INTELLECTUAL PROPERTY RIGHTS IN THE FLOWER CHAIN: AN ANALYSIS OF THE BRAZILIAN PLANT VARIETY PROTECTION SYSTEM

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Abstract

The paper addresses the impacts of the Brazilian Plant Variety Protection (PVP) System on the Brazilian cut flower chain. Specifically, the article examines the major changes in this chain since the introduction of the PVP System in 1997. While the new system has stimulated the marketing of new varieties of plants - in 2000 there were around 10 varieties of roses available whereas in 2010 there were more than a hundred - it has also raised transactions costs for companies operating in the country. Because some provisions of the system are not well delineated within the national jurisprudence, protection of property rights may became ineffective for asexually reproduced plants. In order to deal with such situation, foreign breeding companies have adopted specific contractual arrangements partially supported by the existing intellectual property rights regime. Notwithstanding, the way this provision is established limits the breeders investment level in Brazil as well the access to innovative materials for small growers. Based on semi-structured interviews with Brazilian and foreign flowers breeders, flowers growers and wholesalers, the present paper explores the specificity of concrete experiences in the Brazilian market and advances policy recommendations that may serve for the improvement of marketing and investment conditions at the cut flower chain in Brazil.

Keywords: intellectual property rights, plant breeding, cut flowers, institutions, innovation

1 INTRODUCTION

The purpose of this paper is to examine how the Brazilian cut flower chain has been affected by the Plant Variety Protection Act (*Lei de Proteção de Cultivares*, LPC) enacted in 1997.[1] The act established the recognition of intellectual property rights over new plant varieties by granting protection certificates issued by the National Plant Variety Protection Service (*Serviço Nacional de Proteção de Cultivares*, SNPC) of the Ministry of Agriculture, Livestock and Supply (*Ministério da Agricultura, Pecuária e Abastecimento*, MAPA). The protection certificate gives breeders exclusive rights to the commercial exploitation of new plant varieties.

The plant variety protection through the adoption of instruments of privilege is an institution created to promote innovation. The purpose of this instrument is to ensure the appropriation of economic outcomes as compensation for the resources invested and risks assumed in the development of new plant varieties.

[1]Act n. 9.456 of April 25th, 1997.

The standard argument is that intellectual property protection induces economic activity. More specifically, it is put forth that plant variety protection (PVP) systems stimulate investment in the research into new varieties, contribute to the development of the domestic seed industry, and allow countries to take advantage of foreign germplasm to improve their breeding programs. The promotion of breeding programs is considered a key part of policies to ensure the nation's food security (Lesser, 1997). Many observers, however, are more cautious about the possible benefits and see potential dangers in the concentration of technology ownership and restrictions on farmer seed systems (Tripp *et al*, 2007).

The intent of this paper is to discuss the impact of the Plant Variety Protection Act (LPC), mainly from the perspective of the agents in the Brazilian cut flower chain.

The topic under discussion is based on North (1990), who calls attention to the importance of institutions (formal and informal) as frameworks that constrain individual behavior, and on Coase (1960), who warns about the importance of clarity in legislation addressing the adequate allocation and maintenance of property rights.

The LPC guarantees the "farmers' privilege" (or saved seed) tradition of saving part of the harvest for seeding the next crop. This practice arose as a means of ensuring future harvests and thus safeguarding the economic sustainability of small family farms. However, it is assumed that the act does not ensure true protection for asexually propagated species, such as most cut flowers. Farmers' privilege exposes plant varieties to "piracy," with the result that the protection provided by the LPC could be insufficient, especially from the breeder's point of view.[2]

The hypothesis of this paper thus suggests that the farmer's privilege provision as established does not allow the complete range of benefits expected from the LPC for the Brazilian cut flower chain. Box 1 offers a brief overview of the insertion of this chain in the global flower market, and some of its features.

[2] Asexual reproduction is a process whereby living organisms are capable of self-reproduction without the need for another individual of the same species. Flower growers need only a few plants to produce a large number of identical organisms. Asexually reproducible species are easy to obtain and quite stable, with no variability.

Box 1 –Brazilian floriculture features and overview of its global insertion

The worldwide flower business is estimated to be worth over 60 billion dollars annually (Buainain; Batalha, 2007). As of 2010, the Brazilian floriculture sector was a 2.5-billion-dollar-a-year business (Barros, 2011). Over the coming decade, growth in the international demand for flowers is estimated to be approximately 40% (Flower Council of Holland, 2008). The flower industry is carried out on small farms and is labor-intensive. Brazilian flower production occupies an area of about nine thousand hectares, which places Brazil in eighth position globally (Junqueira; Peetz, 2008; Pizano, 2008). São Paulo is the main producing state with an estimated share of about 70% (Kiyuna et al, 2004; Buainain and Batalha, 2007). Atibaia and Holambra are the main producing districts. Holambra is also a notable flower trading and development center. Although Brazilian per capita consumption of flowers is low, due to the large population the country enjoys a large domestic market and consumes almost everything it produces. In 2008, the year that Brazilian exports reached their historic record, they represented less than 3% of total revenues in the sector. According to Junqueira and Peetz (2008), Brazilian exports are only 0.3% of total sales worldwide. The Netherlands, Colombia, Ecuador, and Kenya account for the production of approximately 85% of the flowers exported around the world (Pizano, 2008).

To understand how the Brazilian flower chain is affected by the LPC we selected three kinds of cut flowers among the top genera traded: rose, alstroemeria, and gerbera. We collected and analyzed primary and secondary data on protected and marketed varieties in the country, the number of protection certificates issued, and the history of protection.

We also conducted semi-structured interviews with agents in the flower chain who are involved directly or indirectly in variety protection, including domestic and foreign flower breeders, flower growers, and wholesalers.

In the next section the paper briefly discusses plant variety protection under the institutions and property rights theory perspective. Section 3 presents an analysis of the LPC and draws comparisons with other experiences of PVP systems. Section 4 explores the results of interviews, and section 5 concludes the paper with final remarks on the relevant aspects of how the cut flower chain in Brazil is affected by the LPC.

2 PLANT VARIETY PROTECTION UNDER THE NEI PERSPECTIVE

2.1 Institutions

The aim of this study is to understand the role of LPC in the intellectual property protection of new flower varieties and in promoting changes in the Brazilian floriculture sector. The New Institutional Economics (NIE) emphasizes that property rights and institutions play a fundamental role in determining the organization and performance of markets.

Institutions are the set of structures that shape, sustain, and constrain human interactions, defining and delimiting the choice set available to individuals (North, 1990). Because of the way they evolve, institutions shape the path of economic change. As per Shirley (2005), institutions that do not work properly create the perception among individuals and organizations that they are subject to the risk of not recovering investments.

Formal and informal institutions are complementary in the creation of specific economic results, and the design of formal, efficient rules must take into account the interaction between existing formal and informal rules (Eggertsson, 1996). In the biotechnology field, Silveira and Borges (2004) understand that this interaction can cause institutions to create a web of contradictory relations which can both stimulate and slow technical progress. In the area of breeding new plant varieties, these authors consider formal and informal institutions to be key elements in the processes of innovation, production, and commercialization.

The relationship between formal and informal institutions is explained by Aoki (2007b), who admits that the rules cannot simply be imposed exogenously or transplanted from one location to another, but rather must be recreated by repetitive daily actions. In other words, institutions must be the result of a process of life-long learning among mutually dependent actors. This explains why a formal rule that works in one particular society can lead to different results elsewhere (Aoki, 2007a).

Institutions are the (mentally) external mechanisms that individuals create to structure and order the environment; if an institution acquires a symbolic or linguistic representation recognized by all agents, it is considered to exist as an objective reality, and its validity can be tested by a real choice. Hence, institutions are characterized by a duality (objective and subjective), internal beliefs, and rules of common knowledge. If the rules of a social norm do not form internal subjective beliefs shared by all agents, it may be irrelevant and therefore cannot considered to be institutionalized. This indicates the difficulty of changing an institution by decree.

According to Eaton and Meijerink (2007), one of the issues that should be considered in a process of institutional change is whether the rules and governance structures that are successful in one situation can be applied to another. The authors argue that institutional arrangements must fit the institutional environment, which in turn must be accommodated within social norms. If there is no equivalence then the organizational arrangements and formal rules may be ignored, ineffective, or lead to unwanted consequences.

The international treaties on plant variety protection are formal institutions, originating from developed countries, that today serve as exogenous rules to frame the relationship among countries regarding the protection of intellectual property rights in plants. Carvalho (2003) argues that these agreements have created standards for harmonized legislation that allows signatory countries to obtain and provide equivalent protection for plant varieties. These agreements seek to adopt the principle of national treatment, namely that countries are free to establish criteria for legislation and implement specific policies, using as a starting point certain basic characteristics of the conventions on plant varieties protection that must be met.[3]

In this sense, it is expected that in institutional terms there are two reasons why the international norms generate different results among societies (see Box 2). One is the adaptations and criteria adopted by legislators, a result of the autonomy offered to individual countries. A second is the way these norms interact with informal institutions. This interaction determines how property rights are defined and allocated among the agents involved in a certain market.

Box 2 – Some mixed empirical evidence on plant varieties protection

Scotchmer (2004) provides an overview of studies that consider patents as a regulatory tool that encourages investment, especially in environments of asymmetric innovation capabilities. However, in the same study the author offers evidence that strengthening intellectual property rights through international treaties like TRIPS presents different results (not always positive) among countries. These results vary depending on the innovative capacity and market size of each country.
Penna (1994 *apud* Lesser, 1997, p.1585) analyzes the impact of the PVP system in the introduction of new varieties in the UK, and finds a significant impact concerning the introduction of new varieties of roses and strawberries, but not for apples and pears.
Diez (2002) studied the Spanish PVP system's impact on research and finds that the incentives were positive, especially for the private sector, which increased its market share. At the same time, the author found that the country has increased imports of seeds and become more technologically dependent on international breeders.
In a study on wheat, Alston and Venner (2002) show that after the 1970 promulgation of the act that established the guidelines for the protection of plant varieties in the USA, private sector investment has remained static, while public sector investment has increased.
Falcon and Fowler (2002) find that new intellectual property provisions in the South hemisphere have, among other results, contributed to the concentration of new technologies in the hands of a few large multinational companies.
Lence *et al* (2005) show that the seed market has an optimal level of intellectual property rights. Maximization of economic development is not always achieved with the maximum level of property rights protection, as alleged by R&D companies.
Eaton (2008) concludes that the existence of strong property rights offers the exporters of easily copyable products a safe environment that encourages the expansion of the market, while on the other hand strengthened property rights enhance the ability of exporters to exercise power monopoly in smaller markets, resulting in higher prices and lower quantities traded.

