INTELLECTUAL PROPERTY RIGHTS IN COMMON BEAN BREEDING

OPPORTUNITIES AND CONSTRAINTS FOR LOCAL AND PARTICIPATORY BREEDING IN NICARAGUA

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By

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ABSTRACT

Intellectual Property Rights in Common Bean Breeding – Opportunities and constraint for local and participatory approaches in Nicaragua

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If intellectual property rights (IPR) are incentives for plant research, how do they affect plant development for the benefit of the resource-poor?

This thesis analyses the implications of IPR from the perspective of small-scale users, providers and developers of seed. Special attention is given participatory plant breeding, *i.e.* the approach that joins farmers and professional breeders, local and formal conditions and the knowledge and visions held by rural communities, civil society and State. The thesis brings on a discussion on intellectual contributions, claims and preferences in a case of participatory breeding and as such, it explores the opportunities and constraints of IPR when breeding is done in collaboration between different actors. The legal requirements for plant breeders' rights of distinctness and uniformity are observed in the field as well as genetically analysed.

In general, the thesis illustrates how international trade regulations translate into national law and onto the field of local and participatory breeding. In focus is the common bean and legislative system of Nicaragua, a developing country that recently adopted plant breeders' rights that go beyond world trade agreements and against farmers' rights to exchange and informally sell seed. The thesis also analyses the possible impacts of rights in counter-balance, *i.e.* community intellectual rights in draft.

Keywords: intellectual property rights, plant breeders' rights, farmers' rights, community intellectual rights, participatory plant breeding, common bean, Nicaragua

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PREFACE

For as much as the diversity between people and minds is eroded because of reasons beyond what this thesis grasps, all too much is being lost because we do not understand. When reality becomes too complex, we tend to translate diversity into linear systems. In the process of reducing, we lose the potential of solving problems that continue to grow in dimensions. The problem is that the whole is bigger than its constituting parts.

Ownership on life goes far beyond any legal discipline into a diversity of cultures, sociology, economy, politics and environmental concern. With an aim to deliver a larger picture, this report joins the MSc thesis works of environmental engineering and rural development. As such, it was an academic challenge that was born out of a concern for equitable relations, a respect for diversity and the desire to understand more about how one system affects the other. In short, how can we make parts support the bigger whole and vice verse?

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ABSTRACTO

Derechos sobre las variedades de plantas en Nicaragua

El asunto sobre la propiedad de los recursos genéticos y los conocimientos asociados a ellos es un tema actual, y para muchos países también un asunto nuevo y alarmante. Entre ellos está Nicaragua, que en 1999 adoptó una nueva legislación en el área de los derechos de propiedad intelectual. Dentro de esta nueva legislación está incluida la ley de protección para las obtenciones vegetales cuyo propósito es el establecimiento de normas para la protección de los derechos de las personas (naturales o jurídicas) que, ya sea por medios naturales o manipulación genética, hayan creado o descubierto y puesto a punto, una nueva variedad vegetal la cual debe ser distinta, uniforme y estable. Estos derechos se consideran como un derecho de propiedad intelectual y se da control exclusivo sobre las variedades inscritas en el Registro de la Propiedad Intelectual del Ministerio de Fomento, Industria y Comercio. Lo anterior contempla que para la utilización del material de reproducción o de multiplicación se requerirá la autorización del obtentor: nadie puede usar, vender o reproducir semilla correspondiente de las variedades protegidas sin permiso del titular o sin el debido pago de regalías. Dicha autorización no se requerirá cuando la semilla de la variedad protegida sea utilizada para fines de investigación en el mejoramiento genético de otras variedades o cuando el agricultor o agricultura la utilice con fines de reproducción o de multiplicación en su propia explotación. En esta monografía se analiza el impacto de los derechos intelectuales en Nicaragua en el mejoramiento de frijol común mediante la aplicación de practicas tradicionales bajo un enfoque participativo.

El sistema de frijol

El frijol es unos de los granos más importantes en Nicaragua ya que constituye una parte importante en la dieta alimenticia diaria junto con el arroz, tortilla, plátanos y huevos. La producción del frijol en su mayoría se encuentra en manos de pequeñ@s productores/as l@s que siembran dicho cultivo en pequeñas áreas. Es frecuente encontrar hasta tres variedades de frijol sembradas en la misma parcela encontrándose entre ellas variedades recientemente mejoradas por el Instituto Nacional de Tecnología Agraria (INTA) o variedades tradicionales conocidas popularmente como variedades criollas. Estas variedades criollas actuales son poblaciones heterogéneas originadas muchas veces de variedades mejoradas liberadas en el pasado por los programas formales de mejoramiento y que han sido cultivadas y mantenidas desde entonces por l@s agricultores/as. Las variedades criollas poseen granos con testa de color rojo o rojo claro siendo el precio de este producto en el mercado mayor en comparación con variedades que poseen otro tipo de color de testa; sin embargo, son bastante susceptible plagas y enfermedades y por ende su rendimiento es con frecuencia inferior al de las variedades producidas por los programas formales de mejoramiento. En Nicaragua una buena parte de las actividades de mejoramiento, producción y mercadeo de la semilla de frijol se encuentra en manos de l@s propi@s agricultores/as quienes hacen uso de diferentes mecanismos (intercambio de semillas entre agricultores/as, autoproducción y/o venta informal de semillas etc) para adquirir este importante insumo. Muchas veces, sin embargo, la calidad del material que se usa para la siembra es deficiente o de origen desconocido lo que viene a afectar la producción enormemente. Tanto la producción así como el mercado de semilla certificada bajo la responsabilidad del sector formal es aun limitada. Sin embargo, existe una presión por parte de las instituciones nacionales e internacionales en reemplazar la semilla de las variedades locales por semilla de variedades mejoradas en vista de la necesidad de

