# PAMPAS FAMILY FARMS AND TECHNOLOGICAL CHANGE: STRATEGIES AND PERSPECTIVES TOWARDS GENETICALLY MODIFIED CROPS AND NO-TILLAGE SYSTEMS*

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## INTRODUCTION

Agriculture in the Argentine Pampas region has been changing its technological pattern in the last decade, in an international context in which biotechnological innovations have great influence. A great many of these changes have not yet expressed their environmental and social consequences, but it is possible to ask some questions about these processes, especially in relation to social actors who are in the most vulnerable situation in structural terms.

In this regard, the aim of this article is to analyse the strategies and perspectives of the Pampas family farmers towards the new technological paradigm composed of no-tillage systems and transgenic varieties, and to state some possible social consequences related to its expansion.

This kind of issue, together with the concern for on-going processes, supports a qualitative approach, based in case analysis. The point of departure for this paper is a research project which focussed on pluriactive family farmers of Junín, an area situated in the north-west of the province of Buenos Aires.[1] For this latest paper, I selected from the typology of family farmers constructed within that earlier study, a sample of those who could be considered representatives of each stratum, to follow their evolution - contrasting their situation in September 1998 with September 1999 - and to explore their strategies and perspectives towards technological issues.

In spite of the fact that this methodological approach presents some limitations concerned with the generalisation of the findings, I think its potential lies in the possibility of generating new hypothesese and a research agenda involving work in an under-researched subject. In fact, the recent literature shows a prevailing interest in important issues like the mergers of biotechnological or agrochemical firms or the degree of acceptance of consumers of genetically modified food (subjects which have recently been much discussed on the Internet). But the concern with producers is rather minimimal, in spite of the fact that they are the actors who adopt these technologies and who, with their decisions, affect the type of agricultural system that is being developed.

In the Pampas region, which is the focus of this study, the technological issue is a very important one. Among other variables, the dependence on external inputs for production from institutions that provide credit for investment and development purposes, and the commercialisation of practically all the production (an important part of which is at the international level), is evidence of the high degree of market integration of the average Pampas producer, or from another perspective, his/her vulnerability and indirect subsumption to capitalism (Whatmore et al 1987). On the other hand, the importance of the technological issue has been highlighted in Argentina in a macroeconomic context defined by the absence of farm subsidies and the implementation of the set of measures popularly called the 'Plan de Convertibilidad', that is, the equivalence between the peso and the dollar, de-regulation and a reduced role for the state in economic activities. As noted elsewhere:

> Taking into account the price of commodities, the economic performance of the Pampas farms depends exclusively on factor productivity, because the possibility of lobbying to fix different exchange rates, as well as the opportunities generated by high inflation, have faded away. *So the only variable in the hands of producers turns out to be production costs, and the incorporation of technology is the only open way to reduce them* (Chudnovsky et al.1999: 2).

Even from different perspectives at the international level, there is a coincidence in the fact that these new technologies will bring about great changes in the agrarian sector, which include the expansion of the agrarian frontier in areas up to now considered as marginal. A no-tillage system (which implies sowing without ploughing the soil) facilitates a better use of rainwater, allowing the cultivation of soybeans in areas affected by drought. Alternatively, biotechnology, with the development of plants that resist salty, cold or dry soils, acts in the same direction.

One of the changes associated with these developments is a greater articulation of producers with agribusiness - the provider of these new technologies - and an increase in vertical integration. In this light, the development of techniques which allow the differentiation of products - a new stage in the evolution of biotechnology, which aims not to improve

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[1] 'Family farms' are considered as those with family involvement in physical jobs which are relevant on a day-to-day basis for the functioning of the farm. Pluriactivity is defined in broad terms, involving the fulfilment of on-farm and off-farm activities by the family, in the agricultural or non-agricultural sector. This definition includes 'machine contractors' among pluriactive farmers.

agronomic traits of crops but to modify the quality and nature of them - would bring about different types of upstream articulation:

> Maintaining the value of a commodity with improved attributes will require identity preservation, including segregation of the value-enhanced commodity by farmers and processors. Increased vertical integration, including production contracts, is likely to occur in grain production to ensure this result (Pasour 1998:16).

