazil | 30,273,763 |
| 3 | Argentina | 19,252,552 |
| 4 | India | 10,908,000 |
| 5 | China | 6,730,668 |
| 6 | Paraguay | 3,500,000 |
| 7 | Canada | 2,235,100 |
| 8 | Russian Federation | 1,915,895 |
| 9 | Ukraine | 1,792,900 |
| 10 | Bolivia | 1,358,683 |
| 11 | Uruguay | 1,321,400 |
| 14 | South Africa | 503,000 |
| 16 | Italy | 232,867 |
| 18 | Serbia | 154,249 |
| 29 | France | 75,800 |
| 36 | Hungary | 42,980 |
| 54 | Germany | 9,000 |
| Total world surface year 2014 | | 117,719,293 |
| Surface represented by the 12 countries participating in this study | | 91,214,671 |

Fig.1 - World soybean surfaces 2014: top ten producing countries and position of the 12 countries participating in this study (in bold) (FAOSTAT | © FAO 2015 Statistics Division)



1. Introduction

Miguel A. Rapela

1.1. Why Soybean?

During 2010-2012 the International Seed Federation conducted a study on Collection Systems for Royalties in Wheat, which was published in 2012.⁶ Following the completion of this study, soybean was chosen to be the second crop for analysis owing to its economic significance and the challenges to the industry presented by the coexistence of PBR and patented traits.

In 2853 BC, Emperor Sheng-Nung of China named five sacred plants: soybeans, rice, wheat, barley, and millet. The first domestication of soybean has been traced to the eastern half of North China in the eleventh century B.C. During the 15th and 16th centuries, soybeans were introduced into several countries, such as Japan, Indonesia, the Philippines, Vietnam, Thailand, Malaysia, Burma, Nepal and India. Soybean production was localized in China until after the Chinese-Japanese war of 1894-95, when Japan began to import soybean meal, the by-product of the extraction of soybean oil, for use as fertilizer.

Europeans had been aware of soybeans as early as 1712 and some soybean seed may have been sent from China by missionaries as early as 1740 for planting in France.⁷ Widespread shipments of soybeans to Europe did not begin until about 1908, when the crop began to attract world-wide attention.

The first soybeans arrived in North America in the early 1800's and the first plantations were located in northeastern North Carolina. Around 1900 the United States Department of Agriculture conducted tests on soybeans and encouraged farmers to plant them as animal feed. In 1904, the American chemist G. W. Carver discovered that soybeans were also a valuable source of protein and oil. He encouraged farmers to rotate their crops with soybeans, but it wasn't until the 1940's that farming of soybeans really took off in North America.⁸

World soybean production grew rapidly from then onwards, and since the 1950s global soybean production has increased 15 fold.

Nowadays, the "king of beans", is produced in both temperate and tropical areas of the world and serves as a basic and principal source of protein and vegetable oil.

Although the soybean is native to Southeast Asia, most of the production is now in the Americas. By the beginning of the present century, the United States alone was producing 75 million metric tons of soybeans, more than one third of which was exported.⁹ The United States dominated world soybean production through the 1950's, 60's, and 70's, growing more than 75 percent of the world soybean crop. A worldwide shortage of feed protein in the early 1970's led to the initiation of large-scale soybean production in several South American countries, most notably Argentina and Brazil, followed by Uruguay and Paraguay.¹⁰

⁶ Curtis, F. and M. Nilsson, Eds. Collection Systems for Royalties in Wheat: an international study. Bio-Science Law Review, Volume 12, Issue 6, 215-238 (2012).

⁷ Gibson, L and G. Benson. Origin, History, and Uses of Soybean (Glycine max). Iowa State University, Department of Agronomy, Revised March 2005.

⁸ Shurleff, W. and A. Aoyagi. History of Soy in South America. Bibliography and Sourcebook. Soyinfocenter, 2009; Shurleff, W. and A. Aoyagi. History of Soybeans and Soyfoods in Southeast Asia. Bibliography and Sourcebook. Soyinfocenter, 2010; <http://www.soya.be/history-of-soybeans.php>

⁹ <http://www.soya.be/history-of-soybeans.php>

¹⁰ Gibson and Benson. Op cit.



In 1975 Latin America passed Asia to become the world's second largest soybean producing region, after the United States. Today, the United States, Brazil, and Argentina together produce about 80% of the world's soybeans.

Europe has never been a major soybean producing region. Most European production comes from the south and south eastern countries of the continent (France, Italy, Hungary, plus Germany and Austria for food grade beans); from the Balkans (Serbia and Croatia) or from the former Soviet Union states (Romania, Moldova, Ukraine and the Russian Federation). A large proportion of the soybeans and soybean products used in Europe are imported.

Soybeans were originally grown in Asia for preparing a large variety of fresh, fermented and dried food products considered indispensable to oriental diets, whereas early use of soybeans in the US was for forage and green manure. Today, the majority of the soybean crop is processed into oil and meal. Oil extracted from soybeans is made into shortening, margarine, cooking oil, and salad dressings. Soybean oil is also used in industrial paint, varnishes, caulking compounds, linoleum, printing inks, and other products. Development efforts in recent years have resulted in several soy oil-based lubricant and fuel products that replace non-renewable petroleum products. Another product extracted from soybean oil is lecithin, a natural emulsifier and lubricant used in many foods, commercial, and industrial applications. The high protein meal remaining after oil extraction can be processed into soybean flour for human food or incorporated into animal feed. Soybean protein helps balance the nutrient deficiencies of such grains as corn and wheat, which are low in the important amino acids lysine and tryptophan.¹¹

In 1995, Monsanto introduced to the market glyphosate-tolerant soybeans that had been genetically modified to be resistant to glyphosate-based herbicides through substitution of the *Agrobacterium* sp. (strain CP4) gene EPSP (5-enolpyruvyl shikimic acid-3-phosphate) synthase. The transgenic version, known as "RR1", is not sensitive to glyphosate.¹² RR1 soybean was the most successful product of the biotechnological revolution, and one year after the release of the first set of soybean varieties containing the RR1 gene, about 8% of all soybeans cultivated in the United States were genetically modified. The same happened in Argentina just one year later.¹³ The RR1 gene has been bred into many different soybean varieties and today almost 100% of the soybean cultivated area in Argentina, United States, Paraguay and Uruguay contains the RR1 gene or other biotechnological developments.

1.2. The Seed Industry and the Protection of Modern Plant Varieties

The main mission of the seed industry is to obtain and develop new, distinct, uniform and stable plant varieties whose seeds maintain genetic purity and intrinsic quality, thus improving features such as productivity, maturity, regional adaptation, disease and insect resistance, and tolerance to diverse weather patterns. This task requires at least 10 years of research, significant investment and production processes that entails the efforts and coordination of diverse technical disciplines. Scientific and technical plant

¹¹ Gibson and Benson. Op cit.

¹² Padgett, S. R. et al. Development, Identification, and Characterization of a Glyphosate-Tolerant Soybean Line". *Crop Science* 35 (5): 1451-1461 (1995).

¹³ Fernandez-Cornejo, J. and M. Caswell, Margriet. *The First Decade of Genetically Engineered Crops in the United States*" United States Department of Agriculture (2006).



improvement has become a professional multi-disciplinary specialty that can only reach creative and inventive levels through suitable intellectual property protection systems. Intellectual property protection is applied in plant improvement to recoup the investment made during the development of new varieties and hybrids, benefiting both the breeder of such varieties and society at large.

Different forms of intellectual property protection are available for plant varieties and biotechnological inventions, including: a) Plant Breeders' Rights (PBR) or Plant Variety Protection (PVP); b) Patents on Novel Genes, Traits, Processes; c) Utility Patents on Plant Varieties; d) Use of Contract Law; e) Biological Mechanisms (Hybrid Crops); and f) Trade Secrets.¹⁴ Other authors also include geographic indications, trademark, and copyright.¹⁵

The most common and usual regime is PVP / PBR. PVP provides a *sui generis* form of IP protection to breeders of new varieties of plants. Most countries have based the protection on the UPOV Convention. This was established by the International Convention for the Protection of New Varieties of Plants (Union Protection Obtentions Vegetales – UPOV) in 1961 and revised in 1972, 1978 and 1991. The Convention, which entered into force on August 10, 1968, sets out certain minimum requirements for intellectual property protection of plant varieties. The Convention was a landmark event that extended and became stronger over time thanks to its own evolution and the accession of an increasing number of countries. The UPOV Convention described the following criteria: the novelty, distinctness, uniformity, stability and denomination requirements; the minimum scope of protection; the minimum duration of the protection; the standard conditions to annul or terminate the protection; the minimum number of genera and species that can be subject to protection; the rules for national treatment; and the priority governing the relations between the Member States, which are the basis for international cooperation.¹⁶

1.3. The Seed Industry and the Protection of Biotechnological Inventions¹⁷

Patents are the most widely used means of intellectual property protection biotechnological inventions. The local or national (government regulated) patent office grants the applicant an exclusive right to prevent others from using patented technology, in turn, the patent holder must disclose his invention to the general public and, in addition, upon lapse of the term of protection, the invention enters the public domain. The patent holder is the only one that may use the protected technology which, as any other property right, may be leased, licensed, sold or otherwise traded.

Molecular marker-assisted breeding and modern biotechnology are scientific disciplines with state-of-the-art and expensive technical development. Obtaining a modern plant variety containing biotechnological events requires considerable investment. Consequently, public institutions and private companies normally seek to protect their innovations.

¹⁴ Curtis and Nilsson. Op cit.

¹⁵ Kesan, J.P. The Statutory Toolbox: Plants. In Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices (eds. A Krattiger, RT Mahoney, L Nelsen, et al.). MIHR: Oxford, U.K., and PIPRA: Davis, U.S.A. Available online at www.ipHandbook.org. (2007).

¹⁶ Kesan, J.P. Op cit; Rapela M.A. Derechos de propiedad intelectual en vegetales superiores. Editorial Ciudad Argentina, (2000), 466 páginas; Rapela, M.A. et al, Innovación y Propiedad Intelectual en Mejoramiento Vegetal y Biotecnología Agrícola. Editorial Heliasta, (2006), 783 páginas; Lesser W.H. Plant Breeders' Rights: An Introduction. In Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices (eds. A Krattiger, RT Mahoney, L Nelsen, et al.). MIHR: Oxford, U.K., and PIPRA: Davis, U.S.A. Available online at www.ipHandbook.org. (2007).

¹⁷ Most of this Chapter is based on: Rapela, M.A. Patents and the Seed Industry. Seed News, Volume XVII, No 3, May 2013, pages 20-25. (2013).



A grant of patent rights is subject to the fulfillment of patentability requirements, which differ from country to country. In principle to be eligible for patent protection any invention should combine these criteria:

a) be a novelty; b) result from an inventive activity, i.e. non obvious for a specialist in the field; and c) be useful or capable of industrial application.

In the United States and Japan, biological material, including plant varieties, can be patented, but this is not the general rule. In most countries, the following are not eligible for patent protection: a) essentially biological processes for the production, reproduction and/or propagation of plants and animals; b) biological and genetic material as found in nature; c) animal breeds; d) the human body and its living parts; e) plant varieties.

Usually, biotechnological patents are granted on products or processes in connection with the genetic material found in the cells of a living organism. Nowadays most countries allow patent protection of DNA sequences, provided the applicant can demonstrate that no pre-existing organism is being patented. Man-made genetic constructs required for the plant transformation processes to develop transgenic varieties are generally considered patentable subject-matter, and the Argentinian and Brazilian Patent Offices, for instance, have granted many such patents. The exclusive right of a patent holder lasts 20 years, commencing on the date of filing of the patent application. This is important, as the proceedings to obtain a patent may last several years. The Breeder's Right on plant varieties also last 20 years, but the term commences from the date the right is effectively granted and not from the date of application.

Therefore, cases can potentially exist where a plant variety is protected by an enforceable Breeder's Right, but the patent protection of the event included in the variety has expired. Upon lapse of the 20year term (or earlier if waived by the holder or dismissed by the patent office), the patent holder cannot prevent others from using the invention. Technically, the invention has entered the "public domain" and any person may freely make use of it.



1.4. Plant Breeding Innovations¹⁸

From *circa* 10,000 years BC, man has selectively improved plants for food and sustainability purposes up to the point that few, if any, commercial species may be considered a product of nature. Most modern food crops and domesticated species have been transformed by man: first, throughout a long period of husbandry based on empiricism and phenotypic selection; and subsequently, through conventional breeding techniques based on the work of Gregor Mendel. In the latter part of the 20th century, breeders

¹⁸ Most of this Chapter is based on: Rapela, M.A. Post Transgenesis: new plant breeding techniques. Seed News, Volume XVIII, No 1, Jan-Feb 2014, pages 14-15 (2013); Rapela, M.A. y G. Levitus. Novas técnicas do melhoramento. Nuevas Técnicas de Mejoramiento. Anuario da ABRASEM, Associação Brasileira de Sementes e Mudás. Páginas 29-32. (2014).

began to improve their efficiency by relating genotypic information to their phenotypic data. Today, in the 21st century, plant breeding has entered the genomic era, in which the fine structure of the hereditary material has become accessible.

As plant breeding innovations are introduced, it is important that Intellectual Property protection mechanisms and royalty collection systems keep pace with technological developments. The enhancement of cultivated crops is a necessary process needed to meet the world's food and energy requirements. The relationship between plant breeding innovations and intellectual property protection is discussed in the Summary and Conclusions section of the present study.

1.5. ISF Position on the Coexistence of Rights

A soybean variety protected by a Plant Breeders Right can in turn contain patent-protected traits or technologies. The coexistence of intellectual property rights is a potential cause for confusion over which right prevails, for example, in the scope of the farmers' exception, breeder's exception, revocation of rights, and expiration of rights.

In its position paper "ISF view on IP" adopted by the General Assembly in Rio de Janeiro on June 28, 2012, the International Seed Federation provides that "strong and effective Intellectual Property (IP) protection encourages further breeding and research required to meet increasing food, feed, fiber, and fuel needs whilst preserving the planet.¹⁹ Both Plant Breeder's Rights and patents are needed to stimulate the full scope of innovation in agricultural sciences. The most effective IP system balances protection as an incentive for innovation and access to enable others to further improve plant varieties." ISF acknowledges that "the scope and complexity of agricultural sciences especially in the area of plant breeding and genetics have significantly expanded in the last decades. Sophisticated methods of plant breeding and variety development based on advanced technologies such as DNA markers and genome sequencing have been developed, which enhance the possibilities for more precise and efficient breeding. These advancements have in many crops significantly shortened the product development cycle, and have created both new opportunities and challenges for the seed industry especially in the area of protection of intellectual property".

ISF considers that both Plant Breeder's Rights and patents are efficient protection systems, which are needed to stimulate the full scope of innovation in agricultural sciences. Both systems have inherent differences based on the nature of the innovation they protect. Nonetheless, ISF considers that the preferred form of protection for varieties per se is through Plant Breeder's Rights.

While the two systems – PBR and patent – cannot be fully harmonized, their smooth integration must be maintained. A key requirement for any IP system is to achieve the right balance between protection, as an incentive for innovation, and access, to enable others to further improve and innovate. With regard to the interaction between PBR and patents this means, that both systems need to be carefully implemented to provide incentives for innovation while continuing to encourage and ensure access to genetic variability and improvements. It also means that the benefit of the breeder's exception under PBR needs to be preserved even when patents are involved".

¹⁹ ISF View on Intellectual Property. Adopted in Rio de Janeiro, Brazil, 28 June 2012.



The research that can be conducted using patented material falls within the scope of what is technically known as “exceptions to the patent holder’s rights”, that is, what a patent holder cannot preclude others from doing with his invention. Therefore, these “exceptions” to the rights of patent holders are the “limitations” imposed on those rights. For the World Intellectual Property Organization (WIPO), an adequate example is the limitation imposed for research or university teaching purposes, which would otherwise infringe the patent holder’s rights. The foregoing can be referred to as “exceptions”, “exemptions”, “authorized acts”, “unrestricted use”, and “restrictions” or, as claimed by some specialists, “users’ rights”. In addition, the exceptions include cases where a person may use the patented subject-matter after paying the applicable fee. These cases are commonly known as “mandatory licenses”, “non-voluntary licenses” or “statutory licenses”.

Currently, the only exception applicable to a patented trait or technology is the research one. However, for trait-bearing plant varieties, the question is more difficult to answer: how does the “breeder’s exception” apply with regard to a variety (protected under the Breeder’s Right) that contains one or more patented components?

ISF understands that during the conference that led to the first UPOV Convention of 1961, the founding members agreed unanimously on “the principle of independence” as a basis for the PBR system. This means that a new, distinct variety is independent from the varieties that were used to create this variety during the breeding process. At that time this was a strong deviation from the patent rights system that is founded on “the principle of dependence”, meaning that if a patent is derived from another patent, the later patent is deemed to be dependent upon the first patent.

For the founders of the UPOV Convention the principle of independence was considered to be important for the stimulation of innovation in breeding. This follows from the fact that breeding is, by definition, the creation of improved varieties by recombining the characteristics of existing varieties. Consequently, the breeder’s exception was introduced into the UPOV Convention to allow the use of PBR protected varieties for further breeding. The breeder’s exception is one of the cornerstones of the PBR-system. As an exception to the general principle of independence the concept of “essentially derived varieties” was introduced in the UPOV 1991 Act. The breeder’s exception as specified in article 15 of the UPOV 1991 Act provides for an exception to the PBR for “acts done for the purpose of breeding other varieties” and for the commercialization of the new varieties obtained, except if these new varieties are EDV’s”.