When property rights are clearly defined and there are ways to ensure their implementation, transaction costs between agents are reduced, encouraging investment and promoting economic development (NORTH, 1990).

[3] The international treaties on plant variety protection will be presented in section 3.

To Eggertsson (1996), the division of the rights of assets is a source of conflict and dispute. One of those sources is the case in which the use of an asset, whose rights are held by an individual, generates negative externalities for other uses of the same asset whose rights are held by other individuals.

To use as example the subject of this paper, the farmer holds nursery material (variety sapling or seed), which is a physical asset, albeit one which has other attributes that are owned by the breeder. If the grower does not respect the breeder's ownership then negative externalities will be generated for the latter agent.

In the present case there are many positive externalities produced by obtaining a new flower variety: new knowledge is generated and new product attributes are designed, such as higher productivity, greater resistance to pests and diseases, and different colors. However, this process can also result in negative externalities due to the farmer's privilege provision of the LPC, which does not clearly define the rights allocation for newly developed flower varieties.

The definition of intellectual property rights through the creation of the LPC was intended to internalize the negative externalities generated in the process of obtaining new plant varieties. But without a clear definition of property, the new varieties may be available for individuals to use free of charge; in other words, these varieties and their differentiated attributes could fall into the public domain with the possibility of appropriation without adequate reward for their inventors.

Given the theoretical approach discussed, and concerning plant varieties protection, the following section addresses in depth the institutional environment in which the flower productive chain operates.

3 PLANT VARIETY PROTECTION IN BRAZIL AND ABROAD

The LPC was enacted in 1997 as a result of commitments made upon ratifying the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), established in 1994 at the Uruguay Round of Multilateral Trade Negotiations of the GATT (later WTO). TRIPS set a deadline for member countries to conform their national laws.[4]

[4] TRIPS states that: "members may also exclude from patentability: plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof." (TRIPS, 1994, p.331).

After ratification, Brazil had to amend old legislation that did not address biotechnology. Brazil chose to adopt a unique *sui generis* system, and ratified the UPOV (International Union for the Protection of New Varieties of Plants) Convention in its 1978 revision. According to Carvalho (2003), some elements of the 1991 Convention were also adopted.[5] The country introduced a plant variety protection system (see also Box 3) having as its purpose:

> To provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. Thus, the UPOV system of PVP is designed to encourage innovation in the field of plant breeding" (UPOV, 2005, p.12).

Box 3 – UPOV and the requirements for the protection of plant varieties

The UPOV is an intergovernmental organization that seeks to establish general rules for the protection of new plant varieties by means of so-called *plant breeder's rights* (PBR). The UPOV was established by the International Convention for the Protection of New Varieties of Plants, adopted in Paris in 1961, and revised in 1972, 1978, and 1991. According to UPOV, a variety must undergo DUS testing to confirm its unique attributes before a protection application may be filed, in order to assess whether the variety is distinctive, uniform (homogenous), and stable. A variety is distinct when it has clear differences from any other in existence on the date that the application for protection is acknowledged; it is homogenous if when propagated on a commercial scale it presents minimal variability in its identifying characteristics, according to criteria established by the competent national agency; and it is stable if when reproduced on a commercial scale it maintains its homogeneity through successive generations. The 1991 revision instituted the attribute "novelty," meaning that a variety may not be protected if it has been on the market for more than one year in the country or more than four years abroad.

Source: UPOV (2009)

The LPC provides for intellectual property rights for new plant varieties to be recognized by means of a protection certificate. The protection title gives breeders exclusivity rights for commercial exploitation of the variety. With the establishment of the LPC the country now has a legal mechanism that protects breeders' rights.

However, agents in the cut flowers sector believe that the current incarnation of the LPC is not clearly defined and thus does not ensure true protection for asexually propagated species, leaving them exposed to piracy, since they are easily reproducible. This is the case with most cut flowers. Authors such as van Rooijen (2006), Nogueira (2006), Fuck (2009), and Carta de Campinas (2009) admit the existence of distortions in Brazilian law.[6]

The LPC states in Article 10, Paragraph II that:

[5] Wilkinson and Castelli (2000) define *sui generis* rights as a legal adaptation to intellectual property protection in cases such as that of plants, which as living organisms do not fall under the traditional protections of intellectual property (industrial or copyright).

[6] Two bills to amend the LPC are under discussion: Bill No. 2325, dated 2007 and authored by Deputy Rose de Freitas, and Bill No. 3100, dated 2008 and authored by Deputy Moacir Micheletto.

> One who does the following shall not be considered to have trespassed on property rights:
> I – sets aside and plants seeds for his or her own use, in his or her own facilities, or in facilities in his or her possession although owned by third parties.[7]

Farmer's privilege describes the agricultural tradition of farmers saving part of their harvest for the seeding or propagation of the next crop. This custom arose as a means of ensuring future harvests and thus safeguarding the financial situation of family farms, and as a means of preserving the genetic attributes of traditional plant varieties. However, the device became a common justification for the storage of any volume of seeds or seedlings with no regard for purpose.

Nogueira (2006) argues that even though farmer's privilege was introduced to promote the economic viability of small farmers by allowing them to save money on seeds, it failed to establish an upper limit to the farmer's scale of production or income. The unlimited permission given by farmer's privilege is considered by some agents to be a loophole that causes the violation of intellectual property rights. It generates an opportunity for farmers to retain amounts larger than necessary for their own use and to trade the surplus in illegal transactions (Nogueira, 2006).[8]

As a result, the use of propagative material originated from the previous harvest on the basis of "farmer's privilege," as provided for in the LPC, has occurred in an exaggerated manner. It is alleged that for the breeders of asexually reproducing cut flowers this practice hampers the appropriation of innovation and discourages the continuity of R&D efforts in and for Brazil (Van Rooijen, 2006).[9]

The justification for farmer's privilege does not apply to flower growers, as they grow species which do not have a food purpose. In addition, due to the size of the Brazilian flower market and the great diversity of flowers grown, the price of an ornamental variety is highly influenced by the amount of material offered. Thus, according to van Rooijen (2006), any propagation activity, even if for a grower's own use, entails a significant impact on the market and a reduction in the earnings of farmers engaged in commercial production.

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[7] "Não fere o direito de propriedade sobre a cultivar protegida aquele que:
I – reserva e planta sementes para uso próprio, em seu estabelecimento ou em estabelecimento de terceiros cuja posse detenha." (Brasil, 1997).

[8] The European PVP system limits the farmer's privilege according to type of crop and the size (area) of the farm holding. This effectively means that only very small, essentially non-commercial, farms growing cereal crops are permitted to re-use seed without permission or payment of a royalty (Eaton, 2007).

[9] Aviani (2009) claims that the LPC is complemented by the Seeds and Seedlings Act (Lei de Sementes e Mudas), which states that "farmer's privilege" should be reported to MAPA in advance, as well as which varieties are being multiplied. For the propagation of the protected plant variety it is necessary to obtain authorization from the breeder, and monitoring is done by MAPA. (Verbal information provided by Aviani at CIOPORA Conference - Conferência CIOPORA sobre Direitos de Obtentores de Plantas) 2009, Campinas.

Tripp *et al* (2006) and Louwaars (2007) point out that in countries without a flower exporting tradition, as is the case with Brazil, the protection afforded by an effective PVP system is particularly important.[10] The authors note that appropriate levels of protection for different types of products should be structured, and that constraining devices may be applied selectively in particular cases where market incentives justify the additional protection, such as cut flowers.

In 1980 the Netherlands allowed farmer's privilege in general, but the reservation of propagative material from the previous crop was forbidden for cut flower growers only (Louwaars *et al*, 2005). As reported by Tripp *et al* (2007), this position has greatly contributed to Dutch economic development; the players in the flower business understood that the use of propagative material without the breeder's authorization was a major disincentive for investment in breeding. The Netherlands is today one of the major players in the flower breeding industry.

In 2003, Colombia, one of the largest rose producers, forbade farmers with an area exceeding five hectares to practice farmer's privilege. Growers with a smaller area must send their requests to the responsible agency and provide details about the way in which the propagative material will be used (Louwaars *et al*, 2005).

Endres and Goldsmith (2007) argue that when the legal requirements fail or do not exist, companies must adapt their strategies to appropriate property rights. Fuck (2009) notes that the lack of clear legislation can give rise to alternative forms of protection, which in some cases can significantly expand the breeder's rights beyond the guidelines of UPOV. The author points out that while these alternative arrangements can stimulate breeder's research activities, they may also limit the farmer's rights.

3.1 Plant variety protection worldwide compared to Brazil

One conclusion reached by Louwaars *et al* (2005) in their study of flower plant breeder's rights (PBRs) in Colombia, Kenya, and Uganda is that respect for property rights contributes to a favorable business environment, allowing farmers to access a wide range of varieties. The authors point out that the presence of PVP systems in those countries is important because it encourages a greater number of contracts between growers and breeders, who can rely on local courts.

[10]UPOV 1991 settled as the object of protection the product of the harvest, when obtained by unauthorized use of propagative material, where breeders have not had previous opportunity to exercise their rights. According to Tripp *et al* (2007) this is used, for instance, in cases where royalties can be charged on marketed flowers whose propagating material was planted in countries without an operational or effective PVP system.

UPOV (2005) notes that the access to new foreign varieties enjoyed by Latin American countries since their subscription to the agency has been crucial to enable farmers to meet the demands of the global flower market.