This scenario has also been identified in the case of Argentina, although the development of quality traits related to differentiated crops is still in an experimental stage:

> The role of the agrarian producer will change. He will lose in a great measure the sense of individualism and independence, which has been a characteristic up to now. The producer who aims to survive will have to associate to compete, or commercially integrate with big firms with practically unlimited resources...Deals between producers and firms to develop crops with precise quality traits are likely to develop (Pizarro 1998: 47).

With regard to the possible consequences of these technologies on agrarian structure, the (large) scale requirements of no-tillage systems have been noted, while in relation to transgenic crops, it has been emphasised that they are developed by a handful of international firms, and protected by property rights. This can lead to the impoverishment of small farmers by raising their production costs.

However, it is difficult to be unequivocal about the patterns of structural change likely to arise in farming due to biotechnologies, because these methods may trigger mutually off-setting trends. As Goodman (1991) has pointed out, a technological determinist explanation of social change is necessarily partial and incomplete, as it does not take into account the actors' strategies and socio-political processes.

From this point of view, my research concerns were diverse but related: what is the degree of adoption of these new technologies among different types of family farmers? What kind of restrictions do they find and what strategies do they develop to face them? What is the degree of viability of these strategies? How do farmers judge these new technologies and the industries that provide them?

## THE STAGES IN THE EVOLUTION OF PAMPAS AGRICULTURE AND THE NEW TECHNOLOGICAL PARADIGM

The evolution of Pampas agriculture from the mid-twentieth century up to the mid-1980s, has been traditionally divided into four stages, each of which is centred in the diffusion of four groups of innovations; agronomic techniques, mechanisation, improved seeds (hybrids in the case of corn, sunflower and sorghum), and agrochemicals. Over this period there occurred what has been termed the 'agriculturisation' of the Pampas region, that is to say, the expansion of the area devoted to agriculture, as well as the concentration of production in five main crops (wheat, soybeans, corn, sunflower and sorghum) (Obschatko 1988).

Agriculturisation took place in a context of changes in production scales and social processes, which included modernisation of part of the big traditional estates (*estancias*), the transformation of part of the family farmers into small renters, and the constitution of new actors, known as 'machine contractors', who offer their services to all types of farms. These machine contractors include farmers who basically employ family labour, and firms which own machinery but not land.

The last decade, well-known as a period of intense change in the macroeconomic context, shows an intensification of agricultural production, most importantlty involving the incorporation of technological packages in some cases or isolated practices in others, aimed at improving the potential capability of the available crops. In this period, the incorporation of technology, as well as management qualities and productive efficiency, turned out to be essential in order to develop (Pizarro 1998).

The most important features of this new stage are the diffusion of reduced tillage and no-tillage systems, a greater use of agrochemicals - particularly herbicides, because of the increase of weeds derived from not ploughing the soil - an increasing use of fertilisers and the introduction of irrigation. In addition, this stage involved the diffusion of transgenic varieties such as 'Round-up Ready' (RR) soybeans resistant to glyphosate, and BT corns resistant to some lepidopters (Pizarro 1998).

With reference to no-tillage systems, although the first tests took place in the 1970s, the technique only gained momentum in the 1990s, with the appearance of more specific herbicides together with adequate sowing machines. The introduction of RR soybeans in 1996, changed the possibilities of adoption of no-tillage systems dramatically, as the technology delivered an easier and much cheaper solution to the main problem of this technique, i.e. weed control[2].

[2] No-tillage costs were very much simplified with transgenic varieties, because with reference to operation costs, what was saved in labour was in turn spent in expensive herbicides. Older varieties with more resistance needed bigger quantities of herbicides, whereas it turns out that with transgenic varieties, one dose of glyphosate is all that is needed (Farmer Interview 1999) .