As regards breeding with a commercialized plant variety containing a patented gene or trait in a non-patented genetic background, ISF understands that it should not be considered an infringement of the respective patent on the gene or trait under the following conditions: if a new plant variety, resulting from that breeding, is outside the scope of the patent claims, it should be freely exploitable by its developer provided it is not an Essentially Derived Variety of a variety protected by the Breeder’s Right. However, if the newly developed variety still falls under the scope of the patent claims, no commercial acts (as defined in article 14 (1) of the UPOV 1991 Act) should be undertaken with the new variety without prior consent of the patent holder. To compensate the patentee for loss of effective patent duration for the patented trait, mechanisms can be in place to ensure a commercially reasonable term of effective patent protection”.



1.6. Value-capture Systems as they Affect Soybean²⁰

In the field of new plant varieties and biotechnology, the value-capture system pursues three goals:

1. To create value through the germplasm and the trait or technology
(Both components have a value)
2. To capture all or part of such value through legal mechanisms
(What mechanisms are available to capture of such value?); and
3. To sustain such value over time
(How do we sustain the value creation and capture model?)

Up to 1995, existing commercial soybean plant varieties were derived exclusively from traditional plant breeding methods and, therefore, the only right available for their protection was the Plant Breeder's Rights provided in the UPOV Convention. From 1995 onwards, transgenic varieties were introduced and in many cases these varieties contained patented traits and technologies (PTT). In fact, as previously described, the complex situation of "coexistence of rights" originated. This scenario potentially becomes even more complex, since patent owners may be individuals, corporations, or consortiums of public and private institutions. The situation is yet further complicated by the fact that a biotechnological event may be protected by multiple patents and these may be owned by different entities. For example: when Ingo Potrykus completed the development of the "golden rice" at his university institute, he obtained a licensing agreement for 60 patents owned by 32 different public and private institutions.²¹ Finally, the accumulation of events ("stacking") seems to be the trend followed by the biotechnological revolution. A clear example is seen in the development of maize hybrids with stacked genes that took place in the US. In this case, hybrids with one or more events have decreased in frequency, whereas hybrids with three or more events are exponentially increasing.

Simultaneously, in other territories, e.g. the European Union and China, the only soybean varieties approved for sowing are of conventional type. In these cases, systems for Royalty Collection are quite similar to those for the wheat crop.

2. The Results of the International Study

Data collected on soybean from the 12 seed markets investigated during the study were presented by individual members of the Working Group, each representing one or more countries. In addition to each individual country report included here, the data are presented in summary form in Table 1 (annexed as a separate sheet). Individual country reports are presented in alphabetical order.

²⁰ Most of this Chapter is based on: Rapela, M.A. Future challenges of the Value-Capture Systems. Seed News, Year XIV, No 6, pages 28-30 (2010).

²¹ Kryder D, Kowalsi SP, Krattiger AF. 2000. 'The Intellectual and Technical Property Components of pro-Vitamin A Rice (Golden Rice™): A Preliminary Freedom-to-Operate Review', ISAAA Briefs No 20. ISAAA: Ithaca, NY. 56 p.



2.1. Argentina

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2.1.1. General Introduction

Argentina is the largest producer of soybeans after the United States and Brazil. It has also the third largest acreage of soybean in the world. More than 20.4 million of hectares were sown with soybean in the 2015/16 growing season.

Almost all this surface is planted with GM varieties, mostly glyphosate tolerant. In 2013, a new stacked event was launched combining glyphosate tolerance and resistance to insects. Although 8 transgenic events have been approved just the two mentioned are being marketed.

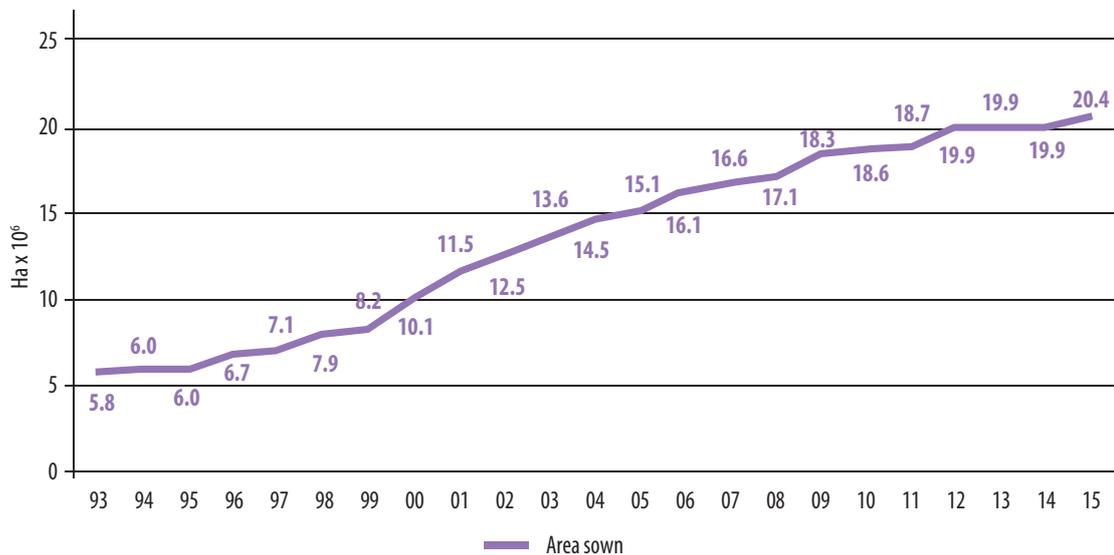


Fig. 4 - Argentina: soybean crop evolution 1993-2015

2.1.2. Intellectual Property Protection

Argentina's law N° 20247/73 on Seed and Phylogenetic Creations passed in 1973, known as the "Seed Law", provides the legal framework for Plant Breeders' Rights (PBR). As this law was created when the model of agriculture was very different to what it is today, several discussions have taken place to revise it. To date, however, no progress has been made.

Some regulations in the Seed Law were developed by the National Seed Institute (Instituto Nacional de Semillas - INASE) and were designed for regulating the appropriate use of farm saved seed (FSS) (Resolutions 35/1996 and Resolution 187/2015). The most recent Resolution 187/2015 orders that a farmer planting soybean must report to INASE the origin of the seed being used proving it is legally compliant.

Neither the Seed Law nor the Resolutions establish a limitation of use for FSS therefore there is no regulation specifying that farmers are allowed saving seed freely and how many growing cycles/seasons this practice can be repeated. Anyhow, the regulatory decree of the Seed Law provides that breeders could fix the terms and conditions for the use of saved seed of protected varieties including - among other conditions - establishing the price for its use.

Biotechnology traits are protected by the Law N° 24481 (the "Patent Law"). The Patent Office of Argentina (Instituto Nacional Propiedad Intelectual – INPI) has granted several patents to biotechnology traits; some of these traits are found in soybean varieties cultivated in Argentina.

2.1.3. Enforcement of Intellectual Property & Value Capture Mechanisms

The seed industry has three ways to enforce intellectual property protection and collect royalties: a) through the sale of certified seed; b) through the Extended Royalty System, and; c) through biotech traits.

2.1.3.1. Certified Seed Sales

Only one category of soybean seed is allowed to be marketed under the Seed Law: certified seed. This seed is produced under the control of the National Seed Institute, this entity certifies the process. In Argentina most seed companies produce certified seed themselves or through third party partners (distributors or seed multipliers). Most certified seed is produced by third parties after paying a royalty to the breeder (i.e. the seed company) that depends on the variety and the quantity of certified seed sold. This kind of production is governed by specific private agreements between the companies. The breeder provides the multiplier with "original" or "foundation" seed in order to produce certified seed. Thus, a farmer can buy certified seed from the breeder, a licensed multiplier or a licensed distributor. Commercialization of farm-saved seed (FSS) is forbidden by the Seed Law.



Fig. 5 - Argentina: soybean seed use evolution 1993-2014

In recent years, the use of certified soybean seed has decreased vis-à-vis the total soybean planted area. From a peak of almost 45% of the total area back in 1997, when the first herbicide tolerant soybean varieties were launched, the use of certified seed dropped to 15% in the 2014-15 growing season. The remaining 85 % of the area was sown with FSS or illegal seed (“Brown bag”).



2.1.3.2. Extended Royalty System

With respect to germplasm, a portion of the value of the FSS market is captured by the payment of royalties based on a private agreement, known as the Extended Royalty System (ERS), between the farmer and the breeder. The ERS is centered on the recognition that intellectual property rights are important for genetic developments introduced by plant breeders. The legal principles for ERS are in the Seed Law and in the Argentine Civil and Commercial Code thereby providing the legal framework for a binding license agreement between the breeder (licensor) and the farmer (li-

licensee). The act of purchasing and opening a bag of seed of a protected plant variety by the farmer represents acceptance of the terms and conditions, viz. the requirement to pay royalties based on the amount of farm-saved seed that the farmer is obliged to report to the breeder.

The license agreement is published in newspapers and attached to seed bags. It is renewed for every new seed multiplication of the protected variety until the expiration of the Plant Breeder’s Rights. Therefore, farmer should pay for each use of farm-saved seed.

Compliance with the system is quite low because there is no enforcement mechanism implemented by the INASE to monitor and control the farm-saved seed practice.

Although there is a contractual obligation by and between the farmer (licensee) and the breeder (licensor) the success of the system finally ends depending on the honesty of the farmer and his understanding that returns on investments made by the breeders is necessary for genetic progress. The ERS has been operating in Argentina for nearly 10 years now. Acceptance although slow is increasing and the latest figures show that 14% of the total area sown is paying extended royalties for the farm-saved seed to the breeder under the ERS.

In order to coordinate efforts and build a more effective system of capturing value lost due to the lack of respect for intellectual property rights and the illegal use of saved seed, the Argentinean plant breeding industry created a non-profit association called the Argentine Association for the Protection of New Plant Varieties (ArPOV). ArPOV coordinates and facilitates the administration and implementation of the Extended Royalty System (ERS) for germplasm protection and intellectual property rights recognition of self-pollinated plant varieties in Argentina.

2.1.3.3. Royalty Collection on biotech traits

Currently in Argentina there is only one patented biotechnology trait in the market which royalty payment is ruled by a technology licensing model comprising private agreements between the patent holder and the stakeholders which are part of the soybean chain (i.e. seed companies, seed multipliers, dealers, growers and grain handlers).

2.1.4. Efficiency of Collection

The efficiency of collection in terms of certified seed is 100%, but only represents 15% of the total area sown. In addition, through the Extended Royalty System, another 14% is captured. These two mechanisms are designed only for royalty collection on germplasm.

2.1.5. Comments and conclusions

The overall situation of value capture for the Argentinean soybean seed industry is highly inefficient. A decrease in the use of certified seed; the lack of control by authorities; and the current legal framework act against the development of new germplasm and technologies.

The main problem affecting the incentives and investments for sustainable genetic progress and the access to new varieties containing biotechnologies is the lack of an up to date applicable legal framework enabling an efficient enforceability of the PBRs. Without an updated legislation the use of soybean certified seed could decrease, and so affecting the industry as a whole. The search of alternative legal measures to enforce in the seed business, as for example the Patent Law for patented transgenic traits present in soybean varieties, will bring parallel solutions.

Within today's laws and a non-solid legal framework many wheat and soybean growers still believe that the right to use FSS freely is conferred by law and it cannot be limited by any contract or time, volume or planted area. This different interpretation and/or misconception needs new clear legal provisions and time for the industry to acknowledge such change.



2.2. Brazil

José Américo Pierre Rodrigues, President, Brazilian Association of Seeds and Seedlings (ABRASEM), Brasilia, Brazil

2.2.1. General Introduction

Brazil is second worldwide in the production and processing of soybeans, and is the second largest exporter of grain, oil and soybean meal. According to the fourth grain survey for the 2015/16 crop season, conducted by the National Supply Company - CONAB, the Brazilian soybean production will reach a production of 102.5 million tons in an area of approximately 33.2 million hectares (Figure 6). It is estimated that the soybean production chain comprises more than 243,000 producers and generates 1.4 million jobs. Currently, 70% of the grain, oil and soybean meal production is exported. Cultivated especially in Midwest and South regions, soybean has consolidated over the years as one of the most important products for the trade balance of the country. This strong growth was only possible due to the hard and persistent work of the seed industry, which invested heavily over the years to ensure that farmers have in their hands more productive soybean varieties that are better adapted to new environmental conditions, to different planting dates and are resistant to pests and diseases.

Regarding the adoption of biotechnology, Brazil advances at a surprisingly fast pace and the rate of adoption of genetically modified varieties continues to grow annually. It is estimated that, in the 2015/16 crop season, 30 million hectares of genetically modified soybean will be planted: approximately 94% of the total area of soybeans in the country. Today, Brazil has approved five biotechnological events for the

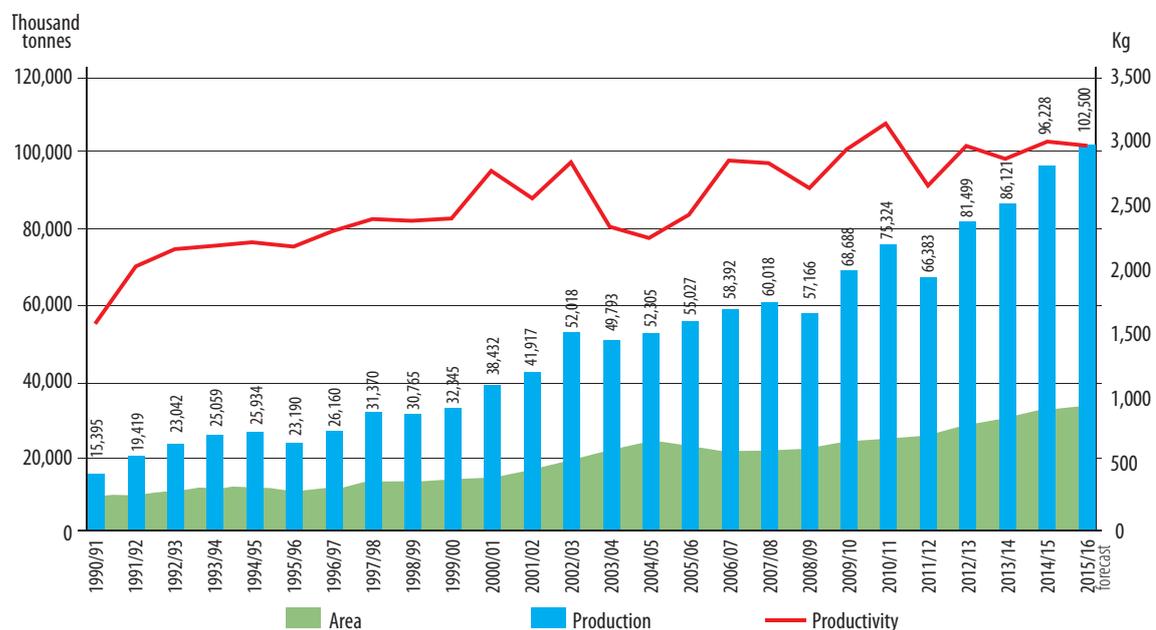


Fig. 6 - Brazil: historical series of planted area (thousand hectares), production (thousand tonnes) and productivity (kg/hectare) of soybean

commercial soybean crop but only three of these are available to the farmer. There is evidence that events with stacked traits will be increasingly popular in Brazilian crops. Use of cultivars with stacked events already represents 36.8% of the soybean seed used.

2.2.2. Intellectual Property Protection System

Brazil's entrance to the WTO and the adherence to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) initiated a series of changes and adjustments in national legislation, particularly in intellectual property law. In 1996, the Industrial Property Law (Law N° 9.279/1996) was approved. This law introduced the possibility of patenting genetically modified microorganisms and products that originate from patented processes. Soon after, in 1997, the Plant Varieties Protection Law (Law N° 9.456/1997) was approved allowing plant variety protection through a sui generis system and, in 1999, Brazil officially became a member of the International Union for the Protection of New Varieties of Plants (UPOV) in accordance with the 1978 Act. Currently, the Plant Variety Protection Law is subject to discussion by the Legislative and different proposals for updating the law are being presented by agribusiness representatives.

2.2.3. Intellectual Property Enforceability & Value Capture Mechanisms

There are currently two value capture models for intellectual property in seeds in force in Brazil. The first model occurs at the time of seed purchase, when the farmer pays the royalty for the germplasm and/or biotechnology event. The second model is by collecting a technology fee at the time that the grain is delivered to an elevator.

2.2.3.1. Royalty collection system on the germplasm and/or biotechnology events at the time of seed purchase

The entire seed production system in Brazil is based on the control of generations by the establishment of seed categories. From the development of breeder's seed to the commercial seed sold to the farmer, the materials produced must comply with all of the standards set by law. This seed can be traced at any stage of production.

The seed production process usually occurs through the licensing of genetic material or through the outsourcing of production. Independently of the production process used, the agreements follow models defined between the breeder and their partners, according to criteria established in contracts. Among the main conditions set out in the partnership agreements are: the identification of the cultivars; the determination of volumes or areas of production; the object of the authorization; the definition of deadlines; the establishment of royalties' values (germplasm and "traits"); the technical criteria for seed quality; and the commercialization form.

Regarding the use of certified soybean seed, Brazil faced a very delicate situation in 2003 when the delay of the approval of soybean seeds tolerant to glyphosate led Brazilian farmers to seek seeds produced in Argentina, adapted to the south region of Brazil, containing the first herbicide tolerance event. The entrance of illegal seed caused a drop in sales of certified seed in south region of Brazil and was responsible for the sharp decline in the use of certified seeds in soybean in subsequent years.



