INTELLECTUAL PROPERTY RIGHT, INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE AND THE STAKES FOR FOOD AND NUTRITION SECURITY

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Introduction

The food crisis affects some countries, particularly in the South. The food crisis has its origin in the increase of the food prices. This increase is due to a combination of events: increase in food demand and decrease in food supply. This increase is particularly the result of an increase in the demand of agricultural production for industrial uses -nonfood production-. This gap between supply and demand is in addition accentuated by speculative behaviors of some people. The populations which are affected by this price increase are mainly those of the countries most dependent on foreign food (only 10% of the agricultural production - percentage variable according to the plant species- are making the object of commercial transaction at the level of the world food market, the majority of the exchanges takes place at the local, national at best regional level). The reduction of the dependence to foreign food seems today a priority in many countries. Thus, the governments speed up to have the access to seeds and agrochemical inputs, and to receive tractors in order to "start again" agricultural sector and to limit thus their dependence to foreign food and to the food price fluctuations. Is such an option most efficient at short and long-term - economically, socially and ecologically-?

At this stage, the choice of the quantity and quality of agricultural production and its uses –food and non food production- is strategic. That asks the question of the management of use conflicts under a constant agricultural production? There are then at least three options to increase the agricultural production for food and nutrition security under a constraint of constant climatic conditions: to increase the cultivated land areas; to regulate the competition between food and non food uses of agricultural production by limiting nonfood uses; to innovate to increase the agricultural production and to limit the conflicts. The first two options

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are rather delicate to implement: to increase agricultural areas seems to be delicate for at least two reasons: at the level of land use conflicts (including the urban expansion) and at the level of the impacts on biodiversity; the third option requires to think about alternative solutions to the nonfood production, that could be realized by the development of R&D activities and the creation of innovations.

My approach is on the incentives to create and to diffuse innovations. These innovations have for objective to increase the agricultural production at the level of each plant species, but also to develop the exploitation and to increase the production of plant species hitherto marginalized -marginal species for the plant breeder's companies but having a great interest at the food level for a large part of the world's population-. These innovations also have for objective to ensure a good adaptation or to propose "controlled development changes" vis-a-vis global changes (climate, biodiversity, …). The options to innovate are multiple:

1. To modify agricultural practices

- To be able to better valorize the actual seeds and agricultural inputs or to be able to adopt new varieties of seeds (with new input requirements, …). If the new seeds are adapted, the farmers adopt them if they have the capacities to response to the new input requirements and to access to sufficient water quantities which these new seeds require. The constraint on the access to water can be associated with the existence of infrastructures – irrigation systems, well, … -. The capacities of demand for seeds and other inputs by the farmers also depend on their solvency and on the demand by the final consumers, …;

- To be able to better mobilize ecosystem services at the level as well of the productivity –increasing yields, decreasing chemical input uses- as of the regulation of bioaggressor and/or of pollinator populations (Leroux and al., 2008).

2. To modify the inputs

- To be able to create inputs (of which seeds) adapted to the pedoclimatic conditions of the countries, including the breeding of plant species considered today as marginal by plant breeder's but with a strong potential of evolution (thus to go beyond the adaptation to go towards the controlled changes or structural changes of economic development). For example, it is more important to breed millet rather than maize in countries with a low quantity of water resources (Fears, 2006).

- To be able to create seeds which are well adapted to the implementation of innovation in agricultural practices. That could be done by proposing seeds which allow, for example, to better mobilize ecosystem services within the farm production systems.

3. To propose alternatives to the nonfood uses of the agricultural productions

- To be able to improve plant species in a non food production target and to be cultivated on nonagricultural land. It is the example of the jatropha which can be planted on unhospital lands and whose production is used to manufacture biofuels (not to omit to make the energy balance of such productions)

- To be able to mobilize new technologies. Kuzma and VerHage (2006) present a study on the nanotechnologies in which they show that it is probable that some technological developments are carried out at the level of the agricultural production (for example: better energy valorization of the stems). That would make it possible to bring an answer to the question of the competition between food and non food uses of the agricultural productions.