According to UPOV (2005) and the Kenya Flower Council (2009), enactment of a plant variety protection policy has been one of the reasons contributing to the emergence and expansion of the flower business in that country and has also supported the competitiveness of its products internationally.

After the introduction of a PVP system in South Korea, the number of rose breeders rose from seven to 23 and the number of varieties increased from 139 to 309. Rose breeding investments by domestic companies increased 700% in the four years following the introduction of the PVP system (UPOV, 2005).

3.2 Some remarks about PVP worldwide compared to Brazil

In a 2005 UPOV report which analyzed Argentina, China, Kenya, South Korea, and Poland, the introduction of a PVP system and the subscription to UPOV encouraged flower protection by national organizations shortly after the regulations were introduced. In Brazil, the first domestic flower variety was not protected until 2010, thirteen years after the enactment of the LPC.[11]

The Brazilian response to the introduction of a PVP system in the form of granting protection titles took longer than the average of the countries analyzed by UPOV (2005). While the five countries took an average of 4.5 years after the introduction of PVP and an average of 1.8 years after joining UPOV to protect the first ornamental species, in Brazil the time spent was respectively six and four years.

Ornamental varieties account for 18% of the titles granted by SNPC, and comparing this figure with European Community Plant Variety Office (CPVO) (2010a) and UPOV (2005) data, one notes that the share of ornamental protections granted in Brazil is on average lower than in the other countries. Between 1996 and 2009 the share of ornamental applications received by CPVO varied between 51% and 68%. For the period measured by UPOV (2005) the proportion of ornamental titles issued was 7% in China, 81% in Kenya, and 39% in Korea.

[11] Croton cultivar (Codiaeum variegatum (l.) a. Juss.), called “Canarinho,” with ownership requested by Tommy van Noije, Brazil. The Croton is a shrubby ornamental foliage.

A detailed analysis of the certificates of protection granted to ornamental varieties in Brazil confirms a mismatch between protected varieties and varieties that are marketed effectively for the three genera of flowers researched in this study.[12]

Based on the discussion above, Box 4 offers some helpful questions to aid in understanding how the Brazilian flower chain has been impacted by the LPC. Such questions helped the process of interviewing agents in the flower chain, producing responses which are presented in the next section.

Box 4 – Qualitative inquiry.

Points to be addressed	Questions	Assumptions
Low development level of ornamental domestic breeding	Why, after LPC enactment and UPOV subscription, has flower breeding exhibited poor development?	- Farmer's privilege as established in the LPC discourages investments in ornamental breeding; - Cost of obtaining the protection is too high;
First flower varieties belatedly protected.	Why were the first varieties protected so belatedly when compared with other countries, as reported by UPOV (2005)?	
Low relative share of protection titles issued for ornamentals.	Why is the share of title for ornamental varieties still relatively low compared to other countries?	- Market is not mature enough to receive a large number of innovations; - Farmer's privilege in the LPC discourages breeders;
Mismatches between protected varieties and effectively marketed varieties	Why is there a mismatch between the protected varieties and those that are actually widely sold?	- Breeders do not yet know the Brazilian market well enough to properly assess which varieties are best to be introduced; - Costs incurred in obtaining a protection title do not justify the investment due to the estimated return on certain varieties.

4 THE LPC'S IMPACT FROM THE PERSPECTIVE OF FLOWER BREEDERS, GROWERS, AND DISTRIBUTOR'S

This section is divided into four parts, which respectively present the results of interviews with breeders, growers, and distributors (wholesalers), as well as data on the protection of rose, gerbera, and alstroemeria varieties.

[12] This theme will be addressed in section 4.4.

4.1 Breeders' perspectives on the LPC

Eaton and van Tongeren (2004) used semi-structured interviews as a research tool to identify the effects that PVP systems had on the business and investment decisions of plant breeding companies with global operations. According to the authors, the use of this type of instrument to obtain the companies' perceptions and experiences is costly in terms of time required to conduct and analyze the resulting information. Nonetheless, it can help identify key issues in studies with broad objectives, as well as reveal the respondent's wealth of experience.

4.1.1 Brazilian breeders

Since the breeding accomplished by Brazilian organizations is still incipient and does not have available data about its market share, the interviews were defined for convenience.

a) Characterization of organizations

ProClone is a private company headquartered in Holambra which carries out seedling micropropagation and zantedeschia breeding and propagation. There are 30 varieties under development, of which four have already been selected for enrollment with MAPA. The company operates both in the genetic breeding of flowers as well as in the production of bulbs in the laboratory to supply a group of family farmers in Holambra and southern Minas Gerais. This group acts as "members" of the company through staggered flower production and testing of selected varieties.[13]

IAC (*Instituto Agronômico de Campinas*) is a research body of APTA, *Agência Paulista de Tecnologia dos Agronegócios*, part of the *Secretaria de Agricultura e Abastecimento de São Paulo*. Founded in 1887 by Emperor Dom Pedro II, the institute is headquartered in Campinas. Among the activities it carries out is the genetic breeding of agricultural species, including some ornamentals such as Anthurium.

As a public organization with more than 120 years of existence, a group of researchers here still resists plant breeders' rights and the charging of royalties. For them, the State's role is to freely provide farmers with the technology generated. On the other hand, the new generation of

[13] ProClone receives funding through "Programa FAPESP de Pesquisa Inovativa em Pequenas Empresas (PIPE)" and "Programa de Capacitação de Recursos Humanos para o Desenvolvimento Tecnológico (RHAE)" from CNPq.

researchers understands the collection of royalties as a means of rewarding investment and research effort. IAC is undergoing a process of defining guidelines to be adopted on the theme.

b) Considerations arising from interviews with Brazilian breeders

Box 5 provides a summary of implications drawn from the interviews.

Box 5 - Implications drawn from interviews with the Brazilian breeders.

Question	ProClone	IAC
What impact has the Plant Variety Protection Act (LPC) made on the Brazilian flower chain?	1) Positive only in some regions; 2) Crucial to replicate the "São Paulo/Holambra" success model to explore Brazilian ornamental biodiversity; 3) To ProClone: conditions for structuring the zantedeschia breeding program.	4) Massive presence of foreign breeders; 5) Market begins to be disciplined in spite of "loopholes"; 6) Compliance occurring in a regionalized manner (Holambra); 7) To IAC: "politically incorrect" practices by growers who act in the face of failed legislation.
Why are almost no Brazilian ornamental varieties protected by a title?	1) High cost of obtaining the protection title; [14]	2) High cost of obtaining the protection title; 3) To IAC: an internal policy on the subject is still needed. Efforts must be made to raise researchers' awareness.
Why, after LPC enactment and UPOV subscription, has flower breeding developed poorly in Brazil?	1) High cost of breeding and dependence on public resources; 2) Breeding activity inhibited by cultural ties between Holambra and Dutch companies.	1) Farmer's privilege discourages investment in the activity; 2) High cost of breeding and difficulty of obtaining resources; 3) High cost of obtaining the protection title; 4) Low demand for flowers; 5) Unawareness of the regulations (organizations have not yet learned how to take advantage of the possibilities).
What are the devices used to appropriate plant breeders' rights over new varieties?	1) Contracts with associated farmers; 2) Caution in choosing partners and constant monitoring; 3) Trust and relationship building.[15]	1) Non-exclusive contracts with propagators; 2) "Fight" for royalty collection; 3) Intent to formulate policies on providing material based on type of farmer.

Even given the problems with the regulation, both organizations interviewed consider the LPC important since it has introduced discipline to the production chain. The perception, however, is that the benefits provided are still very much restricted to Holambra and the state of São Paulo.

[14]The fees charged by the SNPC are: protection application R$200; title issue R$600; maintenance annuity R$320 to R$400; transfer of ownership R$600; denomination changes R$200; duplicate certificate R$50. Brazilian breeders still must bear the costs of the DUS test; in Europe the cost of a DUS test is €1,200 Euros per cycle for each variety. For most ornamental varieties the DUS test extends to more than one cycle (Evans, 2007).

[15]Although ProClone did not comment explicitly about farmer's privilege, the company works with family farmers and should be aware that the act allows this practice and thus remain alert regarding the matter. Eventually these farmers could potentially select some bulbs to propagate illegally, without paying royalties, by claiming the privilege.

In the case of each interviewee's respective business, the LPC was positive for ProClone because the new environment has provided better conditions under which to develop its activities. In the case of IAC's ornamental varieties, it is not possible to assert that the act has had any effective impact since the organization still has not protected any variety.

Both organizations interviewed mentioned that Dutch companies, with their great know-how in the floriculture business, take advantage of cultural ties with the city of Holambra to expand their market share in a manner that inhibits the development of the national companies. According to respondents, the foreign groups or groups of foreign origin (especially Dutch) enforce the LPC rules in practice, due to their coordination and management capacity. These skilled groups were already prepared for the model introduced by the LPC and, according to ProClone, have reaped the benefits generated by the regulation.[16]

The expenditures in the process of plant variety protection were cited by both organizations interviewed as a justification for the absence of protected varieties in Brazil. According to them, such costs can be a limiting factor for ornamental protection, since the market for certain varieties is frequently so restricted that investment in a protection title is not offset by the financial return provided by royalties.

In addition to the administrative fees paid to the SNPC, which are common to both Brazilians and foreigners, the Brazilian breeders must also cover the expenses of DUS testing. Given that the organization and structuring level of domestic breeding companies is far short of their foreign competition, it is clear that the cost of obtaining the protection is a serious obstacle in the development of this activity in Brazil.[17]

Eaton and Van Tongeren (2004) identify that the costs of acquiring PBR certificates, in terms of application procedures and renewal fees, is a major consideration in the decision about whether or not to apply. In the European context these costs vary between 10% and 20% of the total breeding process cost. According to the authors, the main cost component is the DUS testing requirements.

[16] According Louwaars *et al* (2003), a great effort is necessary to familiarize agents with the rules of a PVP system. Agents in most industrialized countries have had the opportunity to adjust over several decades. In developing countries, a very sophisticated system has already been developed in a short space of time. As a consequence, multinational enterprises with long experience in PVP systems may have advantages in this area in relation to local players or even to the national authorities.