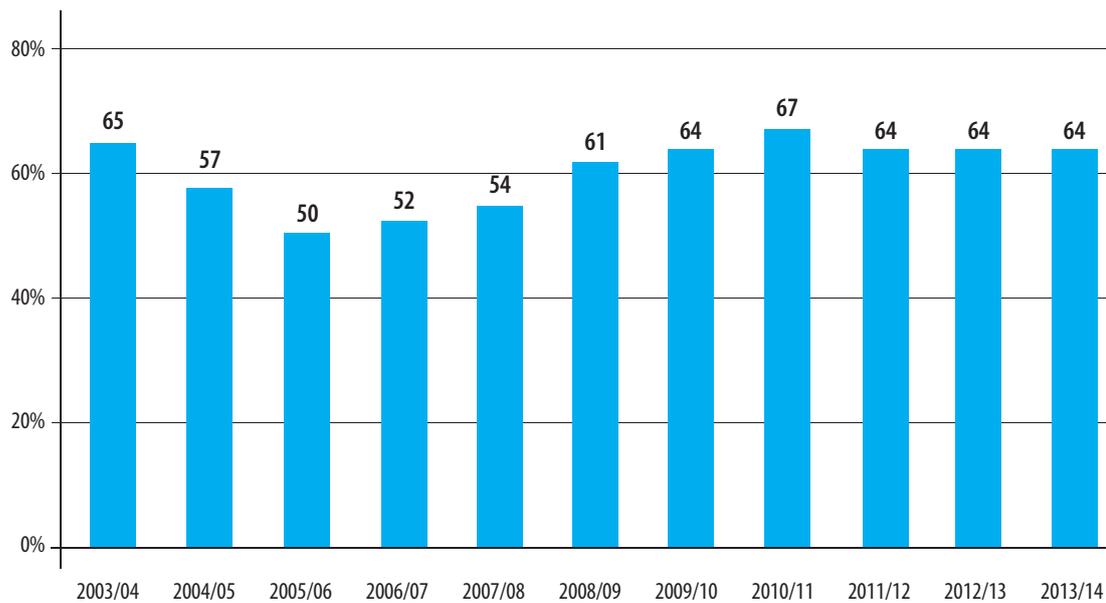


Fig. 7 - Evolution of the use of certified seeds in soybean (2003-2013) (percentages)

Currently, the national average of certified soybean seed use is around 64% (Figure 7) and some States, which are great producers of oilseeds such as Rio Grande do Sul, continue to face problems related to the increasing use of saved or illegal seeds.

The royalty collection system on biotechnology events (germplasm not included) is defined by a license agreement between the farmer and the owner of the trait. The agreement provides for the payment of the royalties due at the time of the sale of soybean grain. If a farmer chooses to pay the royalties directly at the point of seed purchase, he receives a bonus that is calculated based on the average yield of the region, to be paid at the time of delivery of harvested grain.

This mechanism exempts the farmer from paying the royalties twice. The agreement states that at the time of delivery of the harvested crop, the farmer must declare the presence or absence of patented technology in the delivered grain. If the farmer declares that the variety contains no patented trait, the trait owners reserves the right to perform, directly or indirectly, tests in order to confirm the absence or presence of their trait in that grain.

In the case of farm-saved seeds, the farmer who reserves grain of trait-bearing varieties for planting the next crop, should legalize this procedure according to Law N° 10.711/2003, with the Ministry of Agriculture, Livestock and Supply - MAPA. Before the planting of the next crop, the legalization form with MAPA must be presented to a licensed company that will charge royalties for the biotech event, per hectare to be planted.

2.2.4. Efficiency of value capture systems

Brazil has a relatively efficient royalty collection system, supported by a robust regulatory framework. However, the provisions for farm-saved seeds (FSS) foreseen in the PVP Law (Law N° 9.456/1997) and in

the Seed Law (Law Nº 10.711/2003) have been used as an alternative route to get around the law and create an illegal seed market.

2.2.5. Comments and conclusions

Currently Brazil has two legal instruments regarding the management of intellectual property to encourage progress in research and development for agriculture: the Plant Variety Protection Law (LPC) and the Industrial Property Law (LPI). The LPC protects and stimulates classical plant breeding, which generates new cultivars. The LPI, in turn, encourages the use of genetic engineering and advanced biotechnology that incorporate new characteristics into cultivars produced by classical breeding methods.

However, the way these legal instruments are currently used and enforced has resulted in a marked imbalance between protection measures, strengthening those based on patented traits and weakening the protection of the variety as a whole.

The measures that allow the unrestricted use of farmers' own seed under national law, independently of the technology level or farm size, have negatively affected the seed industry as it discourages research



and investment in genetic improvement for the soybean crop. Therefore, it is very important for the Brazilian seed industry that the proposed changes in the current LPC, which are still under discussion in the National Congress, proceed in order to extend the right of protection to the commercially harvested product. This will then limit the unrestricted use of farmers' own seed and set heavier penalties, enabling the laws to coexist more harmoniously, and paying the breeders more fairly.

2.3. Canada

Crosby Devitt, Executive Director, Canadian Seed Trade Association (CSTA), Ottawa, Canada

Teresa Neuman, Manager of Stakeholder Relations, Canadian Seed Trade Association (CSTA), Ottawa, Canada

2.3.1. Introduction

Soybeans are rising in prominence, ranking fourth in Canada's principal crops in terms of acreage with 2.25 million hectares estimated in 2014-15. 2015 saw the seventh consecutive record of soybean production, up 3.1% from 2014 to 6.2 million tonnes.

In 2012, 27,215 Canadian farms reported growing soybeans. Planted in southern Ontario since the 1970s, early-maturing varieties are expanding the area where soybeans can thrive. Soybeans are now included in crop rotations in Quebec, the Maritimes, parts of Manitoba, southeast Saskatchewan and southern Alberta. In 2014, there were 3,215 seed growers in Canada. In 2012, 1.2 million acres of commodity crops were inspected, including 255,062 soybean acres.

Canada produces food-grade and commodity grade soybeans. Food-grade soybeans with specialty traits are typically exported for tofu, soy sauce, natto, soy beverages and miso. Commodity soybeans are processed for soy protein, vegetable oil, animal feed, and industrial products. In 2014, there was an estimated \$1,957,246,507 CDN in soybean exports. Main export markets include Netherlands, Japan, Southeast Asia, U.S., Europe and the Middle East.

2.3.2. Plant breeding innovation

The soybean value chain extends from research, through the farm, and to shipping. Many Canadian businesses and organizations are focused on the development of new traits, varieties and crop management technologies.

In Canada, soybean seed development is conducted by both publicly-funded researchers and private plant breeders. In 2012, private sector investment in plant breeding and research in soybeans was \$9,570,000 CDN and continues to grow.

Breeders work collaboratively with farm organizations to ensure new varieties keep ahead of challenges including soybean cyst nematode and glyphosate resistant weeds. About 200 soybean varieties (GM and non-GM), each developed for specific environments, diseases and pests are available to Canadian farmers. In Canada, about three quarters of the soybean crop is made of glyphosate-tolerant varieties, with about one-quarter as non-GMO.

2.3.2.1. Identity preservation

Canada's identity preservation system is a voluntary program of quality assurance covering specialty grains, oilseeds and pulses. This system offers buyers complete traceability back to the producer and the seed used. The system has been developed over 30 years in collaboration with industry and global partners and includes the Canadian Identity Preserved Recognition System. Participants in the system are subject to rigorous quality assurance controls at every stage from planting, through the growing season, at the elevator and at port. Seed for growing identity preserved soybeans must be certified seed to ensure varietal purity.



2.3.3. Systems for protection of intellectual property

2.3.3.1 Laws and regulations

In Canada, seed is a very highly-regulated commodity. The seed sector is directly impacted by over 12 pieces of legislation and associated regulations. The *Agricultural Growth Act*, which received royal assent on February 27, 2015, brought into law changes to modernize and strengthen the many statutes that regulate the agricultural sector, including the *Seeds Act*, the *Plant Breeders' Rights Act*, and others.



2.3.3.2. Plant Breeders' Rights Act

Since 1991, Canada has been a member of the International Union for the Protection of New Varieties of Plants (UPOV). In 1990, Canada enacted the *Plant Breeders' Rights Act*, aligned to the UPOV 78 convention. In 2015, Bill C-18, the *Agricultural Growth Act*, received royal assent on February 25 and came into force on February 27, 2015. This Act, aimed at modernizing Canada's agricultural legislation, brought amendments to several pieces of legislation including the *Plant Breeders' Rights Act*. Bill C-18 placed Canada on the same footing as other international countries and brought Canada into compliance with UPOV 91. Canada's formal ratification of UPOV 91 took place on June 22, 2015.

As of February 27, 2015, all new varieties submitted for PBR are protected by the new legislation. Varieties granted protection prior to Feb 27, 2015, will continue to be protected under UPOV 78.

2.3.3.3. Farmers' Privilege

For the first time, the new PBR Act enshrines in legislation the ability to save seed of PBR protected varieties. Farmers may save harvested seed of protected varieties that are grown by them and plant the saved seed on their own land. This is known as Farmers' Privilege. The selling of farm-saved seed of PBR protected varieties has always been illegal and continues to be illegal. Also, as has always been the case, if the seed is of a variety that carries other intellectual property protection such as patents or single-use agreements, saving seed may be prohibited.

2.3.3.4. Harvested material provisions

The purchase of harvested material from seed that was not obtained legally is an infringement of PBR 91. The exclusive rights are also extended to harvested material, but only in the case where the harvested material has been obtained through the unauthorized use of propagating material and the rights holder has not had reasonable opportunity to exercise their rights in relation to that propagating material. The breeder can choose to seek compensation for lost royalty revenue, lost markets and for court costs on delivered grain produced from illegally obtained seed.

2.3.4. Mechanisms for enforcement of value capture of intellectual property in seed

2.3.4.1. Certified seed

Seed certification in Canada is a process designed to deliver specific plant breeding traits to farmers and the food industry. The main components of this system are varietal purity, germination and freedom from impurities.

The Seeds Act prohibits the use of a variety name on invoices, tags, advertisements etc. unless the seed is certified. Growers who want to produce pedigreed seed are governed by the *Regulations and Procedures for Pedigreed Seed Crop Production*, or Circular 6 administered by the Canadian Seed Growers' Association as designated by the *Federal Seeds Act and Regulations*. Sales of certified seed are accompanied by the blue certified tag of the Canadian Food Inspection Agency. There is no compulsory reporting of certified seed sales in Canada.

2.3.4.2. Mechanisms for enforcement

Breeders have the "right" to protect their innovations and to be remunerated for their use. Six distinct options are currently available to protect innovation investments in the seed sector, each with advantages and disadvantages. Trade secrets, trademarks, contracts and patents are in use broadly across many industries and require additional adaptation for the seed industry. The Plant Breeders' Rights Act and the Seeds Act were developed specifically by the government for the seed industry and reflect seed business practices and the technology available in this industry. Industry advancements can outpace amendments to legislation.

2.3.4.3. Plant variety protection through the Plant Breeders' Rights

Plant Breeders' Rights are a form of intellectual property protection for plant breeders who develop new plant varieties and want to sell and collect royalties from the sale of reproductive material from those varieties such as seed. PBR is a voluntary process and is administered by the Canadian Food Inspection Agency, Plant Breeders' Rights Office. PBR allows plant breeders to have exclusive control over the sale of propagating material for a specific length of time, up to 25 years for tree and vine varieties (including their rootstocks) and 20 years for all other varieties of plants.

In Canada, the Canadian Seed Trade Association has established a certification mark that designates which varieties are protected by PBR. The use of this certification mark in advertisements and publications provides assurance that the producers are aware of which varieties are protected.

The enforcement of Plant Breeders' Rights is done by civil litigation. Rights holders are responsible to uncover and provide evidence of an infringement to the court. Canada's private sector seed companies have joined together to form the Canadian Plant Technology Agency (CPTA), with the mandate to find and stop illegitimate seed sellers of protected seed varieties through monitoring, education and enforcement. CPTA investigates PBR infringement, but the variety/technology owner determines the actual enforcement action.

2.3.4.4. The Seeds Act:

This Act defines the regulatory requirements to produce, sell and/or import seed in Canada and defines the acceptable use of variety names. The *Seeds Act* is primarily consumer protection legislation with



protections in three areas: seed quality, variety acceptability and grain quality. The Act and its associated regulations apply to all seed sold in Canada of those crop species that are named for inclusion in the Act and Regulations.

2.3.5. Efficiency of systems

2.3.5.1. Value capture

Plant breeding requires significant investment and time as it can often take 10 – 12 years to bring a variety to market. In Canada, the only opportunity to capture this investment is at the point of sale of the seed. The farmer pays a total price for a quantity of seed, and this price includes any royalties for germplasm and biotech traits. The seed sector is starting to explore other strategies to capture value on investment to ensure developers and seed industry suppliers are appropriately compensated for their investment and services.

2.3.5.2. Coexistence

Biotech crops have been grown in Canada for the past 20 years. Given the fast pace of technology development around the world, principles were needed to ensure that crop value chains have the choice of the production system that best serves their businesses and the markets, whether the production system is organic, conventional or makes use of products of modern biotechnology. Coexistence is a framework that guides the implementation of stewardship and best management practices in order for three production systems (organic, conventional and GM) to successfully coexist. Conventional and biotech are the most common production methods for soybean, canola and corn, with organic production systems occupying a small but significant niche market. In Canada, experience has shown that there are ample markets for crops from all production systems, for example, GM and non-GM soybeans.

2.3.6. Looking ahead

The future is bright for soybeans in Canada. Innovative seed traits keep farmers ahead of challenges to their crops, such as pests. Canada's certified seed system, the updated *Plant Breeders' Rights Act*, and other intellectual property protection tools ensure a return on investment for plant breeders. Together with modernized agricultural legislation and regulations, earlier maturing varieties and expanded planting zones, and improved genetic potential and farm management, it is clear that Canada is well-positioned to meet the needs of export and domestic markets as a key producer of high-quality, food and commodity-grade soybeans.

The acreage of soybean production continues to grow in Canada, especially in the Western provinces of Manitoba and Saskatchewan. Significant long term private sector investments in breeding programs and seed infrastructure have resulted in farmers having a profitable, productive crop in their farming system. It is important to continue to have the mechanism available to protect intellectual property and ensure seed developers have the opportunity to be fairly compensated for their investment.



2.4. France

Antoine Alègre de la Soujeole, Managing Director, SICASOV, Paris, France

2.4.1. General Introduction

France is an important consumer of soybean: fourth in the EU in 2015 (with 4 million tonnes) after Germany, The Netherlands and Spain. The country's need has been estimated at 5.7 million tonnes per year. Around 65% of that is covered through importation mostly coming from South and North America that supply more than 95% of this imported volume mainly in the form of soya meal.

In 2015 France ranked 3rd in the EU in terms of soybean grain production (with 261,000 tonnes) after Italy and Romania.

The area under this crop grew from 57,000 hectares in 2005 to 97,000 in 2015; the area in 2008 was exceptionally low at 22,000 hectares. Soybean is grown mainly in the South-western (54%) and Eastern (46%) regions of France. The national average yield is close to 3 tonnes per hectare.

Soybean in France is predominantly used for animal feed in the production of meat (poultry, pork and beef). 70% of total consumption is in the form of soya meal.

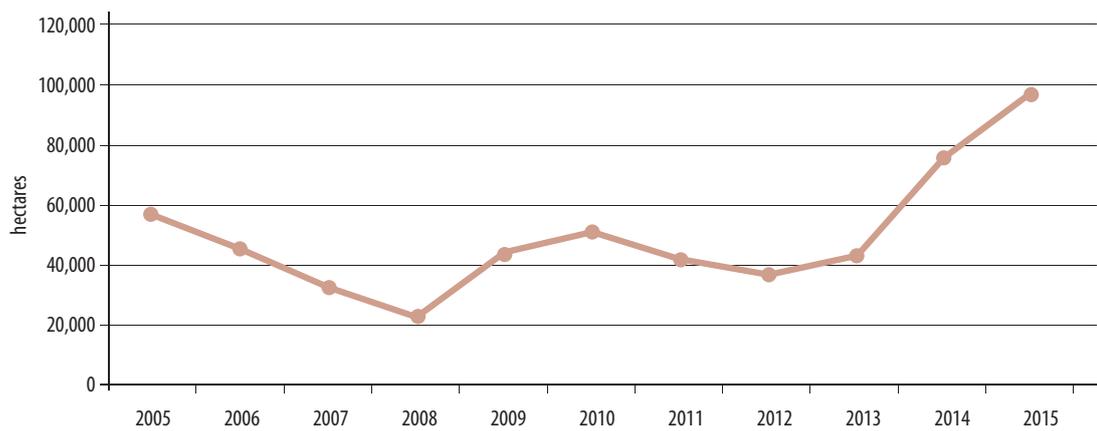


Fig. 8 - France: soybean area (ha)

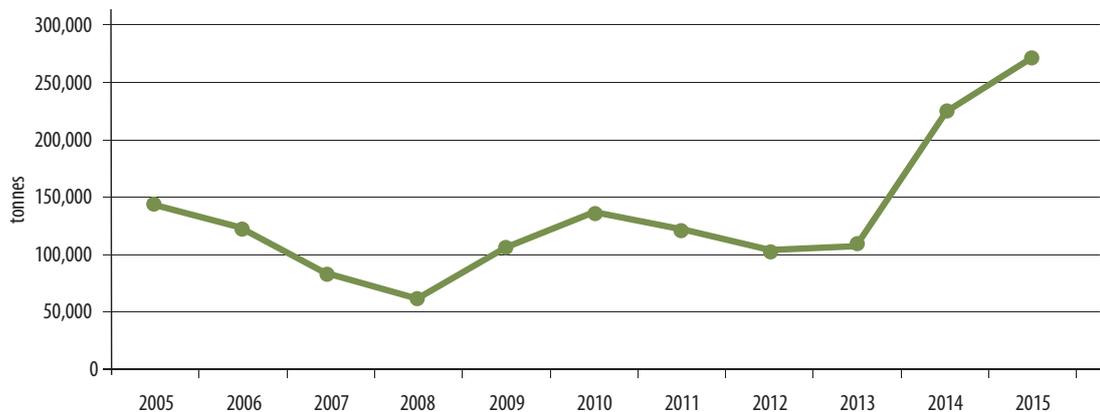


Fig. 9 - France: soybean production (t)



The use of soybeans for the food industry is rather marginal (approx. 3%) but is growing slowly; this product is mostly sourced from beans grown in France.