It is necessary to anticipate all of the possible changes and of course global changes not to defer the food risk in time and space. So, we have to propose sustainable solutions taking into account these anticipated changes (solutions have to be flexible):

- The option of innovation must take into account the maintenance of an ecological potential: The maintenance of capacities of adaptation and possibilities of structural changes (controlled development changes). It is a question of taking into account the potential existence of breaking down points which exceed the simple adaptation to changes;

- The option must analyze the way in which the ecosystem services are or could be mobilized within the farms to face these breaking down points.

The options implemented are all the more efficient as they take into account the characteristics of the countries (Trommetter 2007 and 2008): capacity of research, therefore to create and develop innovations; capacity of demand for seeds and inputs by the farmers (capacity of adoption and solvency), capacities of demand by the final consumers,… So, it is a question of market size for the upstream innovator. It is thus necessary to study the question of the food dependence with the other characteristics of the demand and the global changes.

That means that it is necessary to be interested in the allocation of rare resources and the property rights which are attached to: The implementation of intellectual property right to incite to innovate ; The definition of access to the innovations and to upstream technologies (for example which access to the genetic markers which can be patented) ; The implementation of access rights to the inputs of research (collections of genetic resources, collections of plant mutants,…) ; The implementation of rights on the land and the access to lands to carry out an agricultural production; …

I highlight that the analysis of the intellectual property and the access to the inputs of research are necessary and I also highlight that I'm conscious that this analyze is not sufficient to manage the food crisis. I propose to study the stakes associated with the implementation of an intellectual property right and the international treaty on the plant genetic resources for food and agriculture. I analyze how can be mobilize these tools to act on the food supply? To promote food safety is, indeed, one of the objectives of the treaty (art.1): "The objectives of this treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the convention on biological diversity, for sustainable agriculture and food security". In this note, I analyze the question of the intellectual property and its evolutions in the course of time and the consequences of the implementation of the international treaty. Then, I study the consequences so much for the countries having capacities of R & D and demand (as well for the seeds as for the associated inputs) as for the countries in which there does not exist research capacities, and where the conditions of demand could be diverse: countries having a solvent demand for the seeds and the inputs; countries without solvent demand. Finally I draw some conclusions and proposals for the future.

1. The question of the intellectual property

In this section I study in what way the implementation of an adapted intellectual property right can support research activities.

1.1 Trips agreements and intellectual property right options

Since the Trip's agreements (trade-related aspects of intellectual property, WTO, 1995) there is a liability for the Countries to implement a minimum level of intellectual property in the seed sector. Several options of protection do exist: the patent; the plant breeder's rights ("*Certificats d'Obtention Végétal de l'Union pour la Protection des*

Obtentions végétales, UPOV") and a *sui generis* systems. These options show different characteristics for the access conditions to the seeds and to the genetic resources which compose them:

- The patent limits in a drastic way the access to genetic diversity of the plant varieties and the possibility of reproduction of the seeds by the farmers.

- The plant breeder's right, since 1961, guarantees a free and automatic open access (without contract) to the genetic resources with a finality of research and plant breeding. This protection regime is implemented in 67 countries. Since 1991, a limit exists to open access, it is necessary that the new variety is not looked as being "essentially derived" from the preceding one (cumulative innovation). The plant breeder's right also allows, but in an optional way (at the level of each country), the possibility for the farmers to reproduce seeds (in a free or fee-paying way).

- Lastly, a *sui generis* system could be implemented. This system makes it possible to adapt the intellectual property rights to the constraints of the countries: protection of plant varieties which are neither homogeneous nor stable; access conditions to the genetic resources and reproduction conditions of the seeds at the level of each farm ...