incrementar los rendimientos. Lo anterior es en parte el resultado de cambios que están ocurriendo en el ámbito global entre los que se pueden mencionar los derechos de propiedad intelectual en las semillas.

Impactos de los derechos del obtentor

En el caso de frijol los derechos de propiedad intelectual podrían ser un instrumento para recuperar el costo de inversiones porque el frijol se autopoliniza naturalmente y no hay necesidad comprar material nuevo cada siembra. Es decir, cuando una planta se copia facilmente no hay gran incentivos para comprar semillas del obtentor (o del productor bajo contrato y con acceso al material génetico). Con derechos de propiedad intelectual se garantizan regalías al obtentor. Sin embargo, no existe por el momento un mecanismo claro sobre la manera como dichos incentivos serán entregados al mejorador. Sobre todo se presenta problemas con el mecanismo del control. Puesto que el control de la semilla protegida está en manos del obtentor será difícil y también costoso la realización de dicho control principalmente durante la multiplicación e intercambio de semillas; procesos durante los cuales pueden ocurrir mezclas varietales. Por eso el impacto a corto plazo de ley de protección será mínimo ya que la práctica de producción de semillas para el propio uso o para intercambiar con los agricultores vecinos es bastante fuerte.

Es posible que el sistema de regalías funcione a medida que haya una división más claras en las actividades de mejoramiento, producción y utilización de semillas es decir entre fitomejoradores, productores de semillas y usuarios. El mercado formal de donde un obtentor podría obtener regalía fácilmente es pequeño, aproximada 10% de la semilla está producida en el sector formal. Sin embargo, los Estados Unidos de Norteamérica están apoyando dicho sector a fin de lograr su crecimiento. Recordamos que las empresas multinacionales no empezarán a funcionar mientras el mercado de la semilla de frijol continúe siendo reducido y poco eficiente. Por eso es probable que un fortalecimiento del mercado de semillas sea más importante para una invensión y inversión extranjera que el establecimiento de los derechos de propiedad intelectual. Sin embargo, de hecho al fortalecerse el sistema formal, también se fortalecerá el sistema de derechos del mejorador. La ganancia de los derechos de propiedad intelectual va mano a mano con un fortalecimiento del sector formal. Por eso se puede decir que la ley a largo plazo podrá ayudar la formalización o industrialización de la agricultura nicaragüense, y eso también podría mejorar la eficacia de la producción y reducir la pobreza en las áreas rurales. La cuestión emergente sea ¿Qué tipo de variedades obteneremos con incentivos de propiedad intelectual?

Hasta ahora (Febrero 2003) ninguna variedad de frijol ha sido inscrita para su protección (solo está inscrita la variedad de arroz ANAR-97, protegida por una asociación nicaragüense de arroceros). Dado que los mejoradores de frijol trabajan para el INTA o son agricultores/as nacionales, la pregunta es ¿quién va a pagar regalías a quién? Aunque el INTA ha entregado solicitudes para la protección de variedades de frijol, la posibilidad de obtener regalías o ejercer un control activo es baja. Dado que el INTA está promoviendo la producción privada de semilla certificada (ya existen algunas compañías establecidas) bajo contrato, las oportunidades de obtener regalías se suben gradualmente. Se visualiza que cuando la producción de semilla sea lucrativa y registrada, crecerá la justificación de compartir beneficios con el mejorador u otros actores involucrados en la actividad semillista. Hasta entonces y puesto que es un instituto público, en ves de pedir regalías de las comunidades agrarias y de perder recursos por administración mas bien sería mejor que el INTA continuara con su labor de mejoramiento y difusión de semillas de variedades mejoradas. Recordemos

que la investigación pública tiene un papel crucial en el desarrollo de variedades menos commerciales, como las variedades del frijol nicaragüenses.