[17] The foreign breeders use the DUS test results from places where they have already been carried out.

Respondents understand that farmer's privilege discourages investments in flower breeding activity, but they add that the low development level of the activity nationwide is not due just to the provision. Among the reasons listed by the interviewees, of note is the relative unawareness of the regulation on the part of domestic organizations that have not yet learned how to take advantage of the possibilities offered by the instrument, and also the high costs incurred in breeding new varieties. In the case of IAC, the lack of a structured policy to deal with plant breeders' rights is a further reason why the organization does not yet have any ornamental varieties protected.

4.1.2 Foreign breeders

The set of foreign breeders that have varieties of roses, gerberas, and alstroemerias protected and/or marketed in Brazil includes 18 companies. Seven of these were covered in five interviews conducted with their representatives in Brazil.

c) Characterization of organizations

The rose breeders interviewed account for 54% of varieties of this genera protected in the country. The gerbera breeders interviewed are owners of 72% of the protected varieties. In the case of alstroemeria, interviewees covered 100% of protected varieties in the country. Box 6 presents a brief characterization of the breeders interviewed.

Box 6 – Characterization of foreign breeders interviewed

Breeder	Founded	Nationality	Genera produced in Brazil	Share of protected varieties
Tantau	1906	German	Rose	22%
NIRPirp	1970	Franco-Italian	Rose	13%
Lex	1998	Dutch	Rose	13%
Preesman	NA	Dutch	Rose and gerbera	6% (roses); 33% (gerberas)
Könst	1975	Dutch	Alstroemeria	72% (alstroemeria)
Florist de Kwakel	1975	Dutch	Gerbera	39% (gerbera)
Van Zanten Plants	1862	Dutch	Alstroemeria and statice	28% (alstroemeria)

d) Considerations arising from interviews with foreign breeders

Box 7 summarizes the implications drawn from the interviews with foreign breeders.

Box 7 – Implications from foreign breeders interviews

	Topics	Tantau	Nirp	Lex+	Preesman	Könst	Florist	Van Zanten
Organization perceptions of the impact of the LPC	LPC's influence on the decision to establish business in Brazil	Essential, recognition of plant breeder's rights. Needs to be improved for vegetatively-propagated species.	Essential to enter the country, but operation has brought problems.	Essential. Breeds only protected varieties in Brazil, but faces problems with large-scale illicit propagation.	Essential	Essential	Essential	Essential
	Changes in the flower chain after LPC	Growers want to offer modern varieties and curb non-professionals. Improved technical production, logistics, product exhibition, and distribution.	Producers recognized the importance of paying royalties for the flower industry. In ten years the number of rose varieties jumped from 10 to 100.	Growers concerned with trends. Retailers have begun to recognize varietals by names.	Growers concerned about production technology. Other players in the chain aware of post-harvest and logistics. Consumer experiences buying flowers for own consumption.	The entire flower chain has benefited from innovations. However, growers from RJ and MG have not acknowledged these.	Prepared the environment for introduction of modern varieties. Most growers understand benefits of protection, MG and RJ are exceptions.	Introduction of a PVP system has brought innovation to the Brazilian market.
	Costs of obtaining protection	Satisfactory when analyzed in isolation. High (control and monitoring) given the results obtained.	Like other countries, but depends on the success of the varietals.	Did not respond	Satisfactory	Satisfactory	Satisfactory	Satisfactory
	Influence of farmer's privilege	Negative, makes the law ineffective. Lack of security to invest in research for Brazilian floriculture.	Does not interfere further in the established business, but disrupts plans for the country.	Indifferent. Problems are with illegal propagation without proof of origin.	Negative	Negative	Negative since it adds costs.	Negative since it adds costs.

Continuation Box 7 – Implications from foreign breeders interviews

Topics	Tantau	Nirp	Lex+	Preesman	Könst	Florist	Van Zanten
Mechanisms for appropriation of property rights over new varieties	(i) Contractual agreements; (ii) Seed and Seedlings Act	(i) Contractual agreements; (ii) Seed and Seedlings Act; (iii) relationships; (iv) charging royalties for entire varietals (including those out of date).	(i) Contractual agreements; (ii) monitoring and control of illegal production without deals (contracts).[18]	(i) Contractual agreements only with major growers; (ii) careful selection of customers.	(i) Contractual agreements; (ii) Seed and Seedlings Act; (iii) monitoring and control of illegal production; (iv) charging royalties for entire varieties (including those out of date).[19]	(i) Contractual agreements; (ii) charging royalties for entire varieties (including those out of date).	(i) Contractual agreements; (ii) charging royalties for entire varieties (including those out of date).
Perspectives (from the company regarding Brazil) on the possible exclusion of farmer's privilege for ornamentals	Would be equal, but for breeders with differentiated products would be better.	Would establish operations breeding research units in Brazil.	Equal	Breeding research in and for Brazil. Offer support to small and family farmers.	Equal	Equal, but with more security in the business environment.	Equal, but with more security in the business environment.

[18] When the company finds illegal crops it asks growers to pull them out: some growers offer to enter into deals (contracts) to pay what they owe. In most cases the request is denied by Lex+, since the company establishes annual production quotas for each variety.

[19] Könst, as well as other breeders, has old varieties that were not subject to protection when the descriptors of the species were published. For this reason the company insists that customers pay royalties on older, unprotected varieties (with discount) in order to gain access to new, protected varieties.

Despite some outlying opinions, there is agreement between foreign breeders on most subjects. Concerning the influence of the enactment of the LPC on the companies' decision to invest in Brazil, all were categorical in stating that they would not have established businesses in the country without its enactment. Tantau stated, "without the regulation it would not be possible to establish business relations with farmers through licensing agreements."

This result is similar to that found by Eaton and van Tongeren (2004), who conclude that the presence of a PVP system in the countries of the South is an important factor in the decision to establish a breeding business in these locations. The authors also found that a "well-functioning" PVP system affects the type of presence that the companies establish in a developing country.

Companies interviewed, with one exception, said the manner in which the farmer's privilege is established makes the LPC ineffective for vegetatively-propagated plants and thus negatively influences their business in Brazil. Three of them confirmed that the type of business established in Brazil would be different if the device excluded ornamental flowers.

Nirp indicated that considers establishing breeding and research units in the country and Preesman believes that besides investing in research for Brazilian conditions and in the country, it can also increase the range of growers supported. According to the company, the environment would be safer for working with small farmers that today do not have access to new varieties due to the risk posed by the farmer's privilege provision.[20]

Eaton and van Tongeren (2004) concluded that effective PVP in certain countries of the South may provide a stronger incentive for more breeding activities to shift to such locations.

To ensure ownership over property rights, all the flower breeders operating in Brazil carry out their business with farmers using contractual agreements containing a mandatory clause specifying no propagation using farmer's privilege. Some breeders,

[20] Examples of farmers that the company would support were growers in the region of Nova Friburgo in Rio de Janeiro, Gramado in Rio Grande do Sul, and Barbacena in Minas Gerais.

such as Nirp and Tantau, also use a licensing agreement for varieties in the testing stage. One of the companies interviewed noted that while the contract is a way to minimize the regulation gap, it also incurs additional costs.

Eaton (2007) asserts that the use of contractual agreements entails transaction costs, meaning that the stream of benefits accruing from the innovation will not be completely captured by the breeder. Breeders also incur transaction costs in the control and monitoring some undertake to curb piracy and protect breeder rights.

Furthermore, breeders use these contractual agreements as a way to obtain remuneration for varieties that are not protected. By linking the availability of new, protected varieties with royalty payments on old varieties, they manage to collect on varieties that can not be protected due to the deadlines stipulated in the Brazilian law.

Respondents mentioned that it is possible to call upon the Seed and Seedlings Act as a way to avoid the claim of farmer's privilege by growers which cannot prove the origin of propagative material. As a user of propagative material, the grower needs to demonstrate the origin of the material used for planting. If a grower is not able to demonstrate that he has acquired or grown the seedling within the criteria laid out in the Seed and Seedlings act he can be fined for improper access to propagative material of protected varieties without proof of origin.[21]

However, due to the complexity of the regulations, as well as supplementary regulations that had not yet been published at the time of the interviews, it was observed that it is not clear to all breeders that this possibility (Seed Act) is available.

The expenditure in obtaining a protection title is not a complaint among foreign breeders. However, two respondents offered important considerations on the subject. In terms of the monetary value of administrative fees paid to the SNPC and acquiring DUS tests that come ready from Europe, costs are reasonable. Nevertheless, as Brazil does

[21]The Seed and Seedling Act was drafted along with the LPC, despite having been enacted six years later in 2003. It states that with the exception of family farmers, land reform settlers, and indigenous groups, agricultural growers must prove that the propagative material used for the production of seedlings originates from nurseries listed with MAPA. In cases where the variety is protected, these nurseries in turn must have authorization from the rights holder for that variety in order to use the material.

not have a capable and agile mechanism to effectively monitor piracy, costs increase since breeders need to cover expenses involving monitoring and controlling protected varieties.[22]

4.2 Interviews with flower growers

Using a non-probabilistic sample, 16 growers were interviewed. Although the type of sampling places limitations on the generalization of results, the exploratory character is justified as it is able to generate relevant information on some little-studied issues.

The sample studied covers 2% of the cultivated area in Atibaia and 5% in Holambra. Growers from other important flower-producing cities were also interviewed. The total land covered by interviewed growers accounts for 1.2% of the national cultivated area. Box 8 summarizes the implications arising from the interviews.[23]

Box 8 – Implications arising from interviews with flower growers.

Question	Growers
What impact has the Plant Variety Protection Act (LPC) made on the Brazilian flower chain?	1) The majority (75%) of respondents consider the impact of LPC positive;
	2) Main reasons: (i) assortment (more options) of new varieties; (ii) quality; (iii) lower cost due to the use of resistant varieties;
	3) Half consider royalties to be more of an investment than a production cost;
	4) The majority considers protected varieties to be more productive;
	5) Main reasons for paying royalties: (i) it is a way to reward the breeder's work and fund new research; and (ii) in the future those who do not pay the royalties will not have access to new materials;[24]
	6) Royalty payment means improved technology (greenhouse production).