The intellectual property system proposed by a Developing Country is generally weaker than the Plant breeder's right system in term of "what can be protected". Economically, the choice between these various options of intellectual protection can limit the diffusion of foreign plant varieties in a country and also the diffusion of its own plant varieties towards foreign countries. That joins the work of Goldsmith and al. (2006) which show that indeed too weak intellectual property rights can lead to restrictions in the diffusion of certain varieties and they propose large intellectual property right to diffuse seeds in developing countries. I do not totally agree with them, I argue that (Trommetter, 2008): "It is necessary to implement intellectual property rights that are sufficiently strong to encourage the diffusion of plant varieties and inputs from foreign origin (importing seeds which are bred elsewhere) and sufficiently weak to guarantee to the country the possibility of producing its own seeds and inputs". The question of the foreign food dependency could not be solved by the implementation of a foreign "input for agricultural production" dependency.

The arbitration between these various protection regimes is always managed at the level of the states. Thus in Europe, it is forbidden to patent a plant variety created by

traditional cross breeding whereas it is authorized in the US. In this example the access to genetic diversity is thus potentially more constrained in the US than in Europe.

1.2. Evolution of the match patent/plant breeder's right: a winner?

Since the beginning of the years 1990 with the genetic engineering advances and the settling of GMO varieties, the patent gains the ascendancy over the plant breeder's right, particularly in the US. Patents on genetic sequences and the claims grant at that time - patent claims to all of the functions in which a genetic sequence codes- were limiting factors and potentially blocking factors for future research and innovations: On the one hand because the access to genetic diversity is not any more guarantying and in addition because some patents could be tangled up and/or overlapping (risk of patent thicket). Vis-a-vis these risks and particularly the risk of blocking or delaying research, the patent offices and the States react to limit the risks of too broad patents - even if it takes some years-. Thus, the EU adopts the compulsory cross licenses between plant breeder's right and patent in the EU directive 98/44 on the legal protection of biotechnological inventions.

Today a researcher has the possibility to patent genetic sequences whose functions are experimentally proven; the claims are limited to functions that are close to the initial function. The risks of drifts and perverse effects of the patent system are thus limited. There is a rebalancing mechanism between the patent and the plant breeder's right. The importance of the access to genetic diversity is thus recognized, even if this access can become contractual and fee-paying. The plant breeder's right is revised and is saved partly thanks to the EU directive and to the FAO treaty (see next section).

The conditions for new countries to join the UPOV's club and the plant breeder's right protection regime depend on its long-term credibility. However, the plant breeder's right is again threatened because of the mobilization of biotechnologies in plant breeding, such as the selection assisted by molecular markers; this for several reasons:

- The possibility to quickly copy a specific characteristic developed by traditional breeding techniques ;

- The possibility to patent plant variety and also animal which are improved by traditional cross breeding assisted by molecular markers (e.g. patent EP 1069 819 on broccoli).

In the first option there is appropriation by the competitors of the work of the upstream plant breeder. In the second option, the possibility of patenting varieties implemented by traditional cross breeding modifies the strategy of Europe compared to the patentability of plants and animals until recent period. That situation can have negative consequences on the plant breeder's right, therefore to the access conditions to genetic diversity. The concerned patents, on plant and animal variety, are contested and the "European patent court of appeal" has to propose an interpretation of the expression "**essentially biological processes**".

The first option reveals "the weakness" of the Plant Breeders' Right, also in its version of 1991, insofar as new technologies make it possible to copy more easily expensive innovations. In that sense it is important to revise the Plant Breeders' Right if the objective is not to have it go out with the profit of the patent. An option suggested by ISF (2005) and Le Buanec (2006) is to set up one period during which the plant breeders would be committed to not using a plant protected by the Plant Breeders' Right. It would thus be a question of transforming the Plant Breeders' Right into a mini-patent, which was not UPOV's philosophy at the beginning. Another option is to dissociate access to the genetic diversity from access to the specific characteristics of the varieties. It would be a question of, for example, extending the concept of essential derivation to "essential derivation of specific characteristics" of the plant varieties protected by Plant Breeders' Right. We are moving toward a world in which access is guaranteed but in a contractual way, to limit the risks of privative appropriation.