Thereafter there appeared a package in which no-tillage systems implied the use of transgenic varieties and glyphosate. However, it must be noted that the use of transgenic varieties with reduced or conventional tillage is possible and actually is most prevalent. Some figures may show the importance of the technological change which is taking place:

1) By 1997, the sale of no-tillage sowing machines reached 12,870 units. In terms of cultivated area with this system, there was an increase from 300,000 hectares in 1990-91, to 5.5 million in 1997-98, a figure that represented nearly 25% of the average cultivated area in 1995-98 (Chudnovsky et al. 1999). In the view of these researchers, the expansion of no-tillage systems in Argentina has been occurring at a very high rate, surpassing the United States in proportion of cultivated area, and doubling by the year 2003. In relation to this data, it should be noted that for the 1996-97 season, 57 percent of the area with no-tillage corresponded to soybeans in 'second planting[3] and 16 percent to 'common' soybeans.

2) The agrochemical market trebled in the 1992-97 period, growing from $336 million to $924 million.

3) The seeds market grew form $524 million in 1992 to $872 million in 1996 (ASA 1999). The expansion of transgenic seeds was even more remarkable; at the international level, Argentina holds second place in terms of the area cultivated with these seeds.[4] Genetically modified soybeans represented 20 percent of the soybean-cultivated area in 1997/98, and 72 percent in the following season (Gutman 1999). It was estimated that in 1999, it would reach nearly 90 percent of the cultivated area. In contrast, the adoption of genetically modified corn and cotton is lower, at 30,000 and 8,000 hectares respectively (Hopp 1999a; Sosa Belaústegui 1999).

These data - at least those that refer to genetically modified soybeans - are impressive. It is worth noting that in the United States, the country with the greatest area under genetically modified crops, the level of adoption of soybean is not so pronounced, comprising as it does 50 percent of the soybean area. This situation has important consequences in commercial terms, considering the leading position of Argentina in soybean oil and flour exports.

Together with the diffusion of these technologies, other changes that took place in the Pampas agrarian structure during this decade included a decrease in the number of farms and an increase in the average area of the remaining farms[5], an increasing externalisation of productive tasks carried out by machine contractors, and the constitution of new forms of productive arrangements known as *pools de siembra* (sowing pools).[6]

**FAMILY FARM STRATEGIES TOWARDS THE NEW TECHNOLOGICAL PARADIGM**

As pointed out earlier, the aim of this paper is to analyse the technological issues facing the typical family farmer of the region. Taking into account the pluriactivity study previously carried out (Craviotti 1999), three strata of family farmers can be identified:

a) A 'low resources' family farmer: employs family labour complemented with the use of machine contractors for certain tasks, and owns up to 150 HP traction force. He also fulfils off-farm activities in the non-agrarian sector.

b) A capitalised family farmer: employs family labour complemented with the use of machine contractors for certain tasks, and owns more than 150 HP traction force. He also works as a machine contractor.

c) An entrepreneurial family farmer: owns more than 150 HP traction force and a great variety of modern machinery, and employs at least one permanent worker. He also performs tasks as machine contractor and other non-agrarian off-farm activities.

It was hypothesised that the incorporation of new technologies would be markedly different in the three strata, and that the nature of off-farm earnings would be related to adoption. In considering no-tillage systems, the scale requirements and the social implications of this technique are clear:

> In spite of the fact that no-tillage systems can be applied to any size of enterprise, it involves a drastic decrease in workforce and an increase of planted area on the part of the producer. Certainly it will contribute to a decrease in the number of farmers and an increase in the training and skills of those who remain.... The socio-economic

[3] This refers to soybeans sown in an area which was previously devoted to another crop (normally wheat) in the same season.

[4] By 1999, 39.9 million hectares were planted to transgenics, a 44 percent increase in the single year, 1998-99. By agricultural industry standards, this high rate of new technology adoption is virtually unprecedented. Yet the pattern of adoption is highly skewed; 99 percent of commercial adoptions - by planted area – has so far taken place in just three countries: the United States (72 percent of the global area in 1999), Argentina (17 percent of global area) and Canada (10 percent of global area). Only nine other countries were growing any transgenic crops at all in 1999 (China, Australia, South Africa, Mexico, Sapín, France, Portugal, Rumania and Ukraine) and their combined acreage added up to just 1 percent of the global total (Clive James, 'Global Review of Commercialized Transgenic Crops: 1999', ISAAA report No. 12-1999, Ithaca, NY: ISAAA, cited by Paarlberg, 1999).