[22]Unlike exporting countries, in which the control is exercised through Dutch auctions or European borders (possible since the UPOV 1991), the Brazilian market is mainly domestic, so most of this control must be done internally. The presence of several regional markets distant from major cities makes checking marketed varieties expensive.

[23] The growers were differentiated in relation to the production region. Region of Holambra: growers of Holambra, Holambra II (municipality of Paranapanema), Mogi Mirim (town bordering Holambra), and Andradas, MG (growers of Dutch origin). Nine were grouped as growers of Holambra. The other seven, including four of Japanese origin, were grouped as growers of Atibaia, although two of them produce in other locations (Conchal and São José dos Campos).

[24] Other reasons quoted by respondents, in order of frequency, are: "growers pay because they want to comply with the law; growers pay the royalties because the value is built into the seedling price; paying royalties is rewarded with specific technical assistance for the varieties and the possibility of travelling to the breeder's headquarters in Europe."

Concerning the impact of the LPC on the flower market, 75% of the growers (nine "Holambra" and three "Atibaia") stated that the law was very positive or positive. The main arguments for the positive responses are: "more advanced products that meet new requirements"; "new opportunities for growers and consumers"; "product quality"; "technical assistance"; "enabled better market penetration, reduced losses and differentiation"; "lower costs due to better quality obtained"; "varieties are more resistant to diseases which reduces the total cost"; "encourages the search for innovation, needed because the producer needs more resistant varieties."

Some growers pointed out that the LPC "moralized the market," but that there is still a need to improve the legislation and inspection to facilitate compliance by the producer. Those who did not offer a positive evaluation of the LPC's impact argued that they not have noticed changes in the market.

Half of the respondents consider the royalty payments as an investment rather than a production cost. Even among those who consider them a cost, the majority accept that it is an expense which growers must pay to access new varieties.

Concerning the portion of total production cost represented by royalties, 37.5% of the respondents could not isolate the value, or chose not to express it, as they consider that this value is very relative and may vary depending on the success that each variety finds on the market. It was argued that the royalty cost can be diminished (dissolved) depending on the acceptance of the flower by the market.

Among those who offered an estimate, the figures quoted were quite diverse, ranging from 0.5% to 5% of the total, indicating that the cost can vary considerably depending on the success of the variety and/or the fact that growers do not have full knowledge of its cost.

We found indications that royalty payments are more common when production is carried out in protected environments (greenhouses). Some growers have stated that the investment in royalties is not viable for flowers cultivated in the field.

Growers in “Holambra” have the perception that more growers pay royalties than do those in “Atibaia.” Among the “Holambra” growers, 55.5% believe that a majority were paying royalties, while 45.5% believe that only a few were. In “Atibaia,” only one grower believed that the majority were paying royalties, 71% believed that only some were paying, and one grower did not know.

This observation is complemented by another: in “Holambra,” 55.5% believe that some growers also pay royalties on varieties that are not protected, while in “Atibaia” all were unanimous in saying they do not know of anyone who pays royalties on unprotected varieties.

When asked about changes in profit realized after beginning to pay royalties, 50% stated that profits are higher because the price received for the product increased more than did the cost of production.

“Holambra” growers stated that in that region those who do not pay royalties “need to sell on the black market.” According to one of the respondents, there is consensus among serious growers that paying royalties increases the quality of varieties and is a commitment to the market.

The main reasons quoted to justify the payment of royalties indicate that, rather than a concern to comply with the legislation, growers make the decision on the basis of: (i) increased awareness of the importance of intellectual property rights for innovation; and (ii) the concern to honor contracts in order to keep accessing new products.

The comparison between “Atibaia” and “Holambra” shows that growers from the first have a less positive perception about the LPC, and also tend to perceive the royalty as merely an additional production cost. These findings reinforce what was identified in interviews with the breeders: the benefits of the LPC are still more regionalized to growers in Holambra, or those of Dutch descent, who are most committed to plant breeders’ rights.

4.3 Interview with flower dealers[25]

Interviews were conducted with companies operating in Campinas, São Paulo (state capital), Maceió, Recife, Salvador, and Natal, and with the leading distributors in Brasilia (Federal District) and Santa Catarina, for a total of five companies. The main implications are compiled in Box 9.

Box 9 – Implications arising from interviews with flower distributors.

Question	Distributors
What impact has the Plant Variety Protection Act (LPC) made on the Brazilian flower chain?	1) Are well informed about the LPC and the majority agree that the law has been positive for the market;
	2) Those who recognize the positive impact attribute the major positive changes that have occurred in national floriculture to the law;
	3) Reasons: (i) improvement in flower quality, (ii) professionalization of sector, (iii) greater assortment of varieties;
	4) Distributors recognize distinct attributes in protected varieties even though their clients recognize such attributes only somewhat.

Despite not having direct involvement with plant varieties protection, it was found that distributors are knowledgeable about the topic. [26] Four respondents highlighted that the impact of the LPC on the Brazilian flower market has been very positive or positive, while the fifth believes that the impact has been neutral.

Three respondents said that the law was positive because it enabled an enhancement in the quality of the flowers sold in the country. Two respondents agreed that the LPC has contributed to the professionalization of the sector. One observed that the law promoted an expanded range of varieties to offer customers, in contrast to the prior situation. The same interviewee also stressed that new varieties are released almost simultaneously in Europe and Brazil. The interviewee that described the impact of the LPC as neutral explained that there are still customers who prefer to continue working with the older, more traditional varieties.

[25] Companies that buy flowers in large quantities, have their own distribution structure, and sell the product to florists, decorators, and others. Wholesalers are clients of marketing centers located in the region of Holambra and are also registered with supply centers such as CEAGESP and CEASA as buyers and/or exhibitors.

[26] The respondents identified protected varieties with an 88% accuracy rate.

Respondents listed the attributes they consider most important in differentiating protected flowers from unprotected. Answers included: quality (three times), flower-bud size (twice), long shelf life (once), colors (once), perfect foliage (once), size (once), number of petals (once), and beauty (once).

Regarding the differentiation between protected varieties and unprotected, one respondent said that the market (retail or final consumer) does not recognize the existence of differentiated attributes between them and that the price achieved for both is the same. Two interviewees confirmed that some of their customers perceive the existence of different attributes in protected varieties while others do not. Two other dealers commented that they most often get the best prices on protected varieties, because the market has already recognized that these flowers possess different attributes.

In general the respondents noted that the market has moved forward and modernized as a result of the LPC. They highlighted the wide range of flowers that can be offered to consumers. Their responses indicated distributors' awareness of the need to reward breeders with a share of the benefits provided to floriculture so that they continue to provide the chain with further innovations. However, two respondents felt that the law has been good only for a few growers who invest in their production and differentiate themselves, while others have been deterred and risk having their production closed if they do not pay royalties.

4.4 Figures about flower breeders' rights in Brazil

According to RNC (National Plant Registry),[27] there are more than 25,000 varieties registered for sale in Brazil. According to MAPA (2011), 1,474 varieties are protected: 18% of these are ornamental plants, comprising 267 varieties distributed among 21 botanical species.[28]

[27] Registro Nacional de Cultivares

[28] Data collected on 07/31/2011. The updated list of protected varieties is available at: <http://extranet.agricultura.gov.br/php/proton/cultivarweb/cultivares_protegidas.php>.

e) Protection Titles

Holambra channels trade just over 100 varieties of roses. Altogether, 104 varieties have received protection certificates since 2003. As of July 2011, 86 of these remained protected, while the other 18 varieties had extinct certificates through renunciation by the holder.

More than 150 gerbera varieties are marketed by Holambra channels. As of July 2011, only 18 were protected, out of 20 which have received the protection certificate. In the case of alstroemeria, approximately 50 varieties are marketed. As of July 2011, 18 were protected. The first varieties of both these genera were protected in 2006.

Dutch, German, and French breeders dominate the market in protected flower varieties in Brazil, respectively owning 34%, 35%, and 23.5% of protected rose varieties. In the case of gerberas and alstroemerias all varieties present in Brazil are Dutch.[29]

Chart 1 shows the trend in the number of certificates of protection granted by SNPC through July 2011.

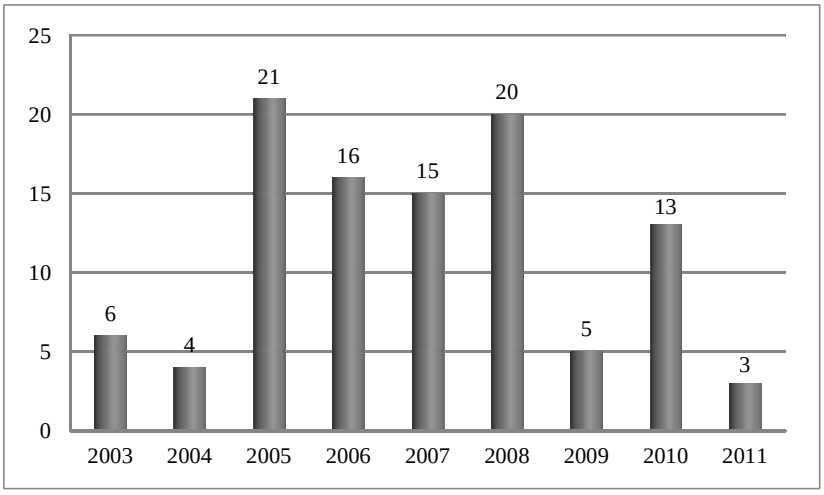

Chart 1 – Roses: trend in the number of certificates of protection granted by SNPC
Source: drawn up by the author based on MAPA (2011).

[29] The breeding business has a very concentrated market structure worldwide. More than a third of the protections granted by the European Union are for varieties coming from the Netherlands, followed by Germany and France (CPVO, 2010).

Chart 1 shows an initial growth in the number of licenses granted for rose varieties, followed by a significant drop in 2009. According to CPVO (2009; 2010) the European breeding business was impacted by the 2008 global crisis, which is reflected in the figures presented in the chart. Using this data it is not reasonable to state that the number of protected rose varieties is increasing or decreasing, but it is possible to verify that 2010 saw a recovery in the number of protection certificates compared to 2009.

f) Mismatch between protection and trade

A divergence was noted between protected varieties and those effectively marketed among the three genera studied.[30] The reasons are discussed below.