France does not grow genetically engineered soybeans.

The shortfall of vegetable protein availability and the importance of soybean as the first species in a crop rotation scheme may favour a further increase of acreage.

The work of two French breeding companies that have dynamic research and development programs and that periodically release new soybean varieties may also have a positive effect on the future of this crop.

Efforts should be made to improve crop management practices in the aim to increase consistency of yield when soybeans are grown in dry land or under irrigation; possibly an increased number of crushing mills and a better distribution in the key soybean growing areas would influence favourably the cultivation of soybean in France.

2.4.2. Intellectual Property Protection (Legal Framework)

Soybean varieties grown in France are all protected under the plant breeders' right system either under the EU law or the French law. These two laws are in line with the UPOV 1991 Convention.

In spite of the laws for Intellectual Property (I.P.) protection, the amount of farm-saved seed that does not pay any royalty is considerable.

Additional complexity is created by the possibility for farmers to save seed of varieties protected under the French Plant Protection Law and the prohibition to save seed of those varieties that are protected by the European Act. Nowadays the majority of soybean varieties in France are protected by a European Plant Breeder's Rights (EU PBR).

Traditionally, farm-saved seed is deeply rooted among French soybean farmers. The high rate of farm saved seed (45 to 60% depending on the year) is the result of the easiness of soybean seed multiplication, of the high cost of certified seed in relation to the additional expected income per hectare and of the irregular yield. The goal of soybean breeders is to be able to receive remuneration on the use of all varieties of soybean farm-saved seed, be they protected under the French Law or the European Act.

Common opinion suggests that recourse to court cases would be not productive in the fight against farm-saved seed use of European protected varieties.

French soybean breeders believe that the increase of production contracts of soybean for human consumption and a dynamic varietal renewal will be the most effective and acceptable ways to increase the rate of certified seed. There have been initial talks between French farmers' organizations and breeders to explore the creation of a system that will allow remuneration of all farm-saved seed.

Additionally, the will to create a supply chain of soybean grain produced in France is also an opportunity to find solutions for the fair remuneration of breeders.

2.4.3. Intellectual Property Enforceability & Value Capture Mechanisms

2.4.3.1. Certified Seed Sales.

Certified seed use varies from year to year from 40 to 55 percent; the rest is farm-saved seed.

Certified seed is produced and marketed under licence agreements by a dozen private companies and cooperatives; few breeders maintain direct sales but they cover only a very small portion of the market.



2.4.4. Efficiency of Collection

Royalties of licensed seed production are collected by SICASOV, a Cooperative Society owned by public and private breeding companies.

Royalty for soybean seed marketed under licence has been set at 300 € per ton. The collection of royalties is based on information on the quantity of seed produced provided by the licensed companies; additionally assessment is made by SICASOV of the quantity of certified seed and on-site inspections of licensed companies' warehouse are possible. When necessary anti-fraud actions are taken by SICASOV This system allows a collection close to 100% of royalties on certified seed produced.

2.4.5. Comments and conclusions

In conclusion, on one hand French farmers have a real and genuine interest in having access to the available modern varieties that are I.P. protected but on the other they remain strongly attached to the concept of farm-saved seed. This tension puts in jeopardy the financing and funding of research and development of new varieties.

The creation and implementation of a system that will assure remuneration to breeders from farm-saved seed is essential for the future of soybean seed breeding activities in France.

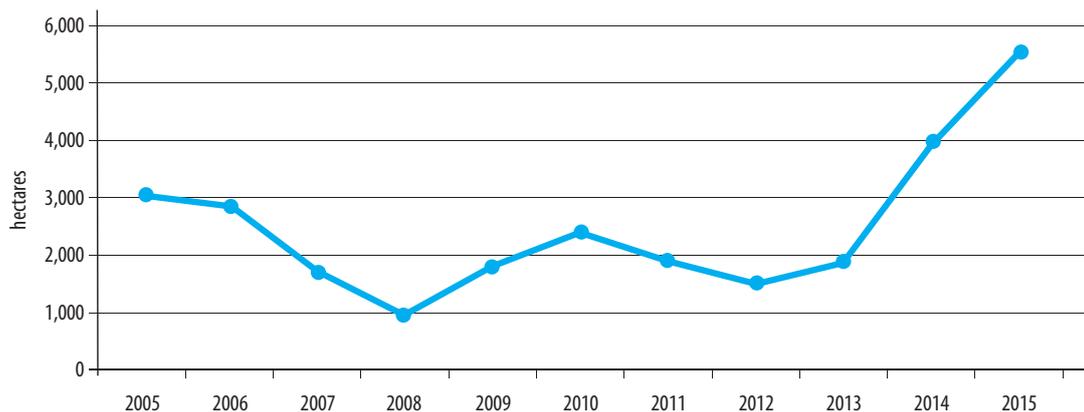


Fig. 10 - France: soybean seed production (ha)

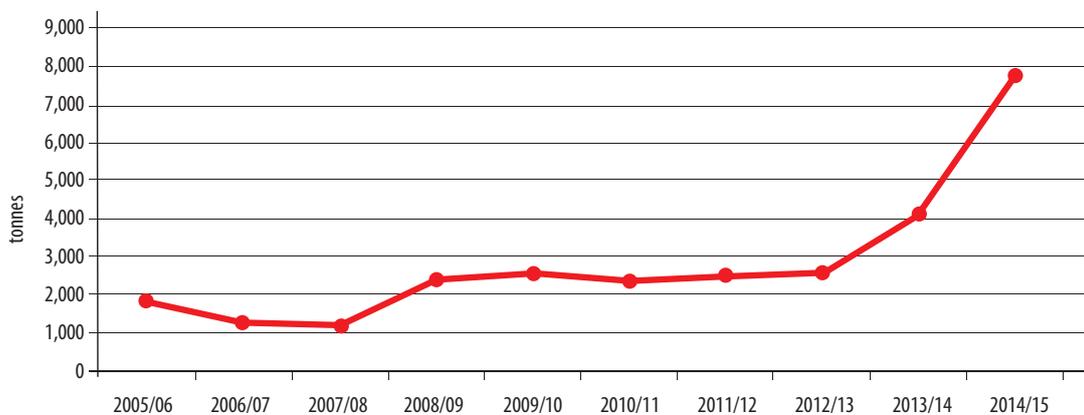


Fig. 11 - France: certified seed sales (t)



2.5. Germany

Alexandra Bönsch, Staff lawyer, German Plant Breeders' Association (BDP), Bonn, Germany

2.5.1. General Introduction

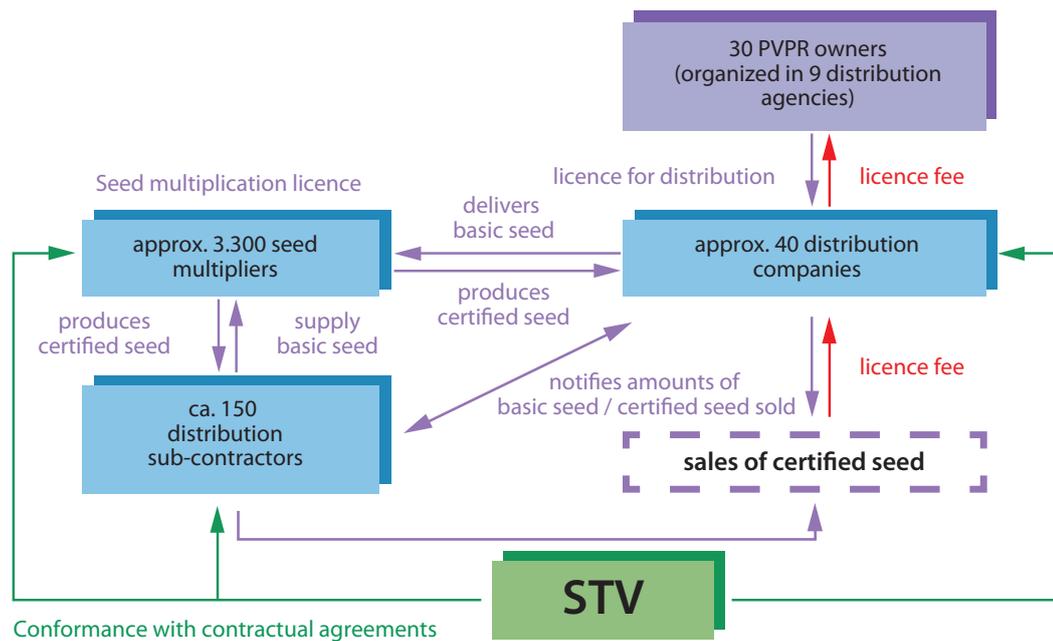
Some 130 plant breeding and seed trading companies operate in Germany; about 60 of them have a breeding program, but only a few work on soybean. Soybean breeding goals are: better adaption to climate and improvement of characteristics like yield, earliness and protein content. Soybean is a minor crop in Germany because the climatic conditions usually are too cold for that crop: it can only be sown in areas where grain maize grows well, which is mainly in the south of the country. Farmers have a choice of about 20 varieties; the most common sowing rate is 130-150 kg/ha; the average yield is near to 3 t/ha. In 2015 leguminous crops (like fava bean, field pea, lupines, and soybean) were planted on approx. 164,000 hectares, but only 17,000 of these were soybeans. Nevertheless in the last six years, the German soybean acreage progressed steadily from 2,000 hectares to 17,000. This extraordinary growth is a consequence of the European agricultural policy that grants farmers higher subsidies (as part of the so called greening measures) for leguminous grains starting from 2015.

There is high political interest in producing soybean in Germany, because GMOs are much criticized by the public and consumers would like to be independent from GM soybean imported from abroad. The main food retail chains have committed to reduce the use of GM soybean as an ingredient in the products they sell in their stores; this reflects into a request to food producers who must find sources of non GM soybean.



2.5.2. Certified seed

The Saatgut-Treuhandverwaltungs GmbH (STV) acts as a service company for the 60 active plant breeders (cereal, potato, oil and protein crops); through a system of audits it enforces the compliance with contractual agreements made between breeders and licensees. Approx. 1000 audits are carried out each year in distribution companies, distributors' sub-contractors and seed multipliers to look for license underpayments.



The right holders give distribution licences to approx. 40 distribution companies and about 150 sub distribution companies. The right holders also deliver the basic seed to the distribution companies who themselves deliver that basic seed to the multipliers (specialized farmers). The multipliers get a seed multiplication licence from the right holders. The multiplied and certified seed is delivered back from the multipliers to the distribution companies which sell the seed and notify the right holder of how much seed has been sold. After it is clear how many seeds of a certain variety have been sold the right holders charge the licence fee for the sold seed from the distribution and sub distribution companies. Most of the right holders of plant variety protection are organised in the Saatgut Treuhandverwaltungs- GmbH (STV) which supports them in checking the fulfilment of licence agreements (e.g. with distribution companies) and regarding farm-saved seed issues.

Fig. 12 - Germany: the licensing system for cereals and legumes

2.5.3. Farm-Saved Seed (FSS)

The use of FSS in Germany is covered by

- EU Regulation No 2100/94, Articles 14 and 94;
- The German Plant Variety Protection Act, §§ 10, 37;
- Distribution licensing agreements and production licensing agreements;
- German Fair Trade Law, §§ 3, 3a in connection with German Seed Marketing Act.

In accordance to European²² and German law²³ the use of FSS is only allowed for certain crops²⁴; for that reason, saving harvested soybean seed for further planting is not permitted.

²² (Article 14 paragraphs 1 and 2, Regulation No 2100/94).

²³ (Annex of German Plant Variety Protection Act).

²⁴ Chickpea, Yellow lupine; Lucerne/alfalfa; Field pea; Berseem/Egyptian clover; Field bean; Common vetch; Oats; Barley; Rice; Canary grass; Rye; Triticale; Common and durum wheat; Spelt; Swede rape; Turnip rape and Linseed with the exclusion of flax.

For the crops for which use of FSS is allowed the collection of royalties on seed saved by farmers is organized by the STV. In April each year around 90,000 farmers receive from STV a blank declaration form to be returned duly completed; that form is a list of questions aimed to verify the varieties and the amount that the farmer has planted during the latest sowing season. According the law the plant breeder (through STV) must present clues that the farmer has had an opportunity to use FSS of a given protected variety in order to obtain the requested information from the farmer for that given variety. Without such evidence, there is no general and comprehensive obligation to give information to the breeder. Nevertheless farmers have the obligation to pay the FSS royalties until the end of the fiscal year (June 30th) in which making use of FSS. This obligation is distinct from the obligation to give information (ECJ, "Vogel-Case", C-242/14). The royalties collected are disbursed to the breeders by STV. In cereals approximately 30 to 40% of the royalties on saved seed cannot be collected due to the difficulty of complying with the obligation to provide clues of use of a given variety (it is not possible for breeders to document non-authorized use of given varieties). Information about the use of FSS by individual farmers can also be obtained through requests to the seed cleaners. Also in this case clues on the opportunity to use or process FSS of a given protected variety has to be presented in order to be able to collect the information.

In order to address the unauthorized use of FSS the breeder can request compensation due to plant breeder's right infringement. In cases of brown bagging there is also a legal basis for national authorities to address infringements on the basis of national seed law via inflicting a fine. But in general officials are unwilling to follow this approach.

2.5.4. Efficiency of collection

Regarding certified seed the royalties are collected with 100% efficiency. In theory there should be a 100% use of certified seed of soybean, because FSS is not allowed. Nevertheless there may be some FSS that falls out of control of STV, and there could be illegally traded seed. No data exist on the current levels of "brown bagging".

2.5.5. Comments and conclusions

The royalty collection system on FSS is *in principle* based on a reasonable system but there is room for improvement. For example, to make the system more efficient, exemptions such as the the small farmers' exemption could be re-evaluated. Furthermore it would be useful to eliminate the obligation to present clues of use of given varieties. In addition the royalties for farm-saved seed should be higher as today because the farmer uses the same genetics as in licensed seed and only has to pay 50 % of the licence fee for licensed seed. Taking this background into account it is rather helpful for soybean breeders' remuneration that the use of FSS is not allowed.



2.6. Hungary

Gábor Polgár, Managing Director, Hungarian Seed Association (VSZT), Budapest, Hungary

2.6.1 Introduction

The Hungarian production of soybean was established by Frigyes Haberlandt in 1873 with breeding of 20 varieties. The species became widely known all over the country in the late Thirties of the last century, when the area sown began to grow and reached 5000 hectares. The yield was around 1200 kg/ha at that time. Among traditional forage crops soybean had less importance, the feed production being based mainly on alfalfa, grasses, and field peas. The role of forage crops significantly increased due to development and modernization of animal husbandry. Centralized subsidy programs were initiated to boost soybean production at several times. In the second half of the Eighties 1980's protein programs were restarted and the production area rose greatly.

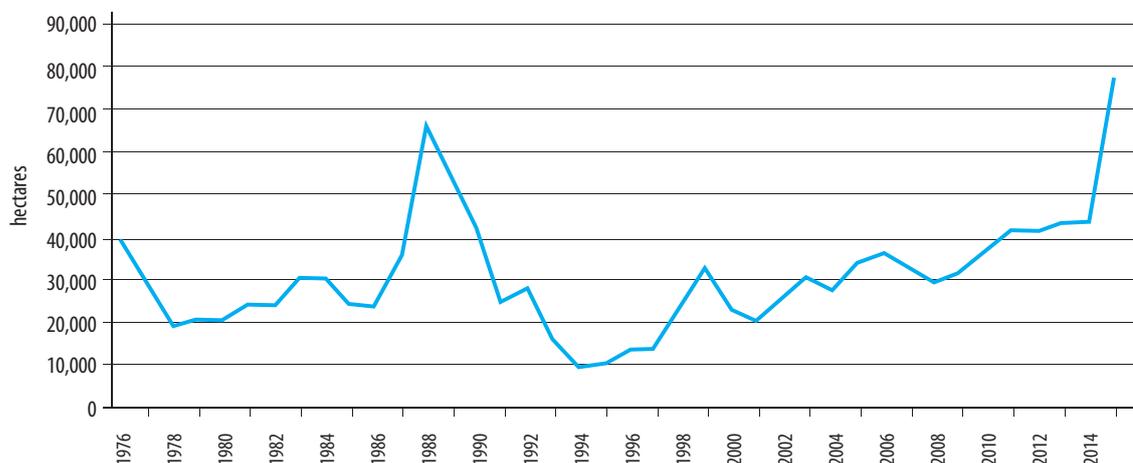


Fig. 13 - Hungary: soybean crop evolution 1976-2015

The subsidies for producers and processors had an important role in the significant growth of soybean production. After the accession to the European Union in 2004 the subsidy system changed, the national direct support for soy production was cut off. In the last two years (2014 and 2015) the government announced a new strategic goal renewing the earlier protein programs to increase the area of forage plants and the quantity of locally produced fodder for animal husbandry, and to decrease the dependency from import of feedstuff derived from soybean. Additionally, there is a strong market demand for non-GM food, which also contributes to enhancing domestic non-GM soybean production.