Oportunidades y amenazas

En la agenda comercial del sistema formal, el cual va creciendo con mucho ímpetu, poco interés existe por los beneficios inherentes del sistema local de producción de semillas basado en criterios locales. Actualmente existe poca integración entre los sistemas formal y informal lo que constituye una sería debilidad ya que a través de una colaboración real podrían juntarse esfuerzos para buscar soluciones a problemas reales como son la pérdida del material genético y el conocimiento a el asociado, y la desaparición irreversible del sistema local de producción de semillas que ha permitido la manutención de muchas familias rurales a través de la producción de semillas, alimentos e ingresos. Como consecuencia de lo anterior surgió la metodología conocida como Fitomejoramiento Participativo cuyo objetivo fue juntar la capacidad, criterios y material genético que existen en el campo con la experiencia del sector formal. Esta metodología está siendo aplicada en Nicaragua en los cultivos de frijol y maíz en las localidades de Pueblo Nuevo y Condega, ambas del departamento de Estelí. El grupo está constituido por 50 productores y productoras, un fitomjerador del INTA y un organismo no-gubernamental (CIPRES) todos dedicados al mejoramiento de variedades basado en criterios locales. Igualmente se discuten en dicho grupo de trabajo aspectos sobre la protección de variedades desarrolladas dentro del proyecto en términos de control, consideraciones técnicas, magnitud de la distribución de semillas, involucramiento del sector formal innovativo, perspectivas acerca propiedad de semilla etc. La toma de decisiones es un tema complejo ya que se debe considerar la diversidad de puntos de vistas, objetos e información – asuntos que cambiaran durante un proceso innovativo y cognitivo. Por experiencia del estudio, la monografía proponga que si el grupo no tiene una opinión clara acerca los derechos de propiedad intelectual se debería presentar el tema initialmente al grupo en términos breves y informativos. Con el tiempo l@s participantes van a crecer en su papel de ser mejoradores/as y en sus habilidades de expresarse y tomar decisiones y hasta entonces no hay mandato para tomar una decisión verdaderamente participativa. Cuando tengan la palabra se pueden enseñarnos sobre la manera de pensar de l@s agricultores/as en la concerniente al derecho intelectual.

El camino siguiente

¿Qué dicen entonces l@s mejoradores del campo sobre la posibilidad de poseer variedades locales? El grupo participativo de Estelí todavía está en la fase de evaluación. Sin embargo, se nota que el grupo no está de acuerdo con relación a los derechos intelectuales; si se deberían aplicar por protección, como se compartiran los beneficios etc. Desde la perspectiva de unos agricultores que han desarollado variedades locales notamos que suportan la idea de tener una mayor responsabilidad en aspectos como son el mantenimiento de la calidad de sus variedades pero no querien controlar su uso o exigir regalías de sus colegas. Se debe recordar que en el sistema local, el precio de la semilla se puede decidir considerando el trabajo invertido (pero más bien el poder adquisición del comprador).

Muchos productores que participaron en la monografía buscaban un mercado más controlado. Sin embargo, aunque existe la demanda de una producción y mercado más controlado no hay recursos en el campo nicaragüense para cubrir los costos de una producción certificada y para dar regalías al obtentor. El problema radica en que el precio de la semilla resulta demasiado elevado y también demasiado uniforme, en comparación con la semilla producida localmente

o la semilla regalada o donada. Por supuesto, l@s agricultores/as tampoco desean restricciones en su derecho de poder multiplicar las semillas libremente. Por eso es importante reconocer que el sistema de calidad no es lo mismo que el régimen de los derechos intelectuales ya que se puede tener semilla registrada y certificada sin estos derechos. Recordemos que la ley tiene por objeto recuperar el costo del fitomejoramiento. O sea, no es una ley para proteger variedades sino las inversiones del fitomejorador o más bien del empleador o empresa.

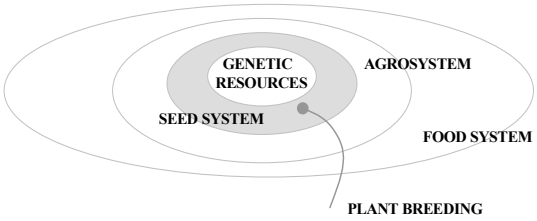
En conclusión se puede decir que la ley no combina muy bien con la realidad rural ni con las demandas del campo. Se debe considerar, además, el asunto ético. Bajo la ley vigente solo se reconoce la prestación ultima, la del mejorador que desarrolle una nueva variedad la cual debe ser distinta, uniforme y estable. No es sencillo innovar o desarrollar variedades que cumplan con los requisitos técnicos que realmente se necesitan considerar durante todo el proceso innovativo. Tampoco es una tarea sencilla demostrar variaciones entre variedades, sea conocidas o nuevas, y por eso la gente del campo se preocupan por lo que se llama la biopiracia. En busca de instrumentos para distinguir una variedad a otra, la monografía exploró variaciones entre variedades por medios del análisis génetico. El resultado señaló que se necesita mucha información, trabajo y recursos para lograr una caracterización válida en por ejemplo causas legales.