In the case of roses, there is a reasonable number of varieties traded at Holambra that do not have a protection title because they have already been on the market for more than 15 years, long enough to come into the public domain. Other varieties are no longer subject to protection, and there are still others which have had the application for protection filed and either rejected, renounced, or still undergoing analysis.[31]

Our interviews demonstrated that it is common for breeders to seek the protection of varieties for which success in the Brazilian market is uncertain. There are cases in which they trust in the success that a particular variety obtained in other countries, and so as not to miss the deadlines stipulated by the legislation choose to protect a large number of varieties even before completing all required testing in Brazil. This fact also explains, in part, why protection for some varieties has become extinct through renunciation by the rights holder.

There are cases in which the breeder gives up during the protection process, or renounces its rights when it proves too costly in relation to the market penetration which the variety achieves; given that the breeder does not have time to perform all necessary

[30] In June 2010 45% of protected rose varieties were not being marketed at Holambra, while 56% of marketed varieties were not protected. In the case of gerbera, 25% of protected varieties were not being marketed and 92% of marketed varieties were not protected. For the alstroemeria, figures were 36% and 82% respectively.

[31] A majority of varieties which are already in the public domain were introduced illegally into the country before the sanction of the LPC, without a chance for breeders to appropriate their property rights.

tests and has a prior doubtful experience with a given variety, the breeder may choose not to request the protection title. It may also be that the variety continues circulating on the market due to piracy and consumer acceptance.

Another reason for the mismatch observed is the dynamism of the flower market; a portion of varieties which have been certified as protected, but not yet entered into the marketplace, may have already become outdated for consumer requirements. In addition, in the case of alstroemerias and gerberas the protection of new varieties is not always feasible. Breeders interviewed noted that with gerbera varieties for which demand does not justify a cultivated area bigger than half a hectare, the protection title is not worth seeking. Breeders consider that if the market for a certain variety is limited, investing in a protection certificate may not be rewarded by the financial return obtained by charging royalties.[32]

g) Roses: comparison between Brazil and Europe

An analysis was made of the time difference between issuance of protection in Europe and Brazil. Chart 2 shows the evolution of these differences over the years.

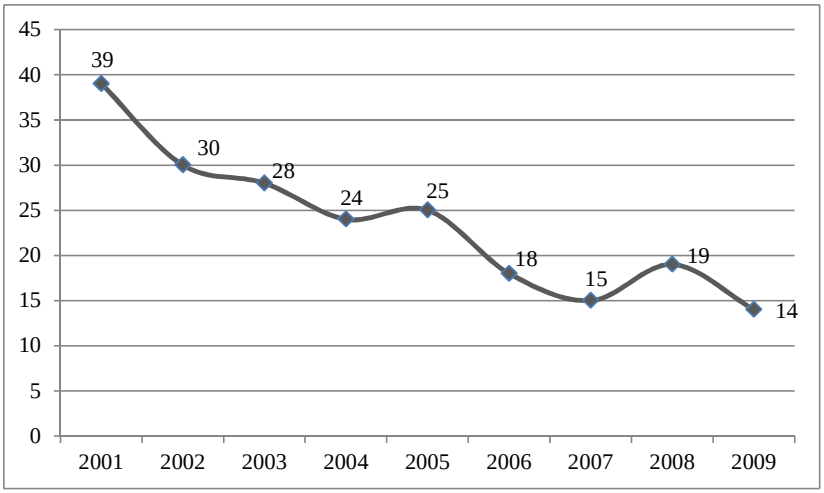

Chart 2 –Roses: evolution in the average time span between the granting of protection in the EU and in Brazil (in months)
Source: drawn up by the author based on MAPA (2011) and CPVO (2011)

[32] The companies generally make use of PVP protection when they feel that the extra protection provided warrants the costs of application and annual renewal. Market potential is clearly a necessary condition for marketing and investment decisions. The size of this potential can also affect the perceived importance of PVP (Eaton; van Tongeren, 2004).

Chart 2 shows the average time span between the grant of protection in the EU and Brazil for all varieties of roses protected in Brazil. The x-axis shows the year in which the license was issued in the EU; e.g.: the varieties which were issued a protection title in the EU during 2009 were issued a protection title in Brazil on average 14 months later.

A declining trend in elapsed time between the grant of protection in Europe and in Brazil is evident, an indication that with the maturing of the LPC protected varieties introduced in Brazil are increasingly in line with the varieties released in the main flower markets. This demonstrates that the Brazilian market for roses has been modernizing itself and more readily following global trends.

h) Implications arising from figures

Box 10 summarizes the implications arising from the analysis of the protected varieties.

Box 10 - Implications arising from the figures

Questions	Considerations
Why is there a mismatch between protected varieties and those that are actually sold?	1) Market dynamism, high turnover of varieties; 2) The deadlines established by the LPC entail both options: protection and not protection, relying on the breeder's accumulated experience about the varieties and having the time to carry out marketing tests; 3) The existing demand for certain varieties of flowers does not justify obtaining certificates of protection.
What impact has the Plant Variety Protection Act (LPC) made on the Brazilian flower chain?	4) Due to the LPC reaching maturity, protected rose varieties introduced in Brazil are increasingly in line with the varieties released in major markets.

The disconnect between protected and marketed varieties occurs as a result of the very nature of the flower business, which is quite dynamic and requires that breeders be constantly attentive to trends. It is not uncommon that all the official procedures required to protect a variety can hamper its protection if in a short time it becomes deprecated by consumer taste. Breeders are still acquiring experience about Brazilian consumer preferences, and the process of selecting which varieties will be protected is in some cases subjective. CPVO (2007) states that in EU countries such a disconnect also exists and is part of the nature of the business.

4.5 Summary of implications

The analysis presented in this paper takes the theoretical approach of the NIE, which calls attention to the importance of institutions in shaping individual behavior (North, 1991) and warns about the importance of clear legislation to achieve appropriate allocation and maintenance of property rights (Coase, 1960).

Under such an approach, and starting from the claim that the Brazilian plant variety protection legislation is not entirely suitable for vegetatively-propagated species, the paper sought to explore, by reviewing available information on plant breeders' rights and interviews, how the Brazilian cut flower chain is impacted by the LPC.

The PVP system introduced in Brazil through the LPC has brought numerous benefits; illustration 1 shows how the institutional environment that has been established is creating a virtuous circle for the flower industry.

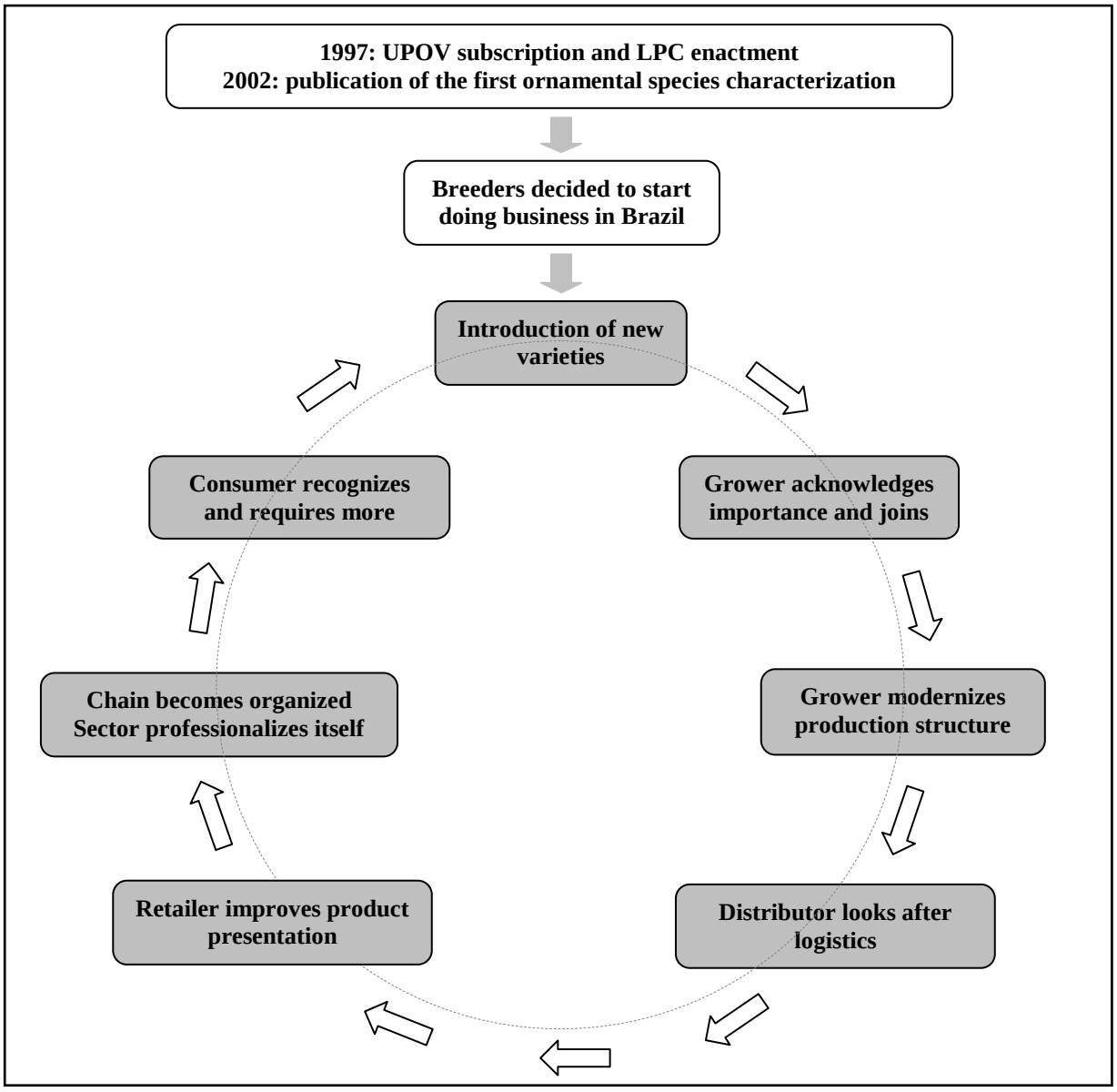

Illustration 1 – LPC impact on the Brazilian flower chain

The LPC brought the recognition of plant breeder's rights and was thus crucial to the entry of breeding companies into the country. The introduction by these companies of new flower varieties with differentiated attributes is modernizing Brazilian floriculture.