[5] Contrasting data from the 1988 Agrarian Census with those of the 1999 Experimental Census in Pergamino, a county representative of the region studied.

[6] Pools are formal or de facto associations that manage contributions (in the form of capital, land or services) of different 'actors', with the purpose of carrying out production over large areas (generally over 1000 hectares). Benefits are distributed in proportion to the contribution of each actor in inputs, operational or management tasks, capital and land. The expansion or contraction of these arrangements is related to grain price cycles.

implications should be considered by the political sector, because of the possible impact on the development of rural communities (Lattanzi 1998: 33).

One of the main restrictions in the adoption of this technique by small and medium-size farmers, derives from the lack of modern sowing machines, the key element of this technology. Farmers find it difficult to recover the cost of machinery (which stand at nearly $40,000), which is double the cost of the full range of sowing equipment required in conventional tillage. In this respect, a study carried out in Pergamino, a province of Buenos Aires, found that in no-tillage systems, there is a threshold of 200 hectares at which point the purchase of these machines is profitable. So adoption is justified for large or medium-sized farmers who also work as machine contractors. Small-size farmers only employ this technology in the sowing of 'second planting' soybeans, but they usually contract the service (Blanco 1999).

Another limitation on adoption arises from the importance of one-year renting in the Pampas region, which restricts knowledge about the type of soil and prevents crop rotations, both of which are relevant in a no-tillage system. On the other hand, the savings in labour and time that this technique brings about, are not so important for small and medium-size farmers (Berdini et al. 1998).

The findings from the case study are consistent with this evaluation, but also reveal further elements about the strategies developed by these types of farmers. They show that in what I term 'low resource' and 'capitalised' family farmers, the incorporation of no-tillage systems takes place later, only in 'second planting' soybeans and only in *part* of the area devoted to this commodity. In 'entrepreneurial family farmers', the incorporation of this technique is much more consolidated; it covers 100 percent of the soybean planted area and it is also found in corn, although not to the same extent. It is important to emphasise that the difference did not occur, as it was predicted *a priori*, in capitalised family farms, but in entrepreneurial ones, where the employment of at least one permanent worker probably denotes a higher production scale.

The main reasons for the more extended adoption of no-tillage in 'second planting' soybeans are that it simplifies work and saves time at a crucial period (the sowing of soybeans must be done in a very short period of time, immediately after the wheat harvest), and also brings about higher yields because it preserves the humidity of the soil. It is clear that the technique has been adopted mainly for the economic benefits although those who have practised this technique over a long period of time also mention the improvement of soil qualities. Non-agricultural off-farm work also affects positively the adoption of no-tillage in soybeans, because it helps at the time at which job requirements overlap, that is, with sowing.[7]

The adoption strategies that prevail are the use of machine contractors or the adaptation of sowing machines; exchanges of labour take place to a lesser extent. The adaptation of machines occurs in those cases involving at least 200 hectares and upwards; the purchase of a sowing machine only was found in one case, i.e. a farmer who was expanding the cultivated area through land rental (in part associated with a seed firm), and was 'influenced' by this association.

These strategies clearly face limitations. Contracting the service means that small farmers are '*last in the queue*', compared to larger farmers. On the other hand, and perhaps more important, is the fact that farmers are externalising an operation previously done by themselves, changing their role as producers and increasing their needs for operating capital.

The adaptation of sowing machines implies an investment of at least $8,000 and requiring several tests as well as technical advice. Likewise, these machines are not so convenient for those farmers who work also as machine contractors, since they are much slower than no-tillage sowing machines, which places them on unfavourable terms in the competition with other machine contractors. Last but not least, adapted machines hinder the sowing of other crops such as corn which, unlike soybeans, require the application of two different fertilisers together with sowing.

Another possibility is the purchase of sowing machines through farmers´ associations. However, the most suitable machines for this kind of arrangement are those that represent a technological improvement, are expensive and are neither a continuous nor a fundamental implement for carrying out production (Tort and Lombardo 1992). No-tillage sowing machines meet all of these features, except for one; they are critical for production. Sowing must be done in a timely manner – over a specific period - with the difficulty about agreeing to take turns being a main issue for the success of these enterprises.