In the second case, the question is not so much to reform the Plant Breeders' Right than to analyze the evolution of the patentability of the plant varieties. Let us note that the evolution of traditional plant breeding by mobilizing genetic selection depends on the conditions of access to the molecular markers and of the protection of the new variety. Two questions arise: On which plants are the markers used? Which are the conditions of access to the markers? Australia and Europe have the will to establish contractual open access to the markers ("open" here does not necessarily mean free), with the implementation of "national genotype centers" that could be managed by a public/private partnerships. The patents, which are accepted today on plant varieties selected by natural cross breeding assisted by molecular markers, are a potential source of debates and conflicts on the access to the genetic diversity

of the plant varieties and on the facilitated access to genetic resources exhorted in the international treaty which I reconsider in the following section.

Mobilization of biotechnologies in traditional plant breeding looks set to replace GMO, with the latter being developed only when the wanted characteristic is expressed in too weak a way inside the species. This substitution is justified because of the cost of the R&D activities. Cross-breeding associated with a marker-assisted selection is less expensive than traditional cross-breeding; less time is needed for research and the technology mobilized is well known. It is also less expensive than GMO technologies; the costs of creating a GMO are at least USD 20 million because of the long and costly "authorization for commercialization" (new GMO approval). This relationship could be modified according to the conditions of access to the markers and of protection of plant varieties, and could be less efficient for the plant breeders and the consumers if the conditions of access are too restrictive.

This point on the implementation or not of delays to have access to genetic diversity, whose molecular markers, is all the more fundamental as decision makers anticipate needs to answer and to adapt to changes which are able to appear rapidly. The stake of the intellectual property in the traditional cross breeding assisted by molecular marker is at the center of the debates, the decision of the "European patent court of appeal" is decisive for the future of the plant breeder's right system and for the future of the conditions of access to the genetic diversity and the other inputs of the research (collections of living materials, databases, ...) (Ménière and al. 2008).

1.3. Conflict of uses / conflict of rights

To limit the land use conflicts, some authors propose the multi-production starting from a same plant. The development of nano-innovations, so that plant varieties are made technologically multi-functional. For example, it would be a question of transforming the production of maize or wheat: the grains would be used for food, and the stem – thanks to the use, for example, of nanomaterial – could be used to manufacture efficiently biofuels (Trommetter, 2008). Indeed, the difference with the GMO marketing is due to the fact that the GMO could have several functions: food and pesticide for example, but with output at the level of the farm that is solely food. In the same way, the second generation GMO can lead to non-food production and thus be covered by the Convention on Biological Diversity. With nanotechnology it is possible to consider multiple productions – food and non-food – within the same farm and in the same plant variety. There is thus a potential conflict of rights at the

level of seed companies (Trommetter, 2008). To limit the risks of blocking (at least delaying) research, it will be imperative to reinforce the conditions for granting patents (Henry, Trommetter and Tubiana already proposed this in 2003) or prohibiting patents on the sequences, or limiting their claims to the functions experimentally proved to avoid having the intellectual property rights overlap. It is thus even more necessary than ever to reinforce the restrictions on the breadth of the patents.

1.4 Syntheses

At the level of the intellectual property rights options we note a certain number of important points. The plant breeder's right is regularly revised to be adapted, vis-a-vis the evolutions of the patentability system, with an objective of not to loose its specificity: to protect the innovation while allowing a free and non contractual open access to genetic diversity. The current evolution of the plant breeding with the mobilization of biotechnologies such as the selection assisted by genetic markers leads to two new risks for the plant breeder's right system: the possibility of quickly copying specific characteristics identified by markers; the possibility to patent plant varieties resulting from this new research organization. This double risk must be partially solved on the one hand in revising the plant breeder's right and on the other hand to give up the patents on the plant varieties which are the result of a traditional cross breeding even assisted by molecular marker. Technology, making it possible to identify the presence or not of the marker, is not an invention in itself.

At the level of the conflicts of uses and rights, I see that it is necessary to be vigilant and to take into account the risks of conflicts of rights when an objective is to support the pluri-production for a same plant variety. Genetic resources according to whether they are mobilized in food or industrial production do not have the same statute.