Es importante recordar que las obligaciones con la Organización Mundial del Comercio y en particular la presión de los Estados Unidos de Norteamérica influyeron en que Nicaragua adoptara la ley de protección a los derechos del obtentor y que se adoptó con palabras que su aprobación era necesaria para remarcar la credibilidad del gobierno Nicaragüense y para fortalecer el comercio entre los Estados Unidos de Norteamérica y Nicaragua. Igualamente recordamos un proceso legislativo sin participación verdadera del sector agrícula o cívico y que se quedó con una ley protegando los derechos del obtentor a costa a los Derechos de los agricultores reconocidos globalmente. Como contrapeso el Ministerio del Medio Ambiente propone en un anteproyecto un sistema para proteger conocimientos, innovaciones y prácticas locales. Aún no se sabe cómo va a afectar a las variedades criollas, los derechos del obtentor y de los usuarios, lo que sí se sabe es que la conservación de las variedades criollas, las prácticas tradicionales, innovaciones y conocimientos son asuntos inseparables. Por eso la colaboración entre grupos de personas e instituciones es importante ya que puede permitir el fortalecimiento de la soberanía y autonomía del sistema local de semillas y, además, puede permitir la integración de iniciativas y perspectivas locales con el desarrollo nacional.

1. INTRODUCTION

The issue of property rights on knowledge and living matters is of great concern as it stands in the crossroad of trade, environment and human rights. One such matter is seed and the issue of intellectual property rights on plant genetic resources for food and agriculture.

Seed is essential for food production; without germplasm no plants, without plants no food. The availability and quality of seed are therefore keys to productivity and a means towards sustainable agriculture and food security. In this connection, the improvement of seed plays a crucial role and so does the manner in which we decide to protect and steer plant development. Seed is also the vehicle of genetic information and diversity (CBDC web page). For this reason, genetic resources serve as the building blocks of seed and plant breeding and as such, they are intrinsically embedded in the seed-, agro- and food system (see illustration).



Most food of today comes from a variety of domesticated species such as rice, beans and maize. These species are themselves divided into varieties, separated by differences in characteristics such as colour, taste and time required to mature in the field. This variation is due to differences in gene structures that emerge from a joint act of nature and deliberate breeding. Farmers have been improving seed for thousands of years, long before the first understanding of gene structures. Even so, plant improvement is inherently related to genetics since the key to improve populations, and in the end to develop varieties, lies in the permanent change in genetic structures over plant generations (Chahal and Gosal 2002:4). This is why the carriers of inherent traits, the genes, are in focus in plant development.

As Mendelian genetics entered the picture, the speed of the breeding process increased and so did the rate of growth of productivity (Busch 1995). For some crops, about half of the increase in production has been ascribed to breeding new varieties (FAO 1996:29). However, as the development of seed became a specialised (formal) profession, the improvement process was shifted away from the farm to research stations and recently into high-tech laboratories. Although hugely successful in some aspects, formal plant breeding and its products have in many cases not been adopted by or are not accessible to resource-poor farmers, mainly because of the context in which it evolved and operates (Lipton and Longhurst 1989).

The question is how we improve, on what material and grounds, for what purposes and for whose benefit.

1.1 FARMER AND FORMAL BREEDING

1.1.1 How we improve…

Plant breeding has no set definition and although all genetic improvement ultimately comes down to selection in the field and to the personal touch of a breeder's fingertip feelings, the methods and breeding objectives of farmers and formal plant breeders may, or may not, be as distinct as the resulting varieties. Where farmers mainly improve by selecting and saving seed from their harvest and in this process collect the fruits of natural crossings and mutants, formal plant breeders and more innovative farmers develop new varieties by crossing existing varieties with desirable characteristics. Together with differences in breeding techniques, the question on how breeders improve is closely related to the variety they seek.

Plant varieties have no clear definition but rather take on different names and criteria depending on who developed the variety. Where so called modern, commercial or formal varieties improved within breeding programmes are often genetically homogenous and regarded distinct from each other based upon yields, seed colour, etc., the varieties developed by farmers are more genetically diverse and the varietal definition is not as clear-cut. Figure 1 illustrates how a combination of two varieties can produce a genetic variability, from which a selection process could produce a diverse set of varieties holding different degrees of genetic variability. Farmers are known to develop varieties that are more genetically heterogeneous (variety A and B) since "materials that contain some genetic diversity may be more suitable for variable and heterogeneous environments, providing them with an increased buffering capacity and potential to adapt" (Almekinders and Elings 2001:427). The formal breeder on the other hand normally seeks uniformity (variety C) to make sure that varieties perform uniformly and in accordance with description within certain domains.