The flower growers who are more dynamic and professionalized understand that investment in new varieties means better business opportunities arising from the consumer market, and that to perpetuate these opportunities they need to reward those who develop new varieties. By respecting breeders' rights they contribute to research continuity and also ensure continued access to innovative products.

The use of modern varieties is arousing concern among growers with the rest of the productive chain. To extract the best possible result from varieties for which they pay royalties, they understand that it is important to also invest in quality propagative material and greenhouse cultivation, among other production technologies.

We found evidence that the Brazilian market has been modernized both in terms of greater range of products as well as in terms of better quality of products. Distributors interviewed acknowledged that such benefits were provided by the LPC. In addition, in the case of roses, the analysis of the number of titles issued showed that the Brazilian flower industry is progressively modernizing to meet key trends and the latest fashions of the European market.

a) Peculiarities of the impact of the LPC: result disparity

From this perspective it can be seen that the LPC has fulfilled one of the main objectives of a PVP system: the promotion of innovation (UPOV, 2005). Although the improvement in Brazilian floriculture has been recognized by growers and distributors, the present work has shown that this impact has not yet been felt in a uniform manner. It was found that the most positive results are restricted to certain regions, especially those inhabited by growers of Dutch origin. Other Brazilian regions were listed as places where breeders' rights are not respected.

In Holambra there is evidence that a collective consciousness has been created about the importance of property rights. The repeated behavior of agents through contract agreements between growers and breeders, as modeled by repeated games proposed by Aoki (2001; 2007a; 2007b), seems to have created a social convention about the importance of paying royalties. That is, there are signs that the rule became an objective reality for this group of growers and so has been fulfilled.

When considering that the region is inhabited by farmers of Dutch descent, it is possible to assume that social ties play a strong role in the enforcement of intellectual property rights—that despite the loophole in the law, growers of Dutch origin would be more rigorous in fulfilling contractual agreements for fear of social exclusion.

On the other hand, for the Brazilian breeders interviewed the impact of the LPC is still relatively small. Although the act has provided a more favorable environment for the plant breeders to appropriate property rights over the results of their research, it has not been sufficient to boost Brazilian research into ornamentals. Financial restrictions remain barriers to greater investment in this activity.

Furthermore, it was found that the most well-organized players are better at using property rights in their favor. This is the case with foreign breeders, typically well-structured companies that better leverage the benefits provided by the regulation compared with Brazilian breeders' organizations.

In Brazil the legislation is recent and still requires a period of maturation while the agents discover how they can use it to promote economic development. IAC seeks to make its researchers aware that plant breeders' rights is a mechanism which favors the rights holder, allowing him to decide the best way to appropriately devolve this right to the various categories of farmers, from small family farmers to rural entrepreneurs.

b) The influence of farmer's privilege on the Brazilian flower chain

Our initial hypothesis was that the farmer's privilege, as established, limits the full magnitude of the potential benefits offered by the LPC for the Brazilian cut flower chain. It was noted that, in fact, it prevents a broader realization of the benefits that are expected to be enjoyed after the deployment of a PVP system.

As per North (1990), the settlement of policies has consequences that are not always planned, as is the case of farmer's privilege in the flower chain. To obtain the expected appropriation of rights, plant breeders need to resort to contractual mechanisms to bypass or minimize the negative effect of farmer's privilege, but such mechanisms incur transaction costs.

Using contracts with clauses which restrict the farmer's privilege is a possible means to avoid the risk of non-appropriation of rights, but breeders need to be able to afford the

costs of enforcing such contracts. Their work also involves efforts in monitoring and controlling pirate crops and building confidence and reputation with growers.

The state does not guarantee a framework of rights that allows individuals to maximize their wealth. As indicated by Eggertsson (1990), the enforcement cost of property rights is affected by the weak institutional environment arising from the influence of farmer's privilege in the cut flower industry.

In other words, because property rights are not well defined, there exist transaction costs to using the market that imply in the need for contractual agreements. In the case of growers of Dutch descent, social coercion (social enforcement) enables the fulfillment of these agreements—the agreements between the parties, more than the legislation, have an important role in disciplining the market with respect to intellectual property. As seen, anyone who violates the agreements is "out of the game" in terms of accessing modern flower varieties.

The Seed and Seedlings Act is complementary to the LPC as a solution that limits the farmer's privilege. However, this purpose is not clear to all agents and in some cases has only belatedly been noticed. This highlights the existence of a loophole in the Brazilian PVP system which, as Coase (1960) warned, hinders the allocation and maintenance of property rights to the creators of new varieties.

In addition to transaction costs incurred by the lack of a clear limitation to the farmer's privilege and the lack of precision with which the two acts are integrated, other difficulties posed by the provision prevent further positive impact of the LPC. It was mentioned by interviewees that the farmer's privilege inhibits investment in Brazilian research units by foreign breeders and deters potential interest in domestic investments.

The exclusion of small family growers from access to innovation has also appeared as a result of farmer's privilege. Some breeders that operate in Brazil feel a lack of security in working with growers who are not professionalized. This is a function of the risk embodied in the farmer's privilege provision and the entire apparatus that needs to be built to ensure the appropriation of property rights.

5 FINAL REMARKS

This paper seeks to contribute to the understanding of the relationship between the institutional environment in which the cut flower and ornamental plant production chain exists, and the continuing development of this sector. The main findings are set out below.

The enactment of the LPC meant the recognition of intellectual property in plant breeding and was therefore decisive for encouraging the entry of breeding companies into the country. In turn, the introduction of new varieties by these companies is modernizing Brazilian floriculture in terms of range, quality, and keeping pace with global trends.

Although the improvement of floriculture in the country has been recognized by most players, it was found that this impact is not yet homogeneous. The more positive results are restricted to the region of Holambra (or agents of Dutch descent). Brazilian breeding organizations cannot yet compete on an equal footing with foreign breeders. One notes that coordinated and organized players employ the property rights provided by institutional regulation in a more effective manner.

It was identified that not all flower piracy practiced in Brazil can be explained by inclusion of the farmer's privilege in the law. It is also a result of propagative material used for seedling production without proof of origin.

Even so, the farmer's privilege prevents a wider enjoyment of the benefits expected from a PVP system. Since property rights are not clearly defined, transaction costs evolve relating to the need for a monitoring framework and to design contractual agreements to support rights appropriation by breeders. There are cases in which the agreements between the parties play a more important role than the legislation regarding market discipline. Those growers who do not comply with the agreements struck with breeders find themselves excluded from further access to new, modern varieties.

The way that the farmer's privilege is established limits the level of breeder investment in the country. It must be emphasized that only clear legislation can provide small growers with access to modern varieties.

The enactment of the LPC has provided a sign of the government's commitment to enhancing the institutional environment for conducting business and contractual agreements in the country. However, as part of the improvement and streamlining of regulations in order to provide more benefits—such as access to innovative materials for small growers and the generation of jobs through investments in flower breeding in the country—the LPC should be improved and efforts undertaken to balance the interests of the various groups involved. A single regulation can enable different levels of protection, in one way providing a minimum level of protection and adding rules for specific crops or groups of growers, or creating a strong system with carefully delimited exceptions.

This paper demonstrates that the LPC has generated a virtuous cycle, as illustrated above. Whether such a cycle increases barriers to entry is a topic that should encourage future research on the theme, as well what Brazil needs in terms of institutions to generate technology in flower breeding.

6 REFERENCES

AGREEMENT ON TRADE RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (TRIPS), 1993, Marrakesh. **Annex 1C - legal instruments: results of the Uruguay round.** v. 31, p. 319-351, 1994. Disponível em: <http://www.wto.org/english/docs_e/legal-_e/27-trips.pdf>. Acesso em: 10 Fev. 2009.

ALSTON, Julian. M.; VENNER, Raymond J. The effects of the U.S. Plant Variety Protection Act on wheat genetic improvement. **Research Policy**, n. 31, p. 527–542, 2002.

AOKI, Masahiko. **Toward a comparative institutional analysis**. Cambridge: MIT Press, 2001. 498p.

_____. Endogenizing institutions and institutional changes. **Journal of Institutional Economics**, v. 3, n.1, p. 1-31, 2007a.

_____. Linking economic and social-exchange games: from de the community norm to CSR. WP Stanford University and VCASI, 2007b. Disponível em: <http://www.vcasi.org/working-papers/wpapp1.html>. Acesso em: 14 Jan. 2010.

AVIANI, Daniela de M. Os direitos dos obtentores: situação atual e perspectivas futuras. *In*: CONFERÊNCIA CIOPORA SOBRE DIREITOS DE OBTENTORES DE PLANTAS, 2009, Campinas.

BARROS, Bettina. Mercado de flores cresce em ritmo forte no país. **Valor Econômico**, São Paulo, 22 ago. 2011. Agronegócios.

BRASIL. **Lei de Proteção de Cultivares**. Lei n. 9.456, de 25 de abril de 1997.

BRASIL. **Lei de Sementes e Mudas**. Lei n. 10.711, de 05 de agosto de 2003.

BUAINAIN, Antônio M.; BATALHA, Mario O (Coord.). **Séries agronegócios:** cadeias produtivas de flores e mel. Brasília: Ministério da Agricultura, Pecuária e Abastecimento, Secretaria de Política Agrícola, Instituto Interamericano de Cooperação para a Agricultura, 2007. 139p. v.9. Disponível em: <http://www.iica.org.br/Docs/CadeiasProdutivas>. *Acesso em: 12 Fev. 2009.*

CARTA DE CAMPINAS. *In*: CONFERÊNCIA CIOPORA SOBRE DIREITOS DOS OBTENTORES DE PLANTAS. Campinas, 2009. Disponível em: <http://www.ciopora.org/fileadmin/assets/pageDownloads/2008/CARTA_DE_CAMPINAS.pdf>. Acesso em: 25 Jun. 2010.