The south-west part of Hungary is the main production area for soybeans, the hot, dry weather conditions in summertime is the utmost obstacle against effective farming and high yields.

At present, as part of the new Common Agricultural Policy of the European Union, various subsidies are dedicated to the soybean production. The indirect payment and greening programs include the support of soybean. The relevant national regulation requires the usage of officially certified seed and achieve-

ment of a minimum yield with 1 t/ha. The regulation resulted in a significant boost in the area of soybean production.

The surface planted with soybean exceeded 77.000 hectares in 2015, and further expansion is among the strategic goals of the National Rural Development Program. Hungary declared the right to healthy food in its Constitution and this is strongly linked to non-GM food. For this reason the multiplication and production of GM varieties are forbidden in Hungary. Marketing of GM seeds is prohibited, and soybean is among the few species which are affected by this regulation. There are no GM varieties registered in the Common Catalogue therefore the soybean production is derived from “conventional” varieties only. The rule of zero tolerance is in force related to adventitious contamination in soybean seeds in Hungary.

2.6.2. Systems for the protection of intellectual property (IP)

The protection of intellectual property concerning plant varieties is based on four pillars. Hungary is member of the European Patent Treaty founded in 1973, and has signed up to TRIPS Agreement. Hungary ratified the 1978 Act of UPOV Convention in 1983, and the 1991 Act was implemented into national legislation in 2003. In 2004 after the accession to the European Union the common legislation of the Community (*acquis communautaire*) came into force. In the scope of protection, the most essential legal rules are laid down in the Council Regulation 2100/94 and in the Directive 98/44/EC of the European Parliament and of the Council.

Variety protection and patents are regulated in the national legislation in the Act XXXIII of 1995 on the protection of inventions by patents.

The multiplication and marketing of seeds and the variety registration are regulated by the Seed Law (Act No. LII of 2003 on the registration of plant varieties and on the production and marketing of propagating materials).

Multiplication, storage and marketing of seeds derived from genetically modified varieties are prohibited by the Seed Law and its decrees.

2.6.3. Mechanisms for enforcement and value capture of IP in seed

Management of intellectual property in varieties can be divided into two different periods in the last 20 years.

In the first period, before the EU accession (2004), the royalty for seeds was regulated by the Seed Law and ministerial decrees related to seed marketing, multiplication and variety registration. The rate of royalty was declared at 10% in general and the breeders were provided the right for obtaining the fees by the law.

The breeders listed in the National List of Varieties were entitled to collect royalties, which were linked to the status of registration. The breeders obtained exclusive rights to authorize the seed multiplication and certification for export in relation with varieties. The main elements of the variety protection were provided by the Seed Law and the national seed certification system, which was maintained and managed by the national seed authority. The plant variety rights and patents concerning varieties did not have great importance in the domestic market because the regulation of Seed Law provided appropriate legal framework and protection. Breeders of agricultural plants did not use the possibility of PVR.



The same protection system was in force for foreign varieties, which were maintained abroad and multiplied in Hungary.

In the second period of the history of PVR, Hungary became the member of the European Union; the regulation of seed law concerning royalties was essentially changed. The rate of royalty and the breeders' right to royalty were cancelled from the Seed Law, and the legal framework was harmonized to other EU countries. The special rights granted to breeders were removed from the new harmonized national regulation; therefore the PVR became the only efficient legal way for protection. In the transition period the varieties which were already listed could not obtain PVR for lack of novelty. Nowadays in case of main agricultural plants, breeders usually apply for PVR to their variety at the same time of registration. Almost half of the recently registered varieties have PVR. The rate of protected varieties largely depends on the species. In the market of hybrid crops and cereals the PVR is the commonly used method of protection; in case of soybean the number of PVR protections and patents is very low.

There are 65 soybean varieties on the National List of Varieties in Hungary, and half of them are multiplied annually. Only 10 varieties have been registered under the PVR system. In harmony with the EU legislation, the Hungarian Patent Law including regulation concerning plant variety rights does not contain soybean within the scope of farm-saved seed. That is the main reason for the small number of variety protections. Generally the royalty fee related to intellectual property is built into the retail price of seed. Soybean is included in the "greening" measures and in the Voluntary Coupled Support in the framework of Common Agricultural Policy 2014-2020 in Hungary. According to the regulation only the usage of certified seed is entitled to subsidy payments; as a consequence the share of certified soybean seed is almost 100%.

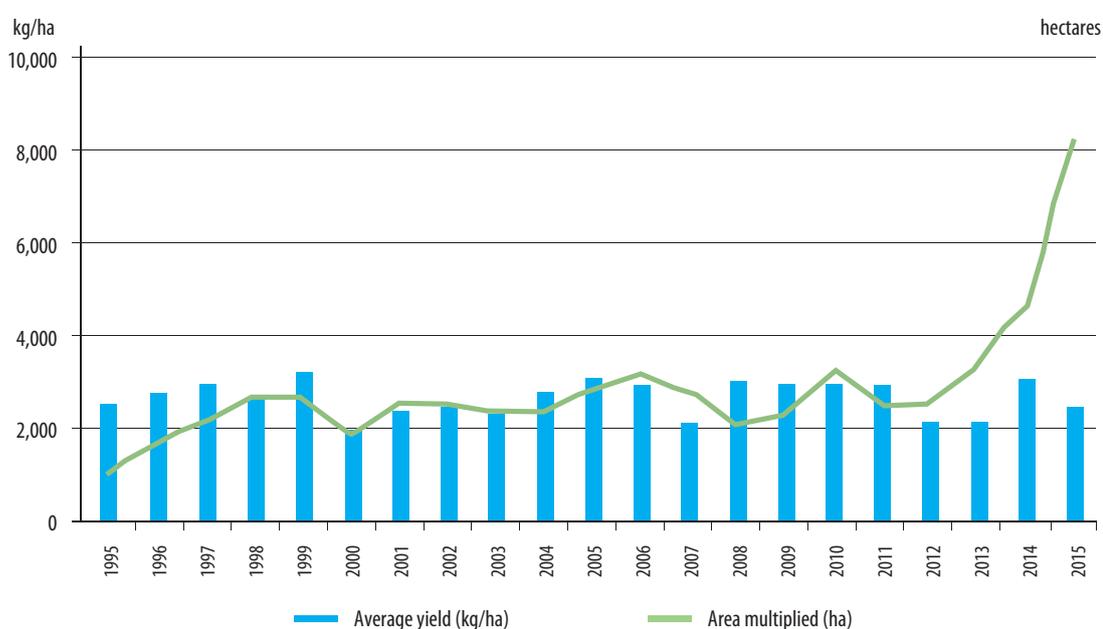


Fig. 14 - Hungary: seed production 1995-2015



As long as the subsidy system for soybean is running the collection of royalties is highly efficient, because of the high rate of certified seeds on the market. The plant breeders organize the seed productions and the marketing of certified seeds.

During the past 15 years, the share of certified seed declined to 60-70% due to the absence of subsidies. The non-certified seed was not farm-saved seed since soybean is not listed in the relevant legislation; uncertified seed-lots were marketed in breach of seed marketing laws. When the subsidy system was reestablished the obligation of planting certified seed has assured the payment of royalties and the recovery of the percentage of certified seed.

In neighboring countries the final category of soybean seed is different from that in Hungary, which has an influence on the seed price in Hungary. Generally the final category of certified seed marketed and multiplied in Hungary is second generation, which is lower than in the neighboring countries. The seed lots of varieties which are bred and maintained abroad are imported mainly for the purpose of multiplication.

2.6.4. Efficiency of systems

The royalties are built into the price of the marketed seeds and collected without difficulties because of obligatory use of certified seed in the subsidy system. The lack of legal possibility of FSS is the main obstacle against applications for PVR. Patents are not in general use and their position will be very limited in the near future because of long-term commitments on non-GM production in Hungary. According to forecasts the area of soybean production will not rise above 150.000 hectares in the coming years. The efficiency of the protection system correlates strongly with the collection of royalties, which depends on requirements of regulations related to certified seed usage in the subsidy systems.

2.6.5. Comments and conclusions

Seed production contracts and the distribution systems of certified seed on the market are the main elements of the royalty collection. Access to subsidies potentially generates usage of certified seeds on the entire soybean area. Lack of legal enforcement reduces usage of certified seed at around 60-70%. The soybean production area is relative small (1,5 - 1,8% of the total arable land) and involves a small number of producers, thus making business relationships between seed producers and traders quite straightforward. The production of soybean is increasingly becoming part of an integrated supply chain system, in which contractors provide their partners with input materials, seeds, fertilizers and chemicals. The legislative conditions for collection of royalties from certified seeds are guaranteed by Patent Law and by contractual business relations with the backing of Seed Law.



2.7. Italy

Stefano Conti, Coordinator Breeders' Section, Italian Seed Association (Assosementi), Bologna, Italy

2.7.1. Introduction

Soybean was introduced into Italy in the early 1980s; the first year, the crop covered only about 150 hectares. In less than 10 years it had reached 500,000 hectares. The success is due both to economic and agronomic factors. The soybean crop leveraged the proven supply and demand combination that already existed with sugar beet, and also introduced the agronomic advantages of crop rotation, in place of or alongside sugar beet. During the first decade, management of the crop was set up and fine-tuned, varieties of various maturity cycles were made available and planting second crop soybean became an option for many farmers. In the beginning varieties were sourced from the USA, but in the early Nineties, some Italian breeding programs were initiated and soon delivered successful varieties. In the second half of the 90s, changes in the European Common Agricultural Policy (CAP) led to a decline of the crop acreage to only 100,000 hectares in 2008.

The decline of soybean acreage also led to a reduction in research and development activities to the extent that there is now only a couple of public and a similar number of private breeding programs still running. These programs are mainly oriented towards the creation of varieties producing grain with increased protein content and reduced anti-nutritional factors; an increase in oil content is a secondary objective of that research.

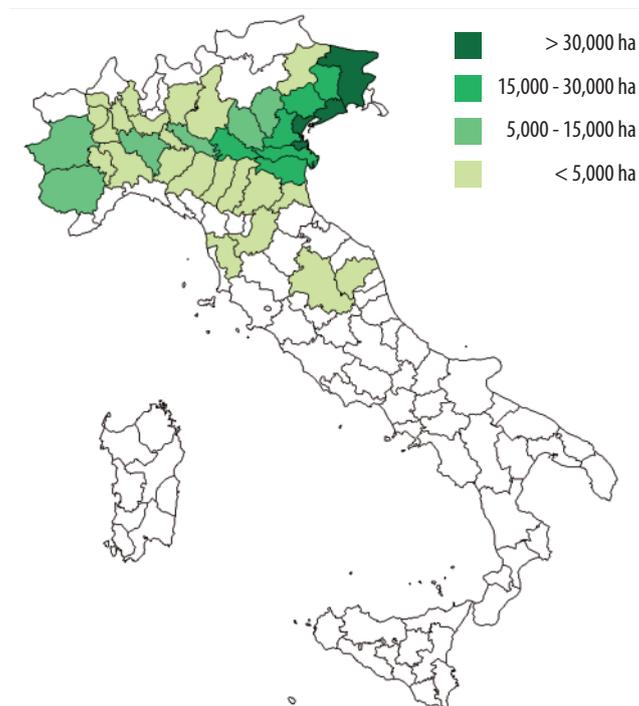


Fig. 15 - Soybean growing regions of Italy

Soybeans are grown mainly in the north of Italy: Veneto (53%), Friuli-Venezia Giulia (9%), Lombardia (19%), Emilia Romagna (12%), and Piemonte (4%).²⁵

Soybean grain produced domestically is mainly consumed by the feed industry (90-95%); the remaining quantity is used for production of soy flour or soy milk and other human food products.

The latest CAP reform, however, seems to have set the stage for a revival of this crop, thanks to a specific coupled support and to a compulsory European Union measure (popularly known as "greening") that includes soybean in the list of crops entitled to receive EU direct payment subsidies. It is possible that

²⁵ Source: ISTAT – Italian National Statistics Institute, 2015.

such decisions together with the low price of maize grain will favor the expansion of the crop also in territories of northern Italy historically devoted to maize monoculture.

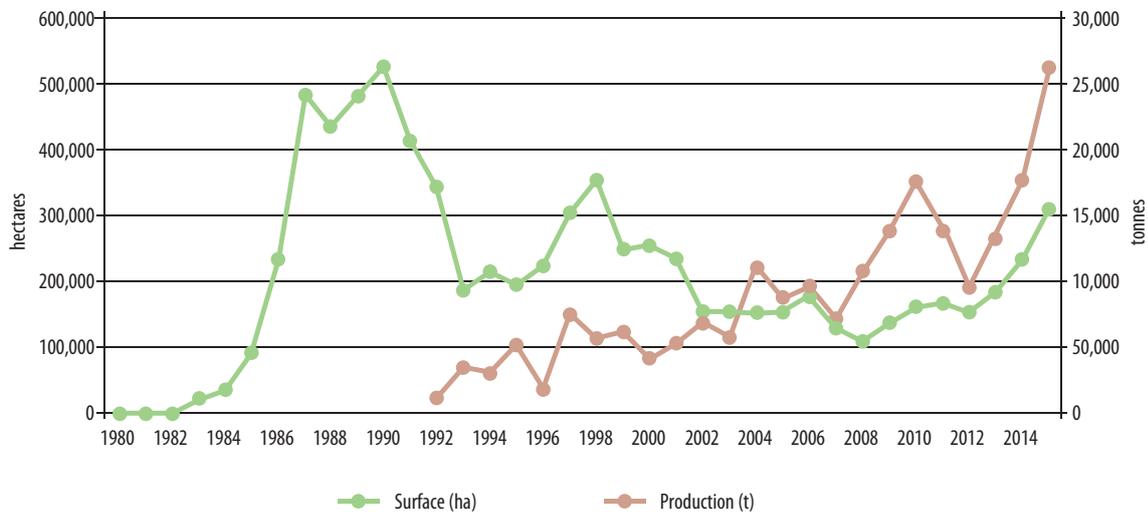


Fig. 16 - Italy: evolution of soybean acreage and production of seed

Despite significant increases in the last three years, the Italian soybean crop is still largely insufficient for the needs of the country, covering just 26% of the requirement. Annual average yields of 3.5-4 t/ha, in 2014 produced approximately 1.1 million tonnes of grain, compared to a national demand of nearly 4.2 million tonnes. The shortfall was filled by imports of 3 million tonnes, comprised of grain (38%) and soybean meal (62%). The lack of a stable infrastructure that would stabilize prices and facilitate market supply is a major factor affecting the potential recovery of the soybean cultivated area.

In the late '90s a moratorium was established preventing the cultivation and any form of experimental activity of GMOs in open fields. Thus, the import of seed from other countries is subject since 2003 to national control measures that exclude the marketing of GM seeds and of conventional varieties accidentally contaminated with such materials (adventitious presence or AP). The measure also covers maize seed and the tolerance threshold is zero.

This situation does not appear to have generated significant benefits for Italian farmers, at least in terms of higher prices paid to domestic production when it is for supply chains that look for "GM-free" feed.

2.7.2. Systems for the protection of intellectual property (IP)

In Italy it is possible to protect new plant varieties with a national system of protection, through the "Code of Industrial Property" (Decree 10 February 2005 n. 30), or with a European system based on the Council Regulation (EC) No. 2100/94; the latter has simultaneous effect in all EU countries.

Both systems are derived from the UPOV Convention, of which Italy ratified the accession in 1986 (UPOV Act 1978). However, there is a substantial difference between the two instruments, particularly on reuse on farm.

In fact, while at European level, the Council Regulation (EC) No. 2100/94 provided a significant exemption to farmers saving seed of protected varieties of some species (not soy however), at the national level that possibility is not permitted. A grower is therefore obliged to recognize the rights of the holder of a PVP and to pay a full royalty, similar to that provided for seed multiplication under contract, in cases of re-use of seed. Although available, at present other instruments such as the 98/44 EC Directive on Protection of Biotechnological Inventions (implemented in Italy with the Legislative Decree no. 3/2006) do not seem to be exploited.

2.7.3. Mechanisms for enforcement and value capture of IP in seed

Not only for soybeans but also for other agricultural species there are no Associations or Consortiums that collect royalties on licensed or farm-saved seed in Italy. Therefore, it is normal practice that the holder of the right or the seed company collects the royalty on its own material primarily through the sale of officially certified seed. For soybeans the use of officially certified seed is estimated at 80% of total seed sown. For other crops, for example cereals, it varies from 60% to 80%.

The greatest proportion of certified seed (about 85%) comes from multiplications made in Italy; another 15% consists of seed imported from other EU countries. Farm-saved seed or seed not certified (brown bag) constitute the remaining 20% of total soybean seed being sown. Assosementi considers farm-saved seed still on the rise, also because of the growing availability of the on-farm seed cleaning services

2.7.4. Efficiency of systems

The use of plant variety protection was widely adopted from the late 80's until the mid 90's but nowadays is modest. 2015 official seed certification data indicate that only 25% of cultivated hectares are sown with variety covered by a European or Italian protection title; the number of varieties protected by a national title is negligible. The remaining 75% of the varieties used are non-protected material.