For the moment, the plant breeder's right is important because it is adopted by a sufficient number of countries so that the market which it covers is sufficiently large. The generalization of the patent in the plant breeding, including in Europe, would lead to the disappearance of the plant breeder's right for a lack of combatants.

The choice of the mode of protection of the intellectual property is thus strategic compared to the objectives related to the implementation of the Trip's agreements. If the objective is to instigate research, it is necessary to choose an intellectual property right which is adapted to the current level of research, not to penalize it. Thus, a country can establish a Plant Breeder's Right or a patent system to attract the innovations of the North associated

with a *sui generis* intellectual property right; the *sui generis* system has for objective to protect traditional varieties and authorizes marketing of the two types of seeds[2]. A farmer can then without any constraint choose the seeds he uses in his field.

The choice of an intellectual protection regime must facilitate the diffusion of the innovations while respecting the investment carried out by the upstream innovator.

2. International treaty and research organization

Compared to the stakes associated with the intellectual property right in the agricultural sector, it is necessary to recall that agriculture has a particular statute at the international level. Indeed, some agricultural plant genetic resources do not depend on the Convention on Biological diversity, but on the International treaty on plant genetic resources for food and agriculture. This situation has some consequences on the future models of intellectual property rights.

2.1. The objectives of the treaty

Parallel to the various options of intellectual property which are undoubtedly necessary and non-sufficient to encourage innovation in the agricultural sector, the international treaty proposes an option for the access to the genetic resources which is based on a multilateral system of exchange of the genetic resources. The access to diversity is at the same time an insurance vis-a-vis the future and a necessary condition to improve the production of the plant varieties. This multilateral system of access and benefit sharing aims to extend the range of the available resources for the plant breeders (Article 10.2. and 11.3.) and for farmers.

The objective to support the exchanges and the innovations is completely compatible with an intellectual property protection regime such as the plant breeder's right but not necessarily with the patent with which it is possible to limit the access to the genetic resources contained in the patented innovation. The treaty thus reinforces the interest to maintain the plant breeder's right compared to other modes of protection of the plant varieties. In the absence of a real statute for the genetic resources, their access, within the framework of the international treaty, could remain open, free and without contract, from which the Material Transfer Agreement (Article 12.3.). This homogenized MTA is associated with strict

[2] Article 27/3b of the WTO trade-related aspects of intellectual property rights agreement provides for the combination of rights, since it stipulates that: "Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof …".

traceability rules with the certificate of origin to guarantee the legality of the granting of the material and the disclosure of the origin of the genetic resources at the time of a deposit of an intellectual property. If an innovator protects an innovation by a plant breeder's right or any other *sui generis* system which leaves a free access to genetic diversity for competitors, there is a voluntary contribution to an international compensation fund. If an innovator protects an innovation by a patent, with a risk of blocking the access to genetic resources, there is a compulsory fee –paying to a compensation funds. There is thus an incentive to leave free access to the resources according to the amount of the compulsory payment to the international fund (this rate is currently of 1.1% of the sales turnover, to see appendix 2 of the standard material transfer agreement). These MTA and this international fund have their importance in the implementation of the Global Plan of Action (art.14) since they must be mobilized to manage and preserve the genetic resources, and to finance plant breeding in favor of the countries of the South (art. 18.4.). Is the objective to support the access to genetic diversity still operational if the plant breeder's right goes out? It is possible to consider the implementation of licenses (compulsory license, compulsory cross license like in the EU directive 98/44, ...) which would facilitate the access to genetic resources, but which would remain on the responsibility of the plant breeders to define or not the conditions of access. Such a situation introduces large transaction costs and potentially large royalties.

2.2 Diffusion of plant varieties and collective management

In article 7, the international treaty aims to support the implementation of research in favor of developing countries. This treaty rests on access and benefit sharing: as well monetary as non monetary. The non monetary benefit sharing is of primary importance for developing countries. It can be implemented by the means of technology transfers (Article 13.d) and diffusion of information.