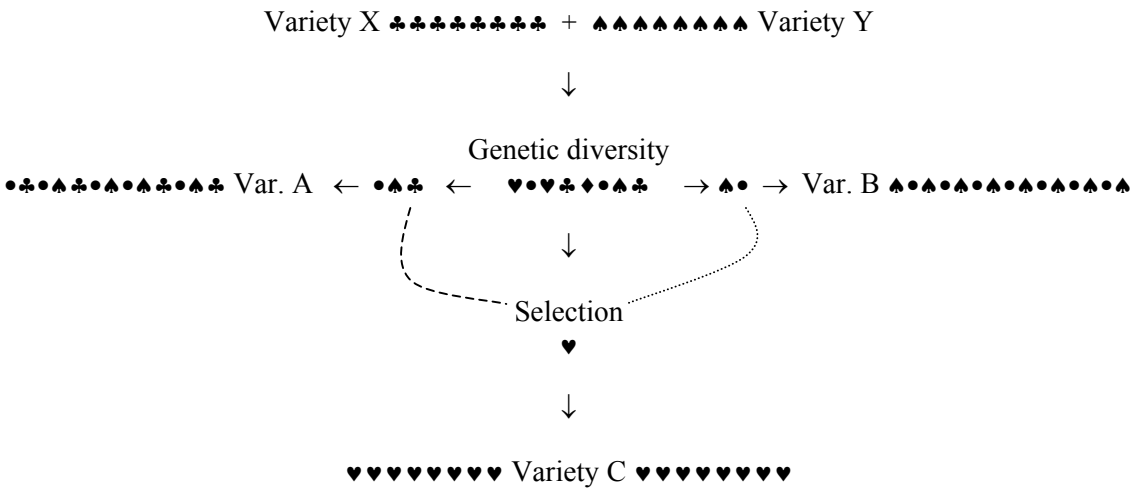


Figure 1 How the selection criteria determine characteristics and level of genetic variability in a variety.

1.1.2 On what material and grounds…

The complexity of plant breeding is represented by the interaction between the genetic structures of the seed and the environment where it grows (G X E indicator). Marginal or heterogeneous areas present problems of high complexity not only in the breeding process (in the difficulties of isolating changes in genetic structures from environmental effects) but also in the adoption and distributional step. A variety adapted to one environment will probably not perform according to description in another environment nor will a centralised breeding programme be able to meet all needs and local criteria. Since formal improvement has general objectives of wide-scale adaptation and distribution, it has concentrated on yield potentials in favourable environments where varieties conserve their improved characteristics. Farmer breeding on the other hand is locally embedded and seed is improved directly in the locale where it is to be used and according to local preferences.

Local seed flow

Small-scale farmers in general produce crops for household consumption, for sale and for seed to exchange or plant in the next cycle (Almekinders 1998). The flow of the seed is therefore integrated with the flow of the crop, in a cyclic interaction and selection in and between fields, storage bags and markets, see figure 2. To this local flow of seed there is an external supply from formal breeding programmes, which adds on formally improved material of national or foreign origin.

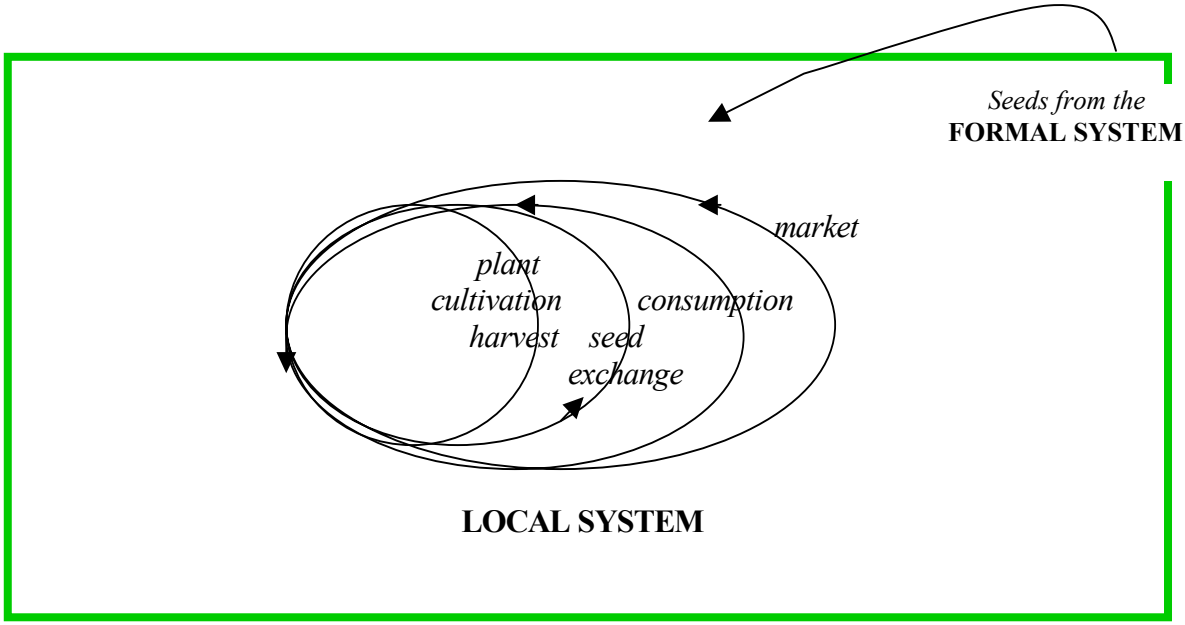


Figure 2 Local (or informal) System of Genetic Resources Management. Based on De Boef, Almekinders and Louwaars in Almekinder 1998.