CARVALHO, Sérgio M. P. de. **Propriedade intelectual na agricultura.** Campinas, 2003. Tese (Doutorado) – Universidade Estadual de Campinas, Instituto de Geociências.

COASE, Ronald H. The problem of social cost. **Journal of Law and Economics.** v.3, n. 1, p. 1-44, 1960.

COMMUNITY PLANT VARIETY OFFICE (CPVO). **Annual report 2006**. Luxembourg: Office for Official Publications of the European Communities, 2007. 83p. Disponível em: <http://www.cpvo.europa.eu/main/en/home/documents-and-publications/annual-reports>. Acesso em: 20 Fev. 2009.

_____. **Annual report 2009**. Luxembourg: Office for Official Publications of the European Communities, 2010. 78p. Disponível em: <http://www.cpvo.europa.eu/main/en/home/docu-ments-and-publications/annual-reports>. Acesso em: 17 Abr. 2010.

_____. Applications and titles in force, 2011b. Disponível em: <http://www.cpvoextranet.cpvo.europa.eu/WD140AWP/WD140Awp.exe/CONNECT/ClientExtranet>. Acesso em: 31 Jul. 2011.

DIEZ, M.C.F. The impact of plant varieties rights on research: the case of Spain. **Food Policy**, n. 27, p. 171–183, 2002.

EATON, Derek J. F. Intellectual property rights in plant breeding and biotechnology: a comparative institutional analysis. *In*: CONFERENCE OF THE INTERNATIONAL SOCIETY FOR THE NEW INSTITUTIONAL ECONOMICS, 11., 2007, Reykjavik. **Conference Programme**… ISNIE, 2007. Disponível em: <http://www.isnie.org/programme-2007.html>. Acesso em: 14 Jan. 2010.

_____. Trade and intellectual property rights in the agricultural seed sector. In: CONFERENCE OF THE INTERNATIONAL SOCIETY FOR THE NEW INSTITUTIONAL ECONOMICS, 12., 2008, Toronto. **Conference Programme**… ISNIE, 2008. Disponível em: <http://www.isnie.org/isnie2008-program.html>. Acesso em: 29 Out. 2009.

EATON, Derek J.F.; MEIJERINK Gerdien. Markets, institutional change and the new agenda for agriculture. **Markets, Chains and Sustainable Development Strategy and Policy Paper**, Wageningen University, n. 6, p.1-25, Mai. 2007. Disponível em: <http://www.boci.-wur.nl/UK/Publications/>. Acesso em: 14 Jan. 2010.

EATON, Derek J.F.; VAN TONGEREN, Frank W. Mixed incentive effects of IPRs in agriculture. *In*: ANNUAL CONFERENCE OF THE INTERNATIONAL CONSORTIUM ON AGRICULTURAL BIOTECHNOLOGY RESEARCH, 8., 2004, Ravello. **Conference papers...** ICABR, 2004. Disponível em: http://www.economia.uniroma2.it/conferenze/icabr-2004/papers/default.asp>. Acesso em: 12 Fev. 2010.

EGGERTSSON, Thráinn. A note on the economic of institutions. *In*: ALSTON, L. J. *et al* (Org.). **Empirical studies in institutional change**. Cambridge: Cambridge University Press, 1996. p. 6-24.

ENDRES, A. Bryan; GOLDSMITH, Peter D. Alternative business strategies in weak intellectual property environments: a law & economics analysis of the agro-biotechnology firm's strategic dilemma. **Journal of Intellectual Property Law.** v. 14, n. 2, p. 237-268, 2007.

EVANS, Anabel. Creativity is in the interest of all. FloraCulture International, Heiloo, v.17, n. 2, p. 12-15, fev. 2007. Disponível em: <http://www.floracultureinternational.com/index.php?option=com_content&task=view&id=12&Itemid=114>. Acesso em: 20 Fev. 2009.

FALCON, W.P.; FOWLER C. Carving up the commons: emergence of a new international regime for germplasm development and transfer. **Food Policy**, n. 27, p.197-222, 2002.

FLOWER COUNCIL OF HOLLAND. Facts & figures, 2008. Disponível em: <http://www.-flowercouncil.org/int/holland/facts_figures/>. Acesso em: 16 Out. 2009.

FUCK, Marcos P. **A co-evolução tecnológica e institucional na organização da pesquisa agrícola no Brasil e na Argentina**. Campinas, 2009. Tese (Doutorado) – Universidade Estadual de Campinas, Instituto de Geociências.

JUNQUEIRA, Antônio. H.; PEETZ, Márcia da S. Mercado interno para os produtos da floricultura brasileira: características, tendências e importância socioeconômica recente. **Revista Brasileira de Horticultura Ornamental**, v. 14, n.1, p. 37-52, 2008.

KENYA FLOWER COUNCIL. The flower industry in Kenya and market data, 2009. Disponível em: <http://www.kenyaflowercouncil.org/floricultureinkenya.php>. Acesso em: 20 Nov. 2009.

KIYUNA, I. *et al*. Floricultura brasileira no início do século XXI: o perfil do produtor. **Informações Econômicas**. v. 34, n. 4, p. 14-32, 2004.

LENCE, Sergio H. *et al*. Welfare impacts of intellectual property protection in the seed industry. **American Journal of Agicultural Economics** v. 87, n. 4, p. 951-968, 2005.

LESSER, Wiliam H. Assessing the implications of intellectual property rights on plant and animal agriculture. **American Journal of Agicultural Economics** n. 79, p. 1584-1591, 1997.

LOUWAARS, Niels P. **Seeds of confusion: the impact of policies on seed systems**. Wageningen, 2007. PhD dissertation – Wageningen University.

LOUWAARS, Niels P. *et al*. Framework for the introduction of Plant Variety Protection in developing countries. **North-South policy brief**. Wageningen University, n. 2, 2003.

_____. **Impacts of strengthened intellectual property rights regimes on the plant breeding industry in developing countries**: a synthesis of five case studies. Wageningen University, Centre for Genetic Resources, Wageningen, The Netherlands. 2005. (report commissioned by the World Bank).

MINISTÉRIO DA AGRICULTURA PECUÁRIA E ABASTECIMENTO (MAPA). Registro Nacional de Cultivares (RNC). **Registro Nacional de Cultivares: inclusões**, 2007b. Disponível em: <http://www.agricultura.gov.br/images/MAPA/cultivares/snpc_06_-24_09_2007.htm>. Acesso em: 07 Jul. 2009.

_____. Serviço Nacional de Proteção de Cultivares (SNPC). **Pesquisa de cultivares protegidas**, 2010. Disponível em: <http://extranet.agricultura.gov.br/php/proton/cultivarweb/-cultivares_protegidas.php>. Acesso em: 31 JuL. 2011.

NOGUEIRA, Antônio C. L. Propriedade intelectual em cultivares no Brasil: análise do marco regulador e comparação internacional. **Informações Fipe**. Fundação Instituto de Pesquisas Econômicas, n. 313, out. 2006.

NORTH, Douglass C. **Institutions, institutional change and economic performance.** Cambridge: Press Syndicate of the University of Cambridge, 1990. 164p.

PENNA, A. L. R. **An analysis of the impact of Plant Breeders' Rights legislation on the introduction of new varieties in UK horticulture**. [Kent], 1994. PhD dissertation, Wye College, University of London, 1994 *apud* LESSER, William, H. Assessing the implications of intellectual property rights on plant and animal agriculture. **American Journal of Agicultural Economics** n. 79, p. 1584-1591, 1997.

PIZANO, Marta. Flora Brasilis. **FloraCulture International**, Heiloo, v.18, n. 9, p. 58-59, set. 2008. Disponível em: <http://www.floracultureintemational.com/index.php?option=com_content&task=view&id=196&Itemid=114>. Acesso em: 25 Fev. 2009.

SCOTCHMER, Suzanne. The political economy of intellectual property treaties. **The Journal of Law, Economics, & Organizations**, v. 20, n. 2, p. 415-437, 2004.

SHIRLEY, Mary M. Institutions and development. *In*: MÉNARD, C.; SHIRLEY, M. M. (Org.). **Handbook of New Institutional Economics**. Dordrecht: Springer, 2005. p. 611-638.

SILVEIRA José Maria F. J.; BORGES Izaías. C. Um panorama da biotecnologia moderna. *In*: SILVEIRA J. M. F. J. *et al* (Org.). **Biotecnologia e recursos genéticos: desafios e oportunidades para o Brasil.** Campinas: Instituto de Economia/FINEP, 2004.

TRIPP, Robert *et al*. **Intellectual property rights**: designing regimes to support plant breeding in developing countries. Washington: World Bank - Agriculture and Rural Development Department, 2006. Report 35517-GLB.

_____. Plant variety protection in developing countries: a report from the field. **Food Policy**, n. 32, p.354-371, 2007.

UNION POUR LA PROTÉCTION DES OBTENCIONES VEGETALES (UPOV). **UPOV Report on the impact of Plant Variety Protection**. UPOV document n. 353(E), Geneva, 2005. Disponível em: <http://www.upov.int/en/about/pdf/353_Executive_Summary.pdf>. Acesso em: 19 Fev. 2009.

VAN ROOIJEN, Silvia. R. P. S. **Proteção de cultivares no Brasil e seu impacto para o setor de flores e plantas ornamentais**. ABPCflor Associação Brasileira de Proteção de Cultivares de Flores e Plantas Ornamentais**.** Atibaia, 2006.

WILKINSON, John; CASTELLI, Pierina. G. **A transnacionalização da indústria de sementes no Brasil**: biotecnologias, patentes e biodiversidade. Rio de Janeiro: ActionAid Brasil, 2000. Disponível em: <http://www.actionaid.org.br/Portals/0/Docs/sementes.pdf. Acesso em: 20 Fev. 2009.