As regards the adoption of RR soybeans, it must be noted that they are inputs which need not to be tested over the full extent of the cultivated area, which thereby minimises the risks associated with the innovation. This probably explains why the differences in adoption rates are not so marked among the categories of family farmers considered, although it has taken place later in 'low resource' farmers. On the other hand, there is an evident coincidence in the nearly total adoption of this soybean in 1999/2000 season. The main reasons are that it simplifies the management of soybeans (it requires the use of only one type of herbicide, which may be applied at almost any time); at the same time, costs are lower and the result, *in terms of weed control*, are guaranteed. Preference occurs in spite of the fact that transgenic varieties are supposed to bring about lower yields than conventional varieties.

Strategies developed in order to diminish the cost of seed (which is high in relation to total costs and which was particularly elevated in the 1996-97 season) are;

a) The purchase of second multiplication seeds;

[7] In the Pampas region, another work demanding timely activity is the harvest, which is mostly contracted.

b) saving seed for own use; and,

c) the exchange of seeds between farmers.[8]

It is clear that the viability of these strategies and their maintenance in time depends on the need of the farmer to buy new or more effective varieties.

**FAMILY FARMERS' PERSPECTIVES TOWARDS NEW TECHNOLOGIES**

In this section, I attempt to keep track of the technology issue, focusing on the actors' perspectives: How do they place themselves with respect to these new developments? Do they visualise these techniques as 'attainable' or as new forms of exclusion?

Concerning no-tillage technology, family farmers interviewed clearly visualise the limitations they face as small and medium-size producers:

> To apply no-tillage nowadays we ought to have a big sale, but nobody will buy the tools we have; or rather we should make a big pit, bury all of the equipment and buy a new sowing machine, a fumigator. We still can use our tractors. Otherwise, we either die in the attempt or kill everyone, because with a sowing machine, we will have to work ten times as much as what we worked before, so if we translate this to the type of farm we have in this area, the farmer who worked 100 hectares will have to work 1000, so as to be profitable. If there are ten farmers working 100 hectares each, nine will have to disappear. I don't know if it is going to be me or if it will be the other nine. (...) Apart from that, there is another issue: in this area, in order to do no-till, you need not only the sowing machine and the fumigator but also everything else has to be adapted; farms must be big, you have to eliminate fences, because you have to work in an organised way. You can't harvest and at the same time trample the field, because afterwards it affects the result (Farmer Interview 1999).
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> Sometimes I think: we have all the tools in the shed and we still pay for other peoples' tools (Farmer Interview 1999).

Reduced tillage, rather than no-tillage, seems a more viable option to these types of farmers, as it requires a change in farming practices using the machinery they already have (Cloquell and De Nicola 1999). That is why it can be found not only in 'second planting' soybeans, but also in other crops, such as corn. From the farmers' point of view, the restriction on the use of no-tillage in corn has to do in part with scale requirements. Adapted sowing machines are not suitable in these cases, and a complete change of the machinery is needed (Refer to Appendix One):

> Why don't you find no-tillage in corn? Because you face a rainy autumn or a bad winter, then the soil is soft, you make big tracks, how do you manage to sow then? You have to do a reduced tillage at least...You need special carts, with special tires, caterpillars, so you don't trample the soil; this doesn't happen with second planting soybeans because the wheat harvest generally is a dry one (Farmer Interview 1999).
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> I am interested in no-tillage in second planting soybeans, maybe I would be interested in common soybeans once I've mastered it; with corn I'm not convinced yet. Besides, it is a matter of management, of implement costs, we have the machinery adapted from conventional to reduced tillage and in order to pass to no-tillage you have to change everything (Farmer Interview 1999).