Because of this flow, the varieties continuously adapt to environmental conditions both in agro-ecological terms (soils, climate, pests and diseases) and in socio-economic terms (food preferences, markets) (Almekinders 1998). The seed collection managed by farmers therefore includes seed with a wide array of origins and scales of distribution,

from nation wide to single farms. As such, varieties answer to many local as well as collective names like landraces or farmer-, traditional- or land varieties. Their common denominator is that they are successively improved directly in the farmers' fields and known to respond to and build upon local demands and opportunities.

Local and formal meets

Local material has been and is successively collected and brought into *ex situ* conservation in seed banks held nationally, privately or on behalf of the international community. The idea is that no exchange or loss should be irreversible. If seed is conserved, they can return to the field in one shape or the other. Nowadays few collected seeds leave gene banks intact but more so its preferred gene structures. Local varieties are crossed with formally improved material, resistant material is combined with high-yielding, domestic material is combined with foreign and local preferences are combined with global demand. In its new shape, the genetic structures usually enter the field again through formal breeding programmes (see figure 3).

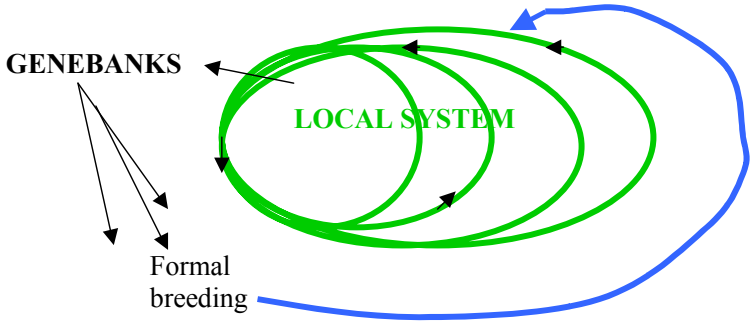


Figure 3 Local system feeding genebanks and the formal breeding system with plant genetic material (based on De Boef, Almekinders and Louwaars in Almekinder 1998).

Formal breeding

Much of the formal cross breeding aimed for the developing countries is conducted at the CGIAR centres (Consultative Group on International Agricultural Research). From here the material can take different routes and either be further developed within the country of head office or brought closer to the target areas through local CGIAR offices, public research centres or on private requests. Usually, seed reaches national grounds when it is still highly segregating, *i.e.* when populations are instable and hold a great genetic diversity. Early selections within these populations are normally made by breeders involved in public or private breeding programs, on-station and according to selection criteria set and practised by formal breeders. Later, promising lines are brought to farmers' fields for further selection and although under the management of farmers, selection criteria are generally set and practised by formal breeders. In this phase, lines are compared, improved and stabilised within certain domains, normally in favourable environments because of technical and financial limitations. Thus, there are mainly two types of selections in the field, the selection between plants in a diverse

population and the selection between uniform lines (varieties). Where the varietal selection is more straightforward, the selection within segregating populations is a hard but fruitful phase as this is when genetics first meet the environment and the full potential of the Genetic x Environment (G x E) interactions can be taken advantage of. Put differently, the field conditions during the early selection phase sets the domain for the future target area since material well adapting to the conditions in question will be kept on behalf of material that could have been preferred if planted in other environments. Figure 4 shows the formal selection process and how it affects genetic variability and farmers' bag of choice.

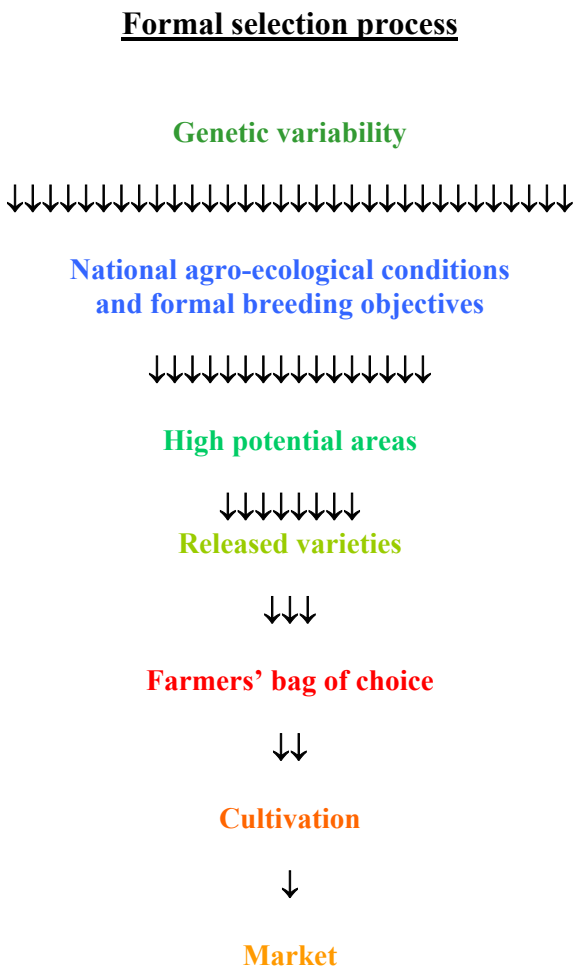


Figure 4 How the formal breeding process affects the genetic diversity for food and agriculture.