As mentioned there are no statistics regarding royalties levied on certified seed. However, considering a usage rate of 70 kg per hectare and the type of material available (public and private varieties), the total amount of royalties generated can be estimated at approximately 300,000 € per year. There are no estimates of collection of royalties on farm-saved seed.

2.7.5. Comments and conclusions

The overall picture is unstable: on one hand the market demand exists for a revival of this crop, considering the necessity of imports; on the other hand, national policies are too weak and fragmented to support a tangible turnaround. Research and breeding has followed the trend of reduced investment, with the result that today Italy is confronted by a general reduction of the national breeding programs.

Remuneration of research is also limited by the inconsistent use of variety protection instruments. The defense of intellectual property is not systematic and is being implemented only by the most organized companies. Adding complication to the situation is also the tendency of farmers to use only the most popular and well-known varieties, with the result that the new ones, possibly protected, struggle to gain a position on the market.



2.8. Paraguay

Maria Estela Ojeda G., General Manager, Association of Seed Producers of Paraguay (APROSEMP), Asunción, Paraguay

2.8.1. Introduction

Soybean is the most important crop for Paraguay's economy for the total acreage planted and for the quantities produced. In the last years the national production neared 10 million tonnes, this year conditions of the crop lead to forecast a higher result. This performance is possible thanks to the introduction of improved genetics and of biotechnologies.

In the growing season 2014-2015 the soybean acreage has been over 3.2 million hectares in first crop and more than 550 thousand ha in second crop. Second crop is a practice that is growing year after year. GM varieties are sown on almost 100% of the country soybean acreage; the largest portion of this surface adopts the first event that was released in South America; in 2014 a new type of GM tolerant to herbicide and to insects has been introduced; few more events of different breeders are currently under the evaluation of the Biosecurity Council.

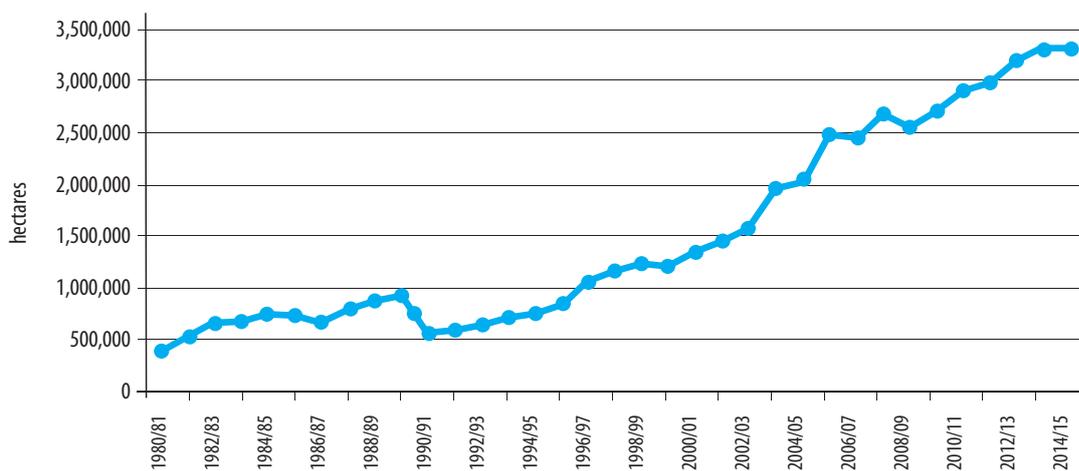


Fig. 17 - Paraguay: evolution of soybean growing area (1980-2015)

2.8.2. Intellectual Property Protection (Legal Framework)

Plant varieties are protected through the breeder's rights as per the Seed and Varieties Protection Law 385/94. The Law 988/96 has approved the participation of Paraguay to UPOV 78; in 1997 Paraguay is accepted as a full member of the Organization. The private seed industry and some Initiatives of public sector have organized talks and started proposals aimed to modify the Seed Law but at this date very little progress has been made.

Biotechnology events are protected by patents as ruled in the Law 1630/00 on Patents. TRIPS²⁶ have been ratified by the Paraguayan Law 444/94.

²⁶ The WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

2.8.3. Intellectual Property enforceability & Value Capture Mechanisms

There are two mechanisms to enforce recognition of intellectual property and payment of remuneration: a) sales and use of certified seed and b) royalty collection on biotechnology.

2.8.3.1. Certified Seed Sales

Certified seed is produced under the control of the National Service for Quality and Health of Seed (the SENAVE). The certified seed system has 4 categories of seed the last 2 being those that can reach the end user and are registered seed and certified seed. The breeders, owners of varieties, can release an authorization for multiplication of seed to officially authorized entities; these can do production of seed directly or through subcontracted agreements.

The percentage of certified seed used by growers is irregular; in the past 10 years it has never been above 50% the rest being farm-saved seed or illegal seed (brown bag).

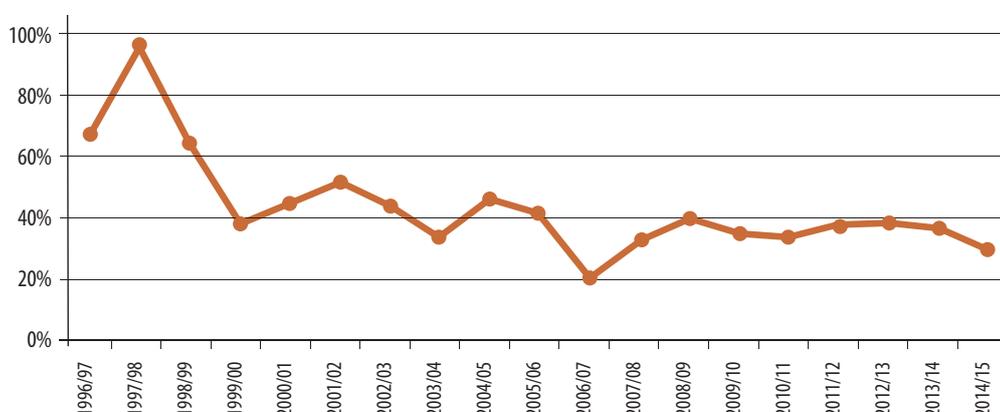


Fig. 18 - Paraguay: use of certified seed percentage (1996-2015)

Some breeders are evaluating and proposing private value capture systems on farm-saved seed.

2.8.3.2. GMO trait collection system

In 2014 a new technology giving herbicide and insect resistance to soybean varieties that have it included in their genotype has been launched on the market. The owner of the technology has designed and proposed a system for capturing the value of this technology after having discussed and negotiated it with the various players of the soybean supply chain.

This technology is patented in Paraguay; it is the first one to be protected by a patent and its use is managed by a license agreement between the grower and the patent holder. Payment terms and conditions are negotiated and agreed every growing season.

This system has 3 key points where value can be captured:

- a) On seed (this is compulsory): the grower who wants to plant seed of varieties containing the new technology find the relevant royalty included in the price of seed; the amount is determined for each package (bag) of 40 kg of certified seed. Each bag allows the grower to deliver at harvest time and only for that growing season a pre-determined quantity of soybean grain containing the technology.

- b) On saved seed (optional): the farmer saving seed from a crop containing the technology is obliged to declare the quantity of seed saved and to pay the relevant royalty as set for a 40 kg bag; this payment covers the use for one growing season only. This payment authorizes the grower to deliver at harvest time a pre-determined quantity of grain and only in that growing season. Should the grower deliver larger quantity of harvested grain as per what he has been granted under conditions in a) and b) a payment on the exceeding amount is due.
- c) At the elevator (compulsory): the grower who cannot prove to having paid the use of the technology as under a) or b) is subject to a payment calculated on the tonnage delivered to the elevator. The amount charged for the use of the technology varies according to the step when it is paid to the patent holder. In the season 2015-2016 these amounts have been 30% and 50% higher than the basic fee on purchase of certified seed for farm-saved seed and for grain delivered to an elevator.

2.8.4. Efficiency of Collection

1. On biotechnology: a one year experience of capturing value through the biotechnology trait use shows that this is an efficient system; the reason is that since it is based on the Patent Law it allows the owner of patented technology to obtain payment for the use of the technology in any one of the steps of the production chain through contracts for the use of the technology. Besides some little problem experienced at delivery point because of the first year of implementation, this system is promising and all hurdles will be solved for next soybean planting and growing season.
2. On genetics: capturing value on genetics is a weak solution because it relies only on seed sale. The law in Paraguay does not limit farm-saved seed use; there have been instances where the exception to breeder's right has overcome the breeder's right itself. In several occasions and upon request of breeders there have been attempts to put a limit on the use of farm-saved seed; agreed regulations were issued but very soon they were not respected anymore. Currently there is not a maximum quantity of farm-saved seed set; there is not a limit to the number of generations that a grower can save and use seed for sowing and there is not a system for capturing value on that saved seed. Currently there are no limits on the number of generations when a grower may save harvested grain to use as seed for re-planting; there is no restriction on the amount of saved seed; and there is not a system to charge a royalty/fee on that seed. Additionally some provisions set in the seed law allow a flourishing market for "brown bag" seed (sale of illegal seed).

2.8.5. Comments and conclusions

Seed companies are seriously affected by the deficiencies of the legislation on all aspects related to breeder's right. Talks among all members of the supply chain aimed at finding a system to recognize plant breeder's right on saved seed have been unsuccessful.

It is important that actions are taken to strengthen the production and use of certified seed and to provide higher incentives to research and innovation leading to national plant breeding programs. Nowadays the seed system in Paraguay sources varieties developed in Argentina and Brazil.

Private sector is willing to modernize the Seed Law and move towards the adoption of UPOV 91 but this is for the time being only a good will.



2.9. Serbia

*Svetlana Balešević-Tubić, Institute of Field and Vegetable Crops, Novi Sad, Serbia;
Secretary General of Seed Association of Serbia (Semenarska), Novi Sad, Serbia*

2.9.1. General introduction

Soybean production has a long tradition in Serbia, with historical references dating back to the beginning of the 19th century. In the 1970s, the area of soybean cultivated was about 20,000 ha. Soybean breeding and spreading domestic varieties adapted to the local growing conditions caused a sudden increase in the size of soybean cultivation area and soybean yield. These activities were, above all, carried out by the Institute of Field and Vegetable Crops Novi Sad, leader in soybean breeding in the region. Soybean production in Serbia has had a steady annual growth regardless of fluctuations in area, while soybean yield has recorded an upward trend with the maximum average yield of 3.3 t/ha achieved in 2014. The soybean cultivation area increased from 52,000 ha in 1995 to reach a record level of 216,000 ha in 2015. Serbia ranks second in European soybean production, behind Italy.

Vojvodina Province is the main region of soybean production in Serbia (92.5% of total soybean production) due to very favorable agro-climatic conditions for soybean growing. Growing and breeding genetically modified soybean varieties is not allowed in Serbia.

Most European countries rely on soybean import as the main source of protein for the food industry, livestock production, and agriculture. Serbia is the only country in Europe which is self-sufficient in soybeans. Serbia has achieved this position primarily through multiannual successful breeding for new varieties, research of production technology, and education of farmers.

The development of a strong local processing industry has encouraged and supported the production of soybean in Serbia using only domestic soybean grain as the main raw material for production of soya protein concentrates, soy oil and animal feed (Sojaprotein, Becej).

Soybeans produced in Serbia remain in the country, mostly integrated into the local livestock production chains. It has been estimated that two thirds of soybean produced in Serbia (of the total 438,000 tonnes) is used for the production of meat, eggs, and milk. About one third of soybean produced in Serbia is exported either as seed, soy meal and soy oil and as a component of animal feed, or adding value with processing and creating high-quality products for human consumption and other purposes. Considering the increased global prices, Serbia has a competitive product on the world market, and even more so in the local market. Therefore, the entire soybean production is sold at prices higher than the global trend. Over 60% of soybean produced in Serbia becomes a component of animal feed. The use of soybean products for human consumption is not significant, but it increases every year, as well as the use of soybean for medical purposes. Breeding soybean for specific purposes is particularly important and, in view of this, the Institute of Field and Vegetable Crops has developed soybean varieties with black seed coats, beneficial for human health.

Other important pursuits are development of new varieties and promotion of sustainable soybean production, with the aim to transfer knowledge from basic to applied research and thus contribute to the achievement of concrete results, such as identification of stress tolerant varieties to allow expansion of soybean growing area, a more efficient use of natural resources, preservation of agro-ecosystems, increase in profit of farmers, and increase in sustainability of crop growing systems.



2.9.2. Intellectual Property Protection (Legal Framework)

The Republic of Serbia has completely harmonized its legislation and the system of plant breeder's rights protection with the UPOV 1991 Convention, by adopting the Law on Protection of Plant Breeders' Rights (Official Gazette of the Republic of Serbia No. 41/2009 and 88/2011). Serbia became the 71st member of UPOV on January 5, 2013.

Granting protection of plant breeders' rights is territorial, therefore protection is granted only within the Serbian territory upon submission of applications in Serbia.

Soybean varieties are not included in the List of agricultural plant species involving exceptions to the plant breed-



ers' rights, prescribed by the Rules on the List of species of agricultural plants involving exceptions to the plant breeders' rights and on the elements for determining small agricultural producers (Official Gazette of the Republic of Serbia No. 38/2010), so farmers are under obligation to pay royalty for using farm saved seed to the owners of breeders' rights.

The use of certified soybean seed in the Republic of Serbia ranges from 50% to 60% of total seed use, depending on the year. In past years, the state subsidized the use of certified soybean seeds so the percentage of certified seed use was significantly higher.

Subsidies for the use of certified seed are no longer provided and this has led to a higher percentage of farm-saved seed use. This is also due to the fact that soybean is a self-pollinated plant, easily multiplied on the farms by small farmers, who sow the untested seeds and thereby have additional production risks. The use of farm-saved seed also raises the question of seed processing and seed treatment.

2.9.3. Efficiency of Collection

Seed certification system in Serbia is established in such a way that the work is partly performed at the Ministry of Agriculture and Environmental Protection, and partly by other institutions (Agricultural Extension Services, Institute of Field and Vegetable Crops) authorized by the Ministry.

Reports of the institution issuing certification labels provide information on the quantity of certified seed. In addition, breeding institutions participate directly in seed sales, thus enabling 100% collection of royalty for certified seed.

Breeders' rights protection is a relatively new topic in seed production in the Republic of Serbia, so a system which would provide remuneration to breeders from farm-saved seed has not yet been established. The Seed Association of Serbia, in cooperation with the Ministry of Agriculture, has been trying to establish an efficient system for providing remuneration to breeders from farm-saved seed. Soybean breeders are interested in a system which would secure financial returns from the new research in breeding, as well as increase of certified soybean seed use.

The processing industry has also made contribution to the encouragement of certified seed use. For example, “Sojaprotein” has organized the production of commodity soybean with contract farmers by providing certified soybean seed, necessary raw material and conditions for harvest, as well as taking over the agreed quantities.

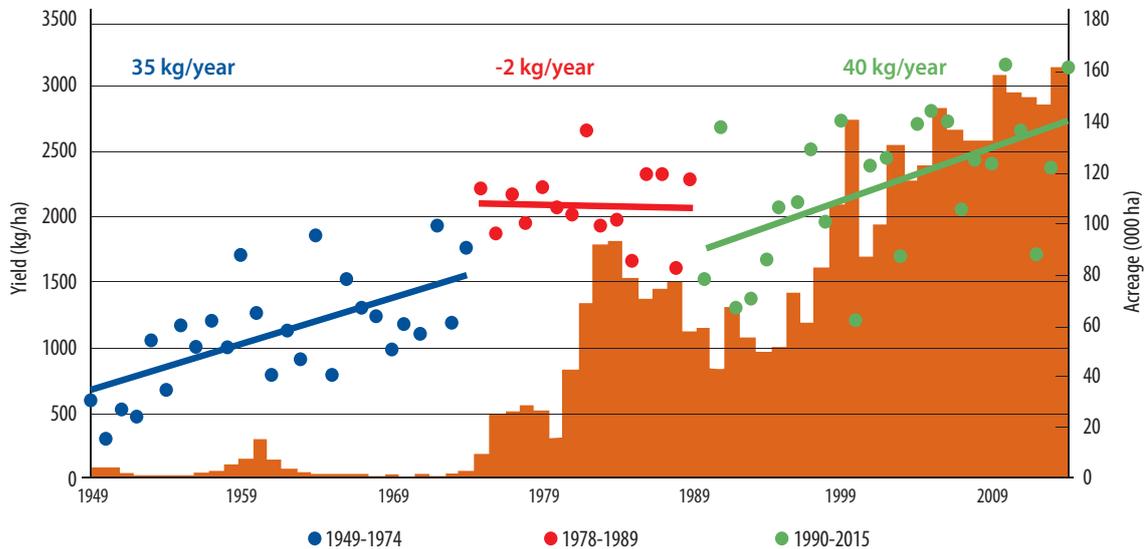


Fig. 19 - Trend of soybean yield and acreages in Serbia.

2.9.4. Comments and Conclusions

Many studies have shown that almost all increase in production per hectare during the last 20 years has been achieved thanks to the development of new varieties and plant breeding programs. Plant breeding innovation is the main path to discovering new traits, values and tolerances that can address the current request for higher yield and more efficient production.

One way to increase the use of certified soybean seed is the improvement of varieties (genetic research) and soybean production technology (agronomic research), increase in adaptability and stability of soybean varieties in specific growing regions, faster involvement of new varieties in the production, improvement of soybean protein production through genetic improvements and specific growing technology. During the past two years, the Institute of Field and Vegetable Crops released 12 soybean varieties in Serbia, 11 soybean varieties in the EU and 8 in other countries, offering a wide choice to farmers in terms of soybean assortment. Delta Agrar, Belgrade (second breeding company) has also contributed with 3 soybean varieties released in Serbia and 3 abroad.