At the empirical level, there exist multiple examples of collective management as well of the intellectual property rights as of research activities: the centers for patent exchanges or the Clearing House Mechanism in the wide field of plant biotechnologies: the Public Intellectual Property Resource for Agriculture, PIPRA, in the USA; the European collective management of Public Intellectual Property for Agricultural biotechnologies, EPIPAGRI in Europe; even the open source genomic network in Australia or in the USA. Which are the reasons of the implementation of a clearing house mechanism, like PIPRA or EPIPAGRI, for the management of the public patents?

* To seek and propose attractive licenses of patent pools and/or to carry out innovations in the public sector (on orphan plant varieties or in favor of the Developing Countries);

* To have a more important capacity of negotiation to have access to the licenses of patents held by the great multinationals of biotechnologies.

The objective of these organizational models is to encourage the research laboratories to cooperate to carry out innovations and to diffuse them in the Developing Countries. A question which remains is undoubtedly related to the conditions of diffusion and production in the Developing Countries. Which is the number of farmers who can benefit from these seeds according to their financial and/or technical constraints (e.g. requirement of expensive inputs)? That also requires to clarify the question of the financing of this kind of research. The investments to finance the R&D activities to carry out an innovation will depend on the anticipated size of the market for this innovation (niche, national, world). Public funds ("public or private for not profit organization") could be allocated to this kind of research if the market is too weak to incite a private plant breeder to finance the research whereas the social consequences are considered as important (Trommetter, 2007). Often, the researches realized by the International Centers of Agronomic Research are also to be analysed (Article 15). This researches are implemented in general on the most used varieties (maize, wheat, rice,…), the objective being to support the development of varieties adapted to the pedoclimatic conditions of the Developing Countries. But what are the conditions of plant breeding of the other plants? These plants are important for many people in developing countries but considered as marginal by seed companies (market size too small).

2.3. Which consequences for countries that have research capacities

Nevertheless with the evolutions of the statute of the agricultural genetic resources only the plants covered by a Plant Breeder's Right and by the international treaty of FAO remain in open access, even if in the international treaty this access becomes contractual and fee-paying in case of privative appropriation. The incentives to the reinforcement of capacities of research and the partnerships (art.13.2.b.) and the commitments on the exchanges of information (art.13.2.a.) are on the same step. The existence of the treaty then reinforces the possibility to mobilize the plant breeder's right or a *sui generis* system to protect the innovations. The coexistence between the plant breeder's right and a *sui generis* system to

protect the local varieties, makes it possible the plant breeder to use the genetic diversity of the varieties protected by the plant breeder's right in their own plant breeding program. That would not be so easy in the case of patent (negotiation of licenses and transaction costs). The result is to allow the plant breeders of the Developing Countries to improve seed varieties by mobilizing the genetic resources within the frameworks of the treaty and the plant breeder's right. The breeding of seeds varieties make it possible to have a better effectiveness to answer the future situations of food crisis. For the countries which have research capacities and which have access to sufficient water quantities, it can be preferable to help them to work on maize and rice to reduce the risks of food crisis while preserving a share of research on marginal plants to anticipate breaking down point risks associated to global changes.

2.4. Which consequences for least developing countries

In least developing countries, farmers do not have sufficient production capacities which are compatible with the mobilization of new production technologies or practices which are often based on a greater requirement of water and chemical inputs. If the objective is to increase the supply of agricultural production to solve the questions of food and poverty, the question is how to select, most effectively plant varieties of species that are actually cultivated by farmers. Fears 2007, in a report for the FAO, proposes to mobilize the most powerful tools in molecular biology in order to make the research most efficient – economically and socially- for the developing countries. He indicates that the priority must be to support research focused on the developing countries. The interest is to mobilize these high technologies to improve local varieties. For these countries, access does not depend on the implementation of IPR on the seeds or inputs. The poorest countries could thus benefit from technological advances without supporting the implementation of unsuitable intellectual property rights. In this context, the developing countries are not obliged to set up IPR to cover technologies they do not have the capacity to implement.