1.1.3 For what purposes and for whose benefit…

Plant breeding is focused on improving the use-value of plants for food and agriculture: to find solutions of depressed yields, shifting disease and pest problems, excessive pesticide use, and physical constraints such as infertile soils and drought (CIAT 2001).

Operational plant breeding, though, includes varietal development, seed production, multiplication, processing, storing, marketing and distribution.

Operational plant breeding

Chahal and Gosal (2002:566) argue that "the actual impact of a variety on agricultural production depends on the extent of coverage and the level of performance at farmer's fields". According to Hardon and de Boef (1993), there are only scant data available comparing the performance of modern varieties with that of local varieties in farmers' fields, under farmer management and utilising farmers' evaluation. The available information, they say, suggests that modern varieties often lack additional characters which farmers consider important. From a case in Zimbabwe, Andrew T. Mushita (1993) concluded that "farmers prefer cultivating crops with a broader base to allow and facilitate the staggering of labour at various peak periods, to cope with different environmental factors, and for selection of different end-utilisation qualities". The latter includes cooking and storage abilities, taste, nutrition and market acceptance. Formal improvement on the other hand has generally concentrated on yield potential in favourable environments with the use of irrigation and agro-chemical inputs (Almekinders and Elings 2001:426). In plain words, the varieties developed within the formal system are not known to recognise the context of resource-poor farmers. Almekinders (1998) sums up the problems for formal breeding in reaching the resource-poor farmers:

> *The combination of the farmers' preferences (which may vary significantly between and even within zones) and on the other hand the variable production conditions (from season to season, place to place, and even field to field) make it difficult for a centralized program, with limited resources and implemented mainly at research stations, to be successful in these environments. One added complication is that most small farmers cannot purchase seed for each cycle, and it is difficult to provide them with good quality seed for each sowing season.*

Sometimes, the reason is distance, in understanding and in space. The majority of farmers are miles away from any formal strategies or bred varieties. Most farmers instead rely on the informal or local seed system for the development and supply of seed. The local system (as illustrated in figure 2) is still highly operational, especially in developing countries. In global figures, it provides 80% of the seed (or other reproductive material) used in food production (Weltzien et al. 2003).

Whereas the formal seed sector develops and releases a few varieties every few years, the purpose and benefits of local improvement are of another dimension. The local system is characterised by contextual meaning with direct benefits and feedback between breeders, users and the environment. Due to the dynamic flow and adaptation to a diverse set of conditions, objectives and uses, small-scale farming also utilises a wide range of genetic diversity (Almekinders 1998). This is why farmers are recognised as producers, improvers and conservers of plant genetic resources for food and agriculture, and why a dynamic seed flow is vital if farmers are to proceed in this multifunctional task.

Interactions between formal and local system

The formal and local systems have in many contexts been coexisting. However, due to a lack of recognition of farmers' capacities and differences in character between the two systems, they have operated practically as separate systems (Almekinders 1998. Figure 5 illustrates the (limited interaction) between the formal and local system.