High and stable soybean production starts with the use of high-quality seed. Education of farmers is the first step and the necessary requirement for successful implementation of activities within the food production chain, with regard to the significance of certified soybean seed use. Seed Association of Serbia has organized seminars in cooperation with breeders, in which farmers and breeders have the opportunity to discuss the significance of certified soybean seed use and remuneration to breeders from farm-saved seed.

2.10 South Africa

Eddie Goldschagg, Technical Manager, South African National Seed Organization (SANSOR), Pretoria, South Africa

2.10.1. Background

The first soybeans were planted in 1903 South Africa when trials were established at the experimental farm at Cedara, Natal (near the east coast) and at two places in the Transvaal (in the northeast interior) at Skinner's Court and on the Springbok Flats. The area planted to soybean production slowly increased over the years, reaching 100,000 hectares by 1998, being mainly used as a rotation crop. However, since then the production increased almost exponentially (see graph below), it is now competing with sunflowers for being the second most important crop in South Africa after maize (2,652,850 hectares in 2015).

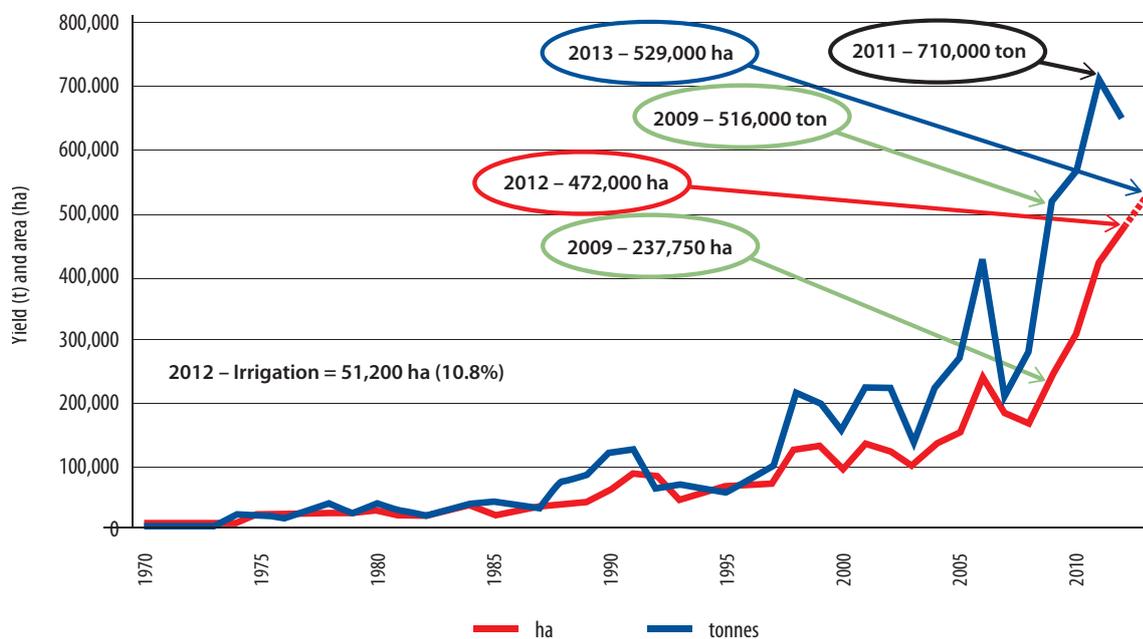


Fig. 20 - South Africa: soybean production from 1970 to 2013

(Source: AS de Beer, Agricultural Research Council-Grain Crop Research Institute, Potchefstroom)

Soybean production reached 1,070,000 tonnes on 687,300 ha in 2015, putting it in second place, but it slipped back to third place in 2016 when only 519,800 hectares could be planted and sunflowers overtook it once again (source: Crop Estimates Committee). This was due to the severe drought conditions during planting time, followed by late rains that favoured sunflowers with a shorter growing season. It is estimated that soybeans will reach 40% of the area planted to maize by 2021 (currently 26%).

Beyond the farm gate, soybeans were mainly processed and marketed in the feed industry in the form of full-fat soya and despite a rapidly growing demand for soybean meal, only very small quantities of soybeans were crushed. Imports of soybean meal spiralled and by 2008 approximately 1 million tons of

soybean meal was imported. The demand for soybeans further rose when it was announced that government has approved legislation phasing in biofuel over the next few years.

2.10.1.1. Seed innovation

South African farmers have adopted GM varieties with glyphosate resistance trait rapidly since becoming available in the early 2000's. It is estimated that more than 90% of the area planted to soybeans are planted with glyphosate resistant varieties. Today they have a choice of 89 glyphosate resistant varieties and 44 non-GMO varieties. Although not a requirement for variety release, most varieties are also entered into the standardised soybean cultivar evaluation programme run by the Agricultural Research Councils' Grain Crop Research Institute (ARC-GCI), primarily to compare cultivars for agronomic performance and to test the adaptability of cultivars and new releases for specific areas and practices.

With the increased demand for soybean seed, new providers (seed companies) have entered the market, bringing new genetics to the farmers. The development of root-knot nematode resistant varieties contributed to the fact that soybeans can be planted on soils previously susceptible to substantial yield losses due to nematode occurrence. Research and development of improved varieties are done by private breeders, with the ARC-GCI being the only public institution still involved with soybean research.

2.10.2. Systems for protection of intellectual property

2.10.2.1. Seed Legislation

The marketing of seeds for planting purposes in South Africa is highly regulated with several Acts and Regulations in force that have to be complied with, most notably the *Plant Improvement Act*, *Plant Breeders' Rights Act* and *Agricultural Pests Act*. All of these Acts are currently under revision, all of them have already reached the Bill stage and public consultations were concluded, it now only has to pass through parliament for enactment. All of these Acts conform to specific Seeds Policies drafted to cover each of the fields on which each of the pieces of legislation is applicable.

2.10.2.2. Plant Breeders' Rights Act

South Africa has been a member of the International Union for the Protection of New Varieties of Plants (UPOV) since November 6, 1977. The current act, *The Plant Breeders' Rights Act, 1976 (Act 15 of 1976)* was aligned to the UPOV 78 convention, but was amended subsequently to reflect the some of the changes introduced in UPOV 91, The act already provides for protection of new varieties of all crops, even though application still has to be made to get the specific specie listed in the Act. *The Plant Breeders' Rights Bill of 2013*, once enacted will be in full compliance with UPOV 91. Varieties granted protection according to the 1976 Act will continue to be protected under the new Bill. However, South Africa has not yet formally ratified UPOV 91 and at this stage it is not clear if they will do so.

2.10.2.3. Farmers' Privilege

The current PBR Act, as well as the PBR Bill makes provision for farmers to save seed of PBR protected varieties for own use on their own properties, the so-called Farmers' Privilege. This provision is subject to the safeguarding of the legitimate interests of the breeder, meaning that royalties could be claimed on farm-saved seeds. However, the Bill provides that certain category of farmers may be exempted from



this – the categories of farmers and extent of the use allowed will be specified in the Regulations, still to be drafted. This is mainly to exempt subsistence farmers from paying royalties; the seed companies in South Africa in general accept this provision.

2.10.2.4. Harvested material provisions

The Bill provides that the undertaking of any activity in respect of harvested material obtained through the unauthorised use of propagating material of the protected variety also requires the authorisation of the holder of the plant breeder's right concerned, unless that holder has had reasonable opportunity to exercise his or her right in respect of that propagating material.

2.10.3. Mechanisms for enforcement of value capture of intellectual property in seed

To enable breeders of improved varieties to continue with development and research, especially for improved varieties to cope with the growing demand for food (food security) in the face of escalating population, diminishing arable land and climate change, finance is needed. It is very expensive and takes a long time to develop new varieties and for this funds must be available. Therefore should there be mechanisms for protection of their intellectual property rights to ensure adequate reward on those innovations so that enough funds remain available to continue with research and satisfy investors. Some of the means for the protection and enforcement of intellectual property rights available in South Africa are listed in the following paragraphs. Even though the expressed purpose of some may not be directly for protection of such rights, it all contributes to some extent towards the execution thereof.

2.10.3.1. The Plant Improvement Act:

This Act is mainly for consumer protection and provides, amongst others for variety denominations and the variety list; registration of premises where seeds are sold, processed, packed and tested; establishment of certification schemes; prohibition on the sale of uncertified seed; and requirements for seed. The Act and its associated regulations apply to all seed sold in South Africa of those crop species that are named for inclusion in the Act and Regulations this covers all the economically important agronomy- (including soybean), horticulture- and forage crops. Only varieties that have been D.U.S. tested (following UPOV guidelines) and of which the variety names have been listed in the National Variety List for Seed Crops may be sold in South Africa, and then only under that variety name. Seed may only be sold



from registered premises, making 'brownbag' and 'across the fence' sales of seeds by farmers illegal. Furthermore, it must be marked with specific information and comply with minimum quality standards for germination and physical purity.

2.10.3.2. Certified seed

Seed certification entails the maintenance of the varietal identity and purity of a variety through the various multiplication cycles, as well as high physical properties such as germination and physical purity (other seed and other material content). Certification of seed is administered by the South African National Seed Organization (SANSOR). The South African Seed Certification Scheme, promulgated in terms of the *Plant Improvement Act*, is based on the OECD Seed Schemes, of which South Africa has been a participating country since 1961. The National Scheme is in line with the OECD rules and procedures for varietal certification, including varietal purity standards and standardised labelling.

Although seed certification in South Africa is voluntary, the breeder/owner of a variety may decide to make certification compulsory for a specific variety. In such a case the name of variety will be listed in terms of the *Plant Improvement Act* and published in a Government Gazette, where after it will be illegal to sell any uncertified seed of that variety. Many breeders/owners of varieties make use of this facility.

2.10.3.3. The Plant Breeders' Rights Act

Application for the granting of a Plant Breeders' Right (PBR) in South Africa is voluntary. Once a right is granted for a variety, that variety is protected in terms of the Plant Breeders' Rights Act; seed/reproductive material of that variety may not be produced and marketed without permission of the owner of the right, usually by means of a licence agreement and the payment of royalties on sales of the seed/reproductive material. A PBR is valid for 20 years in the case of seed crops and 25 years for trees and vine crops. The granting of Plant Breeders' Rights is administered by the Registrar of Plant Breeders' Rights from Directorate Resources of the National Department of Agriculture, Forestry and Fisheries (DAFF).



The enforcement of Plant Breeders' Rights is done by civil litigation, although DAFF may assist with evidence that the right has been infringed (grow-out testing to verify the identity of the variety). The holders of the rights are responsible to uncover and provide evidence of an infringement to the court. In South Africa SANSOR contracts a forensic investigating company to gather evidence to prove a right of a protected variety of a SANSOR Member has been infringed; this is paid for by a special fund being held at SANSOR for this purpose. The money in this fund comes from a voluntary levy

paid on listed and protected varieties by all SANSOR members. Once an infringement has been proved, it is up to the variety/technology owner to determine the actual enforcement action such as costs and damages.

2.10.3.4. Other Mechanisms for enforcement/protection

Other mechanisms such as Patents, Trade Marks, contracts and civil rights acts may be used for enforcement and protection of intellectual property rights. Although the Patent Act, 1978 (Act 57 of 1978) excludes plant variety protection, where applicable patents may be granted on traits, processes related to insertion of such traits, and so on. Trademarks can be used to limit the illegal marketing by restricting the use of the words or phrases. Contracts and agreements with farmers when they purchase seed can include express prohibition of the use of the harvested material for any multiplication purposes, or in the case of seed producers, disposal of the excess.

2.10.4. Efficiency of systems

The collection of royalties through formal structures can be regarded as efficient in South Africa. However, farm-saved seed remains a major problem for owners of rights/technology, especially as far as self- and open-pollinating crops are concerned. The 'Farmers Privilege' clause in the plant variety protection legislation of most countries (including South Africa) that allows farmers to retain seed of protected varieties for own use, deprive the innovators from obtaining adequate compensation. In the case of soybean up to 70% of the area planted to that crop is from farm-saved seeds.

Collection of royalties on farm-saved seed is non-existent in South Africa. In the case of wheat a company has gone into an agreement with seed treatment operators that do seed treatment on farm-saved seeds for the farmers to collect royalties on the farm-saved seeds on their behalf. This works fairly well, but only for seed being treated by 'registered' third parties.

2.10.5. Way forward

To sustain the remarkable growth in soybean production in South Africa, alternative royalty collection systems are being explored. The commercial farmers fully realise the extent of the problem and has agreed full cooperation for a proposed *end-point royalty system*. Grain South Africa, the grain producer's organisation representing crop producers in South Africa, together with SANSOR, including member companies, are exploring ways that an *end-point royalty system* could be implemented.



2.11. United States

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2.11.1. General introduction

The United States is the largest soybean producer in the world with approximately 33.672 million hectares planted in 2015. With farmer saved seed less than 5% of the planted acreage, the United States is also the largest market for soybean seeds in the world (approximately 95 million units).

The predominant systems used for the protection of soybean varieties are:

- Utility patents
- Varieties protected by patents on traits carried by the variety
- PVP (PVP was introduced in the US in 1970 and amended in 1994)

Unlike Europe and other parts of the world, though royalty bearing, most seed sales are not certified. Varieties may carry a utility patent, carry a patented trait, and also carry a PVP. Varieties that carry a patent can't be saved by a farmer for use on his/her farm nor sell to another farmer. A farmer can save seed for use only on his farm if it is a PVP variety and lacks patent protection. There are a very limited number of PVP-only soybean seed varieties sold in the United States today. Much of this is driven by the demand of growers for varieties carrying patented traits and new, patented genetics.

2.11.2. Purchased Seed Market

The purchased seed market for soybeans is greater than 95% of all soybean seed planted in the United States. Seeding rates vary across the growing regions. Using an approximate measure of 395,000 seeds per hectare planting rate, the 2015 Purchased Seed Market was approximately 92 million unit market.

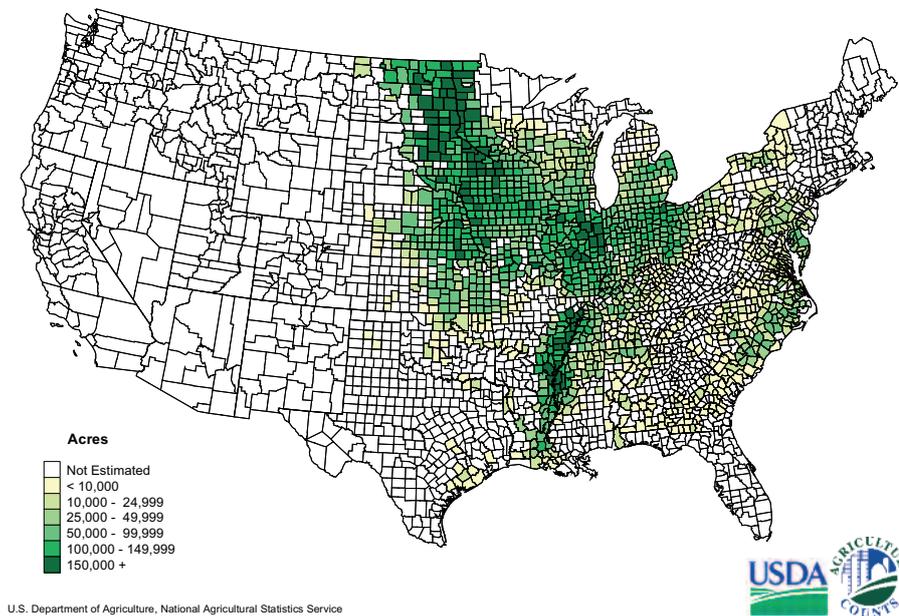
There are over 90 different private soybean brands available to the farmer today. In addition, approximately 10 public breeding programs develop varieties which are generally licensed to private seed companies.

2.11.3. Farm-saved Seed

Farm-saved seed accounts for less than 5% of the overall soybean seed market due to a number of factors including performance expectations of growers, protection mechanisms and enforcement. Seeds are expected to have relevant traits for herbicide resistance and tolerance to key diseases they experience annually, such as phytophthora root rot. In addition, growers also expect seed to be of high quality and deliver consistently higher yields year over year. Soybean seed in the purchased market has traditionally met these grower expectations vs. saved seed that can have variable quality and lacks year over year yield improvement. Couple these grower expectations with the protection mechanisms utilized by companies (i.e. technology use agreements, patents) and enforcement measures taken over the last decade (lawsuits), the size of the farm-saved seed market is very small. Farmers are not willing to risk yield performance or the possibility of litigation from use of illegal seeds.



Soybean 2014 Planted Acres by County for Selected States

**Fig. 21 - Soybean Growing Regions of the United States** (Last Modified: Dec.18, 2015)

2.11.4. Efficiency of Collection

The US system requires the owner (or representative of the owner) of the IP rights to make their own royalty collection. With seed replacement rate over 95% and the collection of the royalty executed by the owner (or representative of the owner) of the IP rights, efficiency is extremely high. Seed companies generally price seed for the overall value it provides (genetics & traits) and do not utilize technology fees. There is no royalty collection system in the United States on farmer saved seed.

2.12. Uruguay

Diego Risso, Executive Director, Uruguayan Plant Breeders Association, (URUPOV), Montevideo, Uruguay

2.12.1. Introduction

Uruguay is a country in which GDP and export markets depend highly on products based on agriculture and its associated industry.