Another reason arises from the fact that corn sowing must be done in a much more careful way, requiring greater technical knowledge and external advice:

> Actually, soybeans are weeds you sow; it is very hardy stuff, it grows anyway, whether it is sown very close together, whether it gets enough light or only a little; these are details, but you can harvest all the same. It is not the same as corn where the sowing must be done in a much more careful way...If you sow five seeds in a metre and you miss two, then the corn is a mess, if you sow too much and it germinates everything, then it is overloaded, it doesn't work (Farmer Interview 1999).

Concerning genetically modified seeds, it is worth noting that the farmers interviewed associated '*transgenic*' with glyphosate resistance, so from their point of view, BT corn, also a genetically modified seed, is *not* transgenic at all.[9]

With regard to the question of the possible consequences of these seeds in environmental terms, only one of the farmers interviewed stated his doubts with respect to this:

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[8] This practice of saving seed is not new, although it was probably strengthened because of the high price of transgenic soybeans during the first years of market introduction. In the eighties, when these varieties did not exist, it was stated that nearly 60 percent of the cultivated area was sown with farmer-owned seed. (Obschatko 1988).

[9] The relationship between the farmers' characterization and the marketing strategies of the agricultural business firms should be further investigated. The president of Nidera, one of the leading firms in Argentina stated that 'in corn, the most important achievements are corn resistance to Round-up, to Liberty-Link and to Lightning - but transgenic corns have not been approved in our country yet' (La Nación, 7/8/99). Up to that date, Argentine authorities had authorized the commercialization of at least three transgenic corns (Res. SAGPyA 372/98, 429/98 and 535/98).

> Soil is going to be used as a sponge, where we are going to apply the amount of fertilisers needed, and of chemicals to destroy the weeds, and later we will harvest. First we destroyed it by plowing it, now we will burn it with what we add to it (Farmer Interview 1999).

Although the few objections that farmers have towards the environmental questions related to the use of transgenic seeds may be impressive, it should be noted that local environmental and consumers' movements against genetically modified organisms (GMOs) were not much developed at the time of this study. Besides, the farmers' assessment of GMOs is not being made in absolute terms but in *relative* terms. That is to say, their comparison is with the cultivation of 'conventional' soybeans, which need up to three different herbicides, some of them with strong residual character. It is in relation to these that farmers judge RR soybeans as 'better':

> I think that glyphosate is good on soil erosion and maybe on soil contamination too. I will explain to you why. Round-up has less toxicity than an aspirin, in the same amount of milligrams. What I don't know is the effect that Round-up Ready soybeans can produce on human consumption; nobody knows. It is like the mad cow disease. [In relation with the soil] I feel safer with it than with the herbicide cocktails we used before (Farmer Interview 1999).

In fact, considering the high level of market integration of these farmers, it can be stated that a change in their perspectives is strongly linked to the evolution of demand, in brief, with the payment of a premium price for non-transgenic grains.

Similar to the situation found in the case of no-tillage systems, in the case of transgenic seeds, family farmers indicate that the reason they restrict their adoption to crops other than soybeans is because:

> The culture that we have is to sow corn not in weedy fields, but in clean ones, maybe we don't need a transgenic corn (Farmer Interview 1999).

Another important restriction arises from the fact that the new seeds are hybrids, which must be bought in each season, instead of varieties that may be multiplied and saved by the farmers for their use. As I previously indicated, this is one of the factors behind the family farmers' strategy.

It can be stated that family farmers find genetically modified seeds 'attainable', provided they can develop the strategies noted previously; but these imply some sort of response on the part of the seed firms. An issue explored in the context of this research was related to how farmers visualised their capacity to deal with powerful actors such as the agribusiness firms:

> ...For the last four years they have been playing with *publicity*. The big enterprises merged: Monsanto, Dekalb, Agrevo and I don't know which others; their aim was to compel the farmer to purchase everything, the seed, the chemicals... That's why there was a great struggle, the guys were going to make good money... A bag weighing fifty kilos cost fifty pesos, I need seventy-five, eighty kilos. The price fell because the demand dropped. Everyone produced his own seed, so they also made a mistake (Farmer Interview 1999).
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> … What I do know is that they are going to introduce a gene and that the seed is not going to germinate; well, I've got the seed, for ten years I manage with it. And we come back to the same, if they are going to charge eighty bucks for the hectare of seed, I'll go back to the common one (Farmer Interview 1999).