To be efficient, these plant breeding programs must satisfy two conditions: To integrate the farmers in the various phases of research (Article 6.2 and 9); To mobilize the international fund to finance plant breeding of local plant varieties in favor of the countries of the South (Article 18.4.). These articles are favorable to the implementation of the participative breeding programs. The participative breeding is a mode of research organization based on a partnership between farmers, researchers and financial institutions. The objective is to improve local varieties that are better adapted to the pedoclimatic

constraints of the countries or regions and to the own constraints of farmers. Initiatives already exist in developing countries (see Cirad initiatives in Africa).

It is necessary to reconsider the priorities of research according to the objectives of food safety for the developing countries (Johns *et al.*, 2006; Fears, 2007). It is for example important to study the consequences of the use of marker assisted selection for the developing countries, the creation of consortia and the mobilization of multi-agencies approaches to reduce fragmentation. It is thus necessary to reinforce the contractual approach of the MTA to limit the risks of private appropriation.

2.5. Syntheses

The international treaty shows the interest to facilitate the access to the genetic resources with finalities: to improve plant varieties and to reduce the risks of food crisis. The treaty is compatible with the plant breeder's right, the relation is undoubtedly more complex with the patent system. The risks of blocking the access to genetic resources lead to the development of harmonized MTA (costs of transactions reduced but nonnull) and to the payment of royalties (fee-paying).

For the countries with capacity of research, the access conditions to genetic diversity and technologies are paramount. The intellectual property must be implemented according to the capacities of research and demand. Finally these countries can of course work on maize and rice if they have the characteristics which enable them to optimize the agricultural production (mobilization of inputs of which ecosystem services, availability of sufficient water resources …).

For the countries with low capacity of research, the intellectual property is not a stake and either is the maize breeding. It is necessary to improve local plants they have the capacity to cultivate. Within this framework we see that the model of collective management and the co-operation North/South can be a factor of success. In particular, we see that the model of participative breeding is to be developed.

3. Conclusion

The international treaty facilitates the multilateral actions. More precisely, the treaty facilitates the access to genetic resource. The treaty, by supporting the multilateralism, has consequences which go well beyond the genetic resource sharing with the collective

management of intellectual property right and research cooperation for the development of innovations in favor of the Developing Countries. We see that the treaty is compatible with the plant breeder's right. We also see that without the multilateral system of exchange of genetic resources, the plant breeder's right, like any *sui generis* system, could not continue to give a free open access without contract to the genetic resources. In such a situation, we prove that the plant breeder's right is threatened with consequences which yet are not completely identified on the conditions of circulation of the genetic resources at the international level. To limit the threat on the plant breeder's right, we propose two necessary solutions: to revisit the plant breeder's right; to refuse patent on plant variety selected by traditional cross breeding. The absence of the treaty would also have consequences on the organization of research and in particular on research in favor of the Developing Countries. We see that benefit sharing cannot be only on monetary terms and the non-monetary benefit sharing is without doubts more important. In the absence of the treaty, how to incite the actors to cooperate? how to incite them to develop research on plant breeding varieties? Thus, in several developing countries to support the breeding and the diffusion of varieties of maize is the most effective option to limit durably the risks of food crisis (mainly in the countries having sufficient water resources). In others, it will be necessary to facilitate the selection of local varieties supported by the most recent technologies, mainly in the countries with low quantities of water resources and inputs.

If the objective is to improve the supply of agricultural production and especially to limit the dependence of the countries to the food imports, that means that it is necessary to support the researches for innovations as well in the seeds as in the practices to implement what Michel Griffon calls that "an ecologically intensive agriculture". I.e. an agriculture which is productive, by ensuring a food safety, thanks to the use of "input" services resulting from the ecosystems functioning and without creating irreversible damage to the environment. This agricultural model has for objective to maintain an "evolutionary potential" vis-a-vis the future constraints (global changes).

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