Uruguay has approximately 3.5 million inhabitants and a total area of 17 million hectares, of which 4 million are considered potentially suitable to be used as cultivatable areas. In these areas, it is necessary to use grassland farming rotation systems to prevent soil degradation. This situation limits the cultivable annual area to 2 million ha (1.6 annual crops and 0.4 permanent crops).

Uruguay has great potential to increase the production of agro-industrial goods. Currently, it produces food for 28 million and it is expected to reach food production for 50 million people in the coming years. The country lies entirely within the temperate zone and most regions have adequate supplies of water from the numerous rivers, lakes and lagoons.

In the last decade, as more and more arable land has been brought into production, the total arable area has more than doubled, with the largest increases in wheat and soybeans. The areas sown with these crops are now approximately four times the size they were 10 years ago.

Uruguay is part of the main food exporting region in the world (together with Argentina, Brazil and Paraguay), soybean being the most important crop in terms of acreage and production.

Soybeans were almost non-existent in Uruguay until the first Round-up Ready® varieties were registered, protected and commercialized in the year 2000. Currently, soybean is the major crop in Uruguay. In 2015, about four thousand farmers planted 1.3 million hectares of soybeans. One hundred percent of the crop is GM varieties: either round-up ready1® or Intacta® (weed & insect resistance).

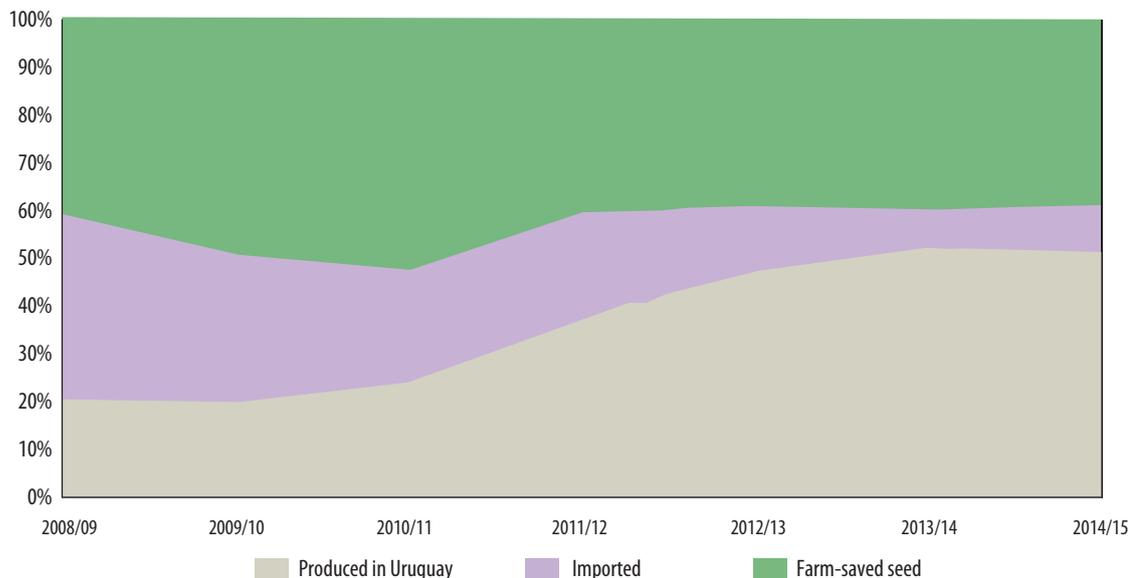


Fig. 22 - Origin of seed planted in Uruguay

Whilst almost half of the seed sown by Uruguayan farmers is of certified origin; farm-saved seed (FSS) is highly significant with an average of 45% of the area planted. The good news is that FSS pays royalties. So called “brown-bagging” has been below 3% in the last 5 years.

In the last years seed companies changed their seed supply strategy shifting the origin of it. If in the early years of this century most of the seed was produced in Argentina and imported in Uruguay ready for planting, at present time, even if bred elsewhere, most of the varieties are grown and processed locally.

2.12.2. Intellectual Property Protection – Legal Framework

In 1994, Uruguay was the first country in South America to ratify UPOV. It has a seed law, based on the UPOV 1978 Act with important amendments (“improvements”) taken from UPOV ‘91 Act. In 1997, the National Seed Institute (INASE) was created by law and is the official body in charge of plant breeders rights (PBR).

Many regulations have been approved since the last law came into force (law #16.811) in order to provide the law with a better framework and more tools for effective enforcement. An example is the definition of “farmers privilege” that has allowed breeders to better enforce their rights and collect royalties.

On another note, new biotech traits for weed and insect control have been approved in Uruguay for commercialization. Traits can be patented in Uruguay under the patent law # 17164. Being this issue relatively new, many traits in Uruguay are in the patent-approval process.

2.12.3. Enforcement

Enforcement is mainly done by two institutions. The National Seed Institute (INASE), which is the government seed agency; and the Uruguayan Plant Breeders Association (URUPOV). URUPOV was founded in 1994 and is a private association comprised by Breeders and license holders, in order to represent breeders, for royalty collection and enforcement of PBR.

INASE and URUPOV work in a coordinated manner in order to effectively enforce the aforementioned activities.

Both institutions have created specific groups to work as a “task force” in order to minimize the occurrence of illegal seed. URUPOV, as a result of its enforcement activities, generates information in order to:

- notify INASE so that this body can make the consequent supervisions, confiscations and/or seizures of the products and the application of the corresponding penalties (warnings, monetary fines and even business closures);
- inform the breeding companies, to providing the necessary background information at the moment of choosing their business partners (seed multipliers, seed distributors) and clients (farmers); and
- provide breeders & seed companies with information enabling them to bring action in court claiming their rights, either through URUPOV, or directly in court, applying the necessary rules of the civil codes.

Database management, robust customized software, DNA techniques and recently satellite images are some of the important tools that are being used to have good enforcement results. Publication of penal-



ties and fines is being considered by INASE as effective tool that could add value to the whole system. Fines are relatively low; therefore, this is an area that needs to be revised by the authorities.

2.12.4. Royalty Collection:

Royalty collection in Uruguay is very simple. There are two ways to collect royalties: either through certified seed or farm-saved seed (FSS).

For certified seed, royalties are returned 100% to the breeder with very low cost of collection (less than 1%). URUPOV has developed a system to control license holders and inform breeders about the amount of royalties to collect every season.

For farm-saved seed, URUPOV has also developed a customized system for Uruguay where the cost of collection accounts for 9% of the amount collected. The overall efficiency of the Uruguay royalty collection system is therefore 92%, providing an excellent illustration of how tax incentives on certified seed and extended royalty schemes for FSS can contribute to the success of the industry.

In 2013 a new biotech trait was included in the system, but no major changes occurred because royalties are still collected entirely through the seeds (certified and FSS), then they are distributed among plant breeders and trait developers. The benefit that this new trait has brought to the system is the possibility to use quick DNA testing to check presence or absence of the trait and the control of refuges. The possibility of visiting all the farms in order to verify if refuges are done correctly and testing plants provides URUPOV's task force information to detect possible infringements, thus a more effective enforcement.

The following graph illustrates the evolution of the total area planted with soybean and the royalties collected under two systems: certified and farm-saved seed.

Final figures for 2014/15 illustrate that 97% of the total area planted was completed with seed that pays royalties (certified 57% and FSS 40%).

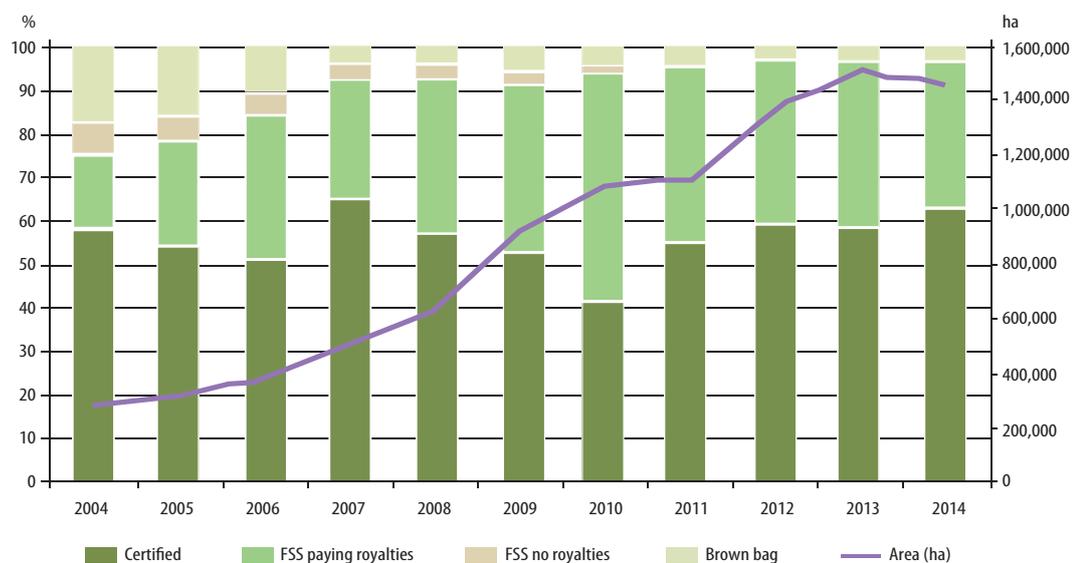


Fig. 23 - Uruguay: evolution of total planted area and of seed type sown

2.12.5. Royalty Collection system on farm saved seed

The so-called “Technology Value System” or “Extended Royalty System” has been in force since 2003. Its main goal is to collect royalties from farm-saved seed. Currently this is being applied for soybean, wheat, barley and peas and it is a single system that covers all the crops (a “one size fits all” system).

How does it work?

When the seed is purchased, a contract is signed between the breeder and the grower, where the conditions to produce farm-saved seeds are established.

The contract is based on the protected variety and automatically renews with every new multiplication when making use of farm-saved seed. The payment of the extended royalty is made only on the net amount of sowed seed.

Every season, URUPOV collects the information from its members (breeders) in order to build a database containing useful data such as: name of farmer, contact details, variety and amount purchased. After that, auditors from URUPOV personally contact and visit farmers in order to get a declaration form signed.



This happens twice a year:

- After harvesting (to collect information on saved seed - amount and place) and
- After sowing (to collect information on seed used). Farmers will pay royalties based on this data. Finally, URUPOV processes all the information collected “in field” and a new database is available on-line (www.urupov.org.uy) for breeders to raise the invoices and collect royalties from farmers.

2.12.6. Tax Incentive

Since 2007, the government has applied a tax incentive program to encourage the development of the certified seed industry. Uruguay has a decree (Regulatory decree 150/2007 Art. 57), that gives farmers the benefit of claiming a tax incentive of 1.5 times the amount of money they spend on certified seed when declaring their income tax.

This measure has been very successful and has been a key factor that contributes to the high level of value capture.



2.12.7. Breeding and Germplasm

Today, most of the varieties that Uruguayan farmer sows are bred with elite germplasm produced outside Uruguay, and considering that soybean is the major crop in the country, there is a general consensus among all stakeholders that PBR needs to be respected and recognized. The same story applies to biotech traits.

2.12.8. Commitment

It should be highlighted as one of the main contributors of success that all the stakeholders play an important role and all of them contribute in different ways to respect Plant Breeders Rights in Uruguay.

Stakeholders:

- *Farmers*: Recognizing PBR and paying royalties for FSS
- *Breeders*: Permanently investing and releasing new plant varieties and biotech events
- *Government*: Giving the adequate legal framework and contributing to enforce PBR
- *Multipliers and Distributors*: Delivering the message to farmers about the importance of PBR and collecting information for the royalty collection system on FSS
- *URUPOV*: Gathering all Breeders together in order to have a unique and strong voice and developing efficient royalty collection and enforcement systems.

Uruguay has a unique royalty collection system for germplasm and biotech developments, where all stakeholders are operating in a balanced manner, bringing the country the benefit of having access to the latest technologies.



3. Summary and Conclusions of the Working Group

Different approaches to plant breeding can be typically classified as follows:

- Conventional Breeding: applicable to simple inherited traits with high heritability and low Genotype by Environment interaction. Outcomes may be quite limited under unfavorable conditions.
- Modern Breeding – including Marker Assisted Selection (MAS): Successful for the identification of genes that control qualitative traits and for the introduction of such traits from new germplasm sources.
- Transgenic Breeding: Introduction of exogenous DNA into a plant.

More recently, plant breeding innovations have been introduced that may in due course produce specific results in a shorter period of time. Such innovations include:

- Gene editing;
- Introduction of unlimited amounts of DNA between genotypes;
- Modification of traits through epigenetic alterations without changing the genomic sequence.
- Insertion of specific DNA sequences between sexually compatible individuals;
- Silence gene expression;
- Build *de novo* genomes.

Plant breeding innovations reduce the times for creation of new plant varieties and increase plant breeding accuracy and genetic diversity. Such techniques not only enable breeders to develop varieties with traits that cannot be achieved through conventional breeding but also enable changes that previously could only be achieved through transgenesis.

The future challenge lies within the fact that plant breeding innovations require ongoing updates and harmonization of regulatory and intellectual property issues in order to protect and reward breeders' investments.

The value-capture systems described in the present study may or may not be useful in managing the intellectual property rights in varieties arising from the complex technologies described above.

Different countries throughout the world have implemented different systems: on one hand, the US has a single system in which the plant variety, the technologies and components are protected by patents and therefore there is no "coexistence" of rights. On the other hand, in the European Union, the sowing of varieties containing PTCs is quite limited. Lastly, Canada and Latin America have a series of newly enacted laws and value-capture systems based on the breeder's right protection (Uruguay), on contracts and the Civil Code (Argentina), on patent protection (Brazil) or on private agreements (Paraguay).²⁷

Once again, the answer seems to be a negative one: at present, there is no value-capture system that can be directly applicable to such complex scenarios.

To find a solution, it should be noted that the legal frameworks (international agreements such as UPOV, TRIPS, law on breeders' rights, patent law, trade secrets law and biosafety system) do not constitute a "system" themselves. On the contrary, legal frameworks only support a system. Agreement, trust, responsibility and communication between the participants are necessary to implement complex value-capture

²⁷ Rapela, M A and D. Risso. Plant Property Rights and Enforcement in Argentina and Uruguay. *Bioscience Law Review*, vol. 9 [2006/2007].



systems. Negotiation strategies shall also be taken into consideration, especially to define whether zero sum games of competitive and value-capture strategies or non-zero sum games of cooperative strategies and shared value are to be implemented.

By adding several theoretical elements it could be possible to design a future "ideal" value-capture system that enables to address the complex coexistence of breeder's rights and patents. Such a system should:

- Enable farmers to use or not use new technologies;
- Be as plain as possible;
- Introduce a minimum disruption of the usual commercial practices currently in force;
- Be based on the payment of a royalty on the certified seed and a renewal option of license of use or other licensing system;
- Implement grain control;
- Maximize the use of existing structures;
- Enable the creation of a single grain control procedure for the germplasm and biotechnology;
- Create general guidelines to be observed by all participants, based on a prior agreement;
- Allow each germplasm/biotechnological event combination to implement the terms and conditions on their own technologies agreed with third parties on an independent basis;
- Be effective, efficient, feasible and lasting; and
- Promote the use of certified seeds.

As it can be seen, the challenge is huge, considering that the legal frameworks alone are insufficient. In addition, all participants must enter into agreements in order to implement any future "ideal" Royalty Collection System.

In this line of thought, it seems that the "ideal" system will require the participation of the whole production chain and not only the seed-man, breeder or biotechnologist, as it has been the case so far. Considering that the creation of new plant varieties containing better biotechnology will benefit the whole production chain and, especially, the last link in the chain, i.e. the farmer, this also highlights the responsibilities that should be undertaken.

So, the answer to the last question rests in our hands: is it possible to develop such an ideal system? Meanwhile, what we have in the real life is a wide-range of different Royalty Collection Systems in soybean that are described in this paper from which it is possible to conclude that:

- There are multiple and diverse systems for value capture in soybean.
- Results on value capture efficiency differ from one country to another depending on several factors: there is not an industry model that ensures the success of each system.
- More complexity is found in the systems due to the introduction of patent traits in the seed; there is more than one element to be protected: germplasm and biotechnological events.
- Seed industry should work seriously at government level to ensure the legal protection in this new scenario where the new varieties include different technological developments aside from the germplasm.
- This study should be the starting point for the new understanding of the seed industry in order to ensure the future of the business.



4. Acknowledgements

The editors of the report would like to extend their grateful thanks to individual members of the ISF Royalty Collection Working Group who have diligently researched and reported the prevailing Intellectual Property protection mechanisms and royalty collection practices in their own countries. We would also like to thank the Chairman of the Field Crop Section Board, Bryan Gerard and in particular Piero Sismondo, for their guidance and for enforcing the necessary deadlines that enabled us to complete the report in time for the 2016 ISF Congress in Punta del Este, Uruguay; a special thank you to Frank Curtis, former chairman of the Wheat Royalties Working Group, for his continuing and valuable support.

The completed report represents the culmination of many hundreds of man hours expended over a one year period. The Working Group presents the final report, through the ISF Field Crops Section Board to all ISF members, companies and organizations in the hope and belief that it will provide a valuable source of reference to those nations, organizations and individuals that are seeking to review or create and implement royalty collection systems within their own territories

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| | |
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The Working Group was led by Pablo Bergadá, with the collaboration of Miguel Rapela, Roberto Enriquez, Diego Risso, Juan F. Mendizabal Frers, and Piero Sismondo.



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