Generally the farmers assess the strategies they develop as successful, although they take place within the boundaries of a productive pattern that does not leave too many options available to them:

> I don't know what is going to happen in the next twenty or thirty years, working in this kind of activity, with this rhythm, each time we take more out of the soil, some years ago one talked about corn that yielded fifty thousand kilos, today one talks of ten thousand; one must talk of ten thousand because the farmer that obtains only seven is left behind (Farmer Interview 1999).

**SOME FINAL REMARKS**

This research work leads me to the conclusion that although a change in the technological pattern in the Argentine Pampas region is taking place, this change is restricted to the cultivation of soybeans, where the use of both technologies - no-tillage and transgenic varieties - is more extended. In other crops there is a more heterogeneous situation.

Besides, quantitative and qualitative data support the suggestion that there are different stages of use of no-tillage in the different categories of family farmers. There is a more marked and earlier adoption in entrepreneurial family farmers, and this is probably related to their larger scale of production.

With respect to RR soybeans, its generalised adoption probably has to do with its 'neutral' character in relation to the size of the farm, and its impact in lowering costs, in a difficult macroeconomic context in which the evolution of commodity prices and economic policies did little to defend vulnerable family farmers.

Another issue that arises from the analysis of in-depth interviews is that family farmers should not be considered as *passive* subjects in the face of these technologies, but *actors* who, once they have decided on the adoption of a technological pattern, take advantage of all the means within their reach to keep up with these technologies, and to counterbalance the asymmetry of their relationship with agricultural firms.

It is not that they are setting an alternative pattern of production. Theirs are strategies that aim at integration within the leading productive pattern, that pursues profitability and is highly dependent on input prices and the evolution of international markets. Maybe in this aspect lies their greater vulnerability, since capital, either fixed or operating, turns out to be a central variable, as does the possibility of accessing it through financial institutions.

As I have demonstrated, the strategies which farmers developed present some limitations in relation to no-tillage systems. This may lead to the polarisation of the group of family farmers who also work as machine contractors. It is not easy to have access to this equipment and considering their work capacity, probably there will not be a demand for the services of all of them. They are successful in respect of transgenic seeds, although it must be taken into account that the development of technologies patented by agrochemical firms, which eliminate the germinative power of seeds or condition them to the application of certain products, might establish major limitations on these types of farmer, and lead to some being excluded.

State action in respect of these new technologies, and the participation of the different categories of agrarian producers in the committees that advise on these matters, appear then as fundamental for the viability of actors such as those studied, who find themselves in a clearly asymmetric situation.

From this perspective, I consider the institutional issue as particularly relevant and deserving further research, as well as the possible developments of contract farming (related to the production of differentiated grains), which would mean a qualitative transformation of the ways in which the commercialisation of production is traditionally practiced in the Pampas region.

**REFERENCES**

ASA (Asociación de Semilleros Argentinos), 1999. “La dinámica de la actividad”. In: htpp//intenet.alvisoft.com.ar/@asarg/espanol/mercados/merc_0897_06.htm

Blanco, Mariela. 1999. “Desarrollo sustentable: Las principales transformaciones agrarias sobre la base de la incorporación de sistemas conservacionistas en la región pampeana.” Paper presented in *Primeras Jornadas Interdisciplinarias de Estudios Agrarios y Agroindustriales*. Buenos Aires: Facultad de Ciencias Económicas, Universidad de Buenos Aires. November 4-5.

Berdini, W. A Couretot and C Senigagliesil. 1998. “La siembra directa en el ámbito de los productores de Cambio Rural del Norte de Buenos Aires.” Paper presented in *Primer Congreso de Profesionales de Cambio Rural*, Buenos Aires, May 20-21.

Buttel, Frederick. Olaf Larson and Gilbert Gillespie. 1990. *The Sociology of Agriculture*. Connecticut: Greenwood Press.

Chudnovsky, Daniel. Eugenio Cap, Eduardo Trigo and Sebastian Rubin. 1999.

*Comercio internacional y desarrollo sustentable. La expansión de las exportaciones argentinas en los años 1990 y sus consecuencias ambientales*, Documento de Trabajo 25. Buenos Aires: Centro de Investigaciones para la Transformación.

Cloquell, Silvia. and Mónica de Nicola. 1999. “Características de la sustentabilidad

agrícola en un área de producción familiar capitalizada.” Paper presented in *Primeras Jornadas Interdisciplinarias de Estudios Agrarios y Agroindustriales*, op.cit.

Craviotti, Clara. 1999. “Viejos y nuevos actores: La pluriactividad en las explotaciones

familiares de la región pampeana argentina”. Pp.123-146 in *Revista Paraguaya de Sociología* 104, Asunción: Centro Paraguayo de Estudios Sociológicos.

Goodman, David.1991. “Some Recent Tendencies in the Industrial Reorganization of the Agri-food System.” Pp. 37-64 in *Towards A New Political Economy of Agriculture,* edited by William Friedland, Lawrence Busch, Frederick Buttel and Alan Rudy. Boulder: Westview Press.

Gutman, Graciela. 1999. “Innovaciones tecnológicas y organizativas en complejos agroalimentarios. El complejo oleaginoso en el Mercosur”. Paper presented in *Primeras Jornadas Interdisciplinarias de Estudios Agrarios y Agroindustriales*, op.cit.

Hall, Alan. 1995. “Las contradicciones de la producción agrícola y el desarrollo de una agricultura sustentable: El caso de la labranza cero en Canadá”, *Ruralia* 5: 66-83.

Hopp, Esteban. 1999a. “Biotecnología agropecuaria: plantas y animales transgénicos.”

Paper presented in *Seminario Internacional Biotecnología y Sociedad.* Buenos Aires: Facultad de Derecho, Universidad de Buenos Aires. November 16-17.

---------. 1999b. “Entre mitos y realidades”, *Supercampo*, 57: 109-111.

Lattanzi, Alfredo.1998. “La siembra directa y la agricultura sustentable.” Pp. 29-33 in

*Siembra directa*, edited by José Luis Panigatti, H. Marelli, D. Buschiazzo R. Gil. Buenos Aires: Editorial Hemisferio Sur.

Obschatko, Edith. 1988. *La transformación económica y tecnológica de la agricultura pampeana, 1950-1984.* Buenos Aires: Ediciones Culturales Argentinas.

Paarlberg, Robert. 1999. *Agrobiotechnology Choices in Developing Countries*. Science,

Technology and Innovation Discussion Paper No. 1. Cambridge, MA: Center for International Development, Harvard University.

Pasour, E. 1998. *The Potential Impact of Increased Vertical Integration on North Carolina Grain Farmers*, North Carolina Soybean Producers Association.

Pizarro, José. 1998. *Evolución y perspectivas de la actividad agropecuaria pampeana Argentina*. Cuadernos del PIEA 6. Buenos Aires: Programa Interdisciplinario de Estudios Agrarios.

Rural Advancement Foundation International: *RAFI Communiqué*, March/April 1997,

July/August1998, in: htpp://www.rafi.ca/communique/fltxt/19983.html; *RAFI News*, 10/4/99.

Tort, María Isabel and Patricia Lombardo. 1992. *Formas asociativas para el uso de maquinarias en el agro. Estudios de casos en el área pampeana.* Parte II.

Buenos Aires: IESR-INTA.

Sosa Belaustegui, Magdalena. 1999. "Situación actual de cultivos transgénicos". Paper

presented in *Seminario Internacional Biotecnología y Sociedad,* op cit.

Teubal, Miguel, 1999. "Complejos y sistemas agroalimentarios: aspectos teórico-metodológicos". Pp. 97-120, *Estudios rurales. Teorías, problemas y estrategias metodológicas*, eidted by Norma Giarracca. Buenos Aires: Editorial La Colmena.

Whatmore, Sarah., Munton, Richard., Little, Jo., and Marsden, Terry. 1987. "Towards a Typology of Farm Businesses in Contemporary British Agriculture", *Sociologia Ruralis* XXVII (1): 20-37.

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