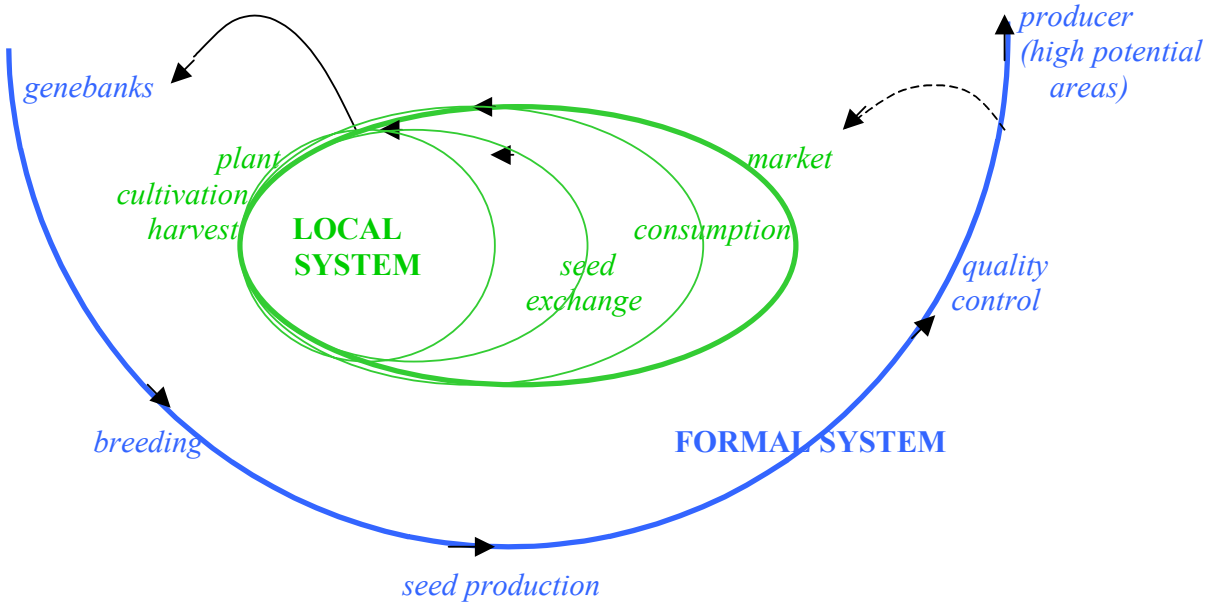


Figure 5 Formal and Informal System of Genetic Resources Management (based on De Boef, Almekinders and Louwaars in Almekinder 1998).

Restructuring of global agriculture

There is a trend of countries looking to modernise agriculture and in this process of change, the local system is often criticized by the formal sector for being backward or thwarting development. Thus, the inherent benefits of the local system are unlikely to be merged into the formal system. From the local perspective, there is scepticism towards inviting the formal flow of technology since the risk of becoming swept over is quite evident. Instead, because users will prefer one system or the other, the outcome of a formalisation might be even higher barriers between the two systems, between breeders of different objectives, and between farmers of different scales and end-purposes. Or, only the fittest system will survive.

In reality, both traditional farming systems and classical plant breeding are in for a change. What regards formal plant breeding, conventional techniques are in many respects being out competed by new biotechnology. With molecular-, genetic- and atom technology, plant breeders have entered the laboratories and this time in the search for

genes rather than new crops (Chahal and Gosal 2002:3). Following this trend, breeding is shifting away from the public sector into the hands of private seed industry (*ibid*, CIPR 2002, Busch 1995 and Crucible II Group 2000). In this process, agricultural research and plant breeding turns into big business, gene structures are tagged and privatised, and the rules of the game change.

Agriculture is being industrialised. In this process, Goodman et al. (1987 in Busch) speak of *appropriation* of farm practices and products (such as seed production and multiplication) and *substitution* of farm products (synthetic production). To add on, Lawrence Busch (1995) talks of a *standardisation* towards one industrial discipline and a single and anonymous market. The shift away from local complex systems towards linear seed development and seasonal seed purchases is part of the global plan to restructure world agriculture. As seed development becomes business, seasonal seed purchases are heavily promoted and restrictions are put on the exploitation and seed use.

When technology transfer of seed is promoted on behalf of local seed sources, it implies a change in agricultural traditions away from reusing, improving and producing seed locally, a practice known to conserve genetic diversity and farmers' embedded seed knowledge. When uniform seed arrive in the field like other inputs, farmers may lose not only their knowledge of plant breeding and the relation and deeper knowledge to the seed itself but also the possibility to further improve and adapt the variety. As this exchange is likely to occur in many fields simultaneously, there is a loss of genetic diversity because the blend of genetically diverse varieties is exchanged for only a few varieties. Mooney (1999) argues that the loss includes not only genetic erosion and the erosion of species, soils, and the atmosphere - but also the erosion of knowledge and the global erosion of equitable relations. Many people with him argue that while genetic erosion threatens the world's base of food plants, the erosion of knowledge threatens the human capacity to maintain and further cultivate this diversity (Amanor, Wellard, de Boef and Bebbington 1993:1). If local knowledge is lost, it might mean the end of the local system itself. Rural people face ever more problems beyond their control and as local capacities are impoverished, the resource-poor stand even more insecure. Formal assistance is expected to be rather poor; seed technology is transferred only to a limited extent, and to a specific target group (see figure 6).

Figure 6 Why there is a danger in trusting the formal seed system (solid) in providing seed to the local system (dashed).

The control of how and which plant material is to be developed is gradually shifting from rural households to formal breeders and professional researchers linked to national

breeding programs or private companies (GRAIN 2003b). In fact, the shrinking budget for the public sector and the low possibility of cost recovery place ever-greater demand on external revenues (Rangnekar 2002). In effect, when research must pay its own cost the interest is turned towards crops that pay well and public research could lose its crucial task to develop technologies for a large but resource-poor farming community. This is most distressing since research conducted in the private and the public sector is non-substitutable as they are targeting different farming groups (Rangnekar 2002). Public breeding therefore plays a crucial role as regards crops that are mainly used in subsistence farming, such as the common bean.

Thus, there are problems in responding to the needs and preferences of the resource-poor of marginal areas spanning from genetic to global structures. Meanwhile, farmers are left on their own to cope with problems that are new, bigger, global, and perhaps even universal. This is a known fact, and it will prevail as long as formal plant breeding has objectives of money generation, wide-scale adaptation and/or remain with poor knowledge about local needs and preferences. The challenge is to avoid a projection of the present and instead start acting in an alternative manner. In the context of plant breeding, the undertaking is to further the interaction between capacities and to strengthen the red thread as illustrated in figure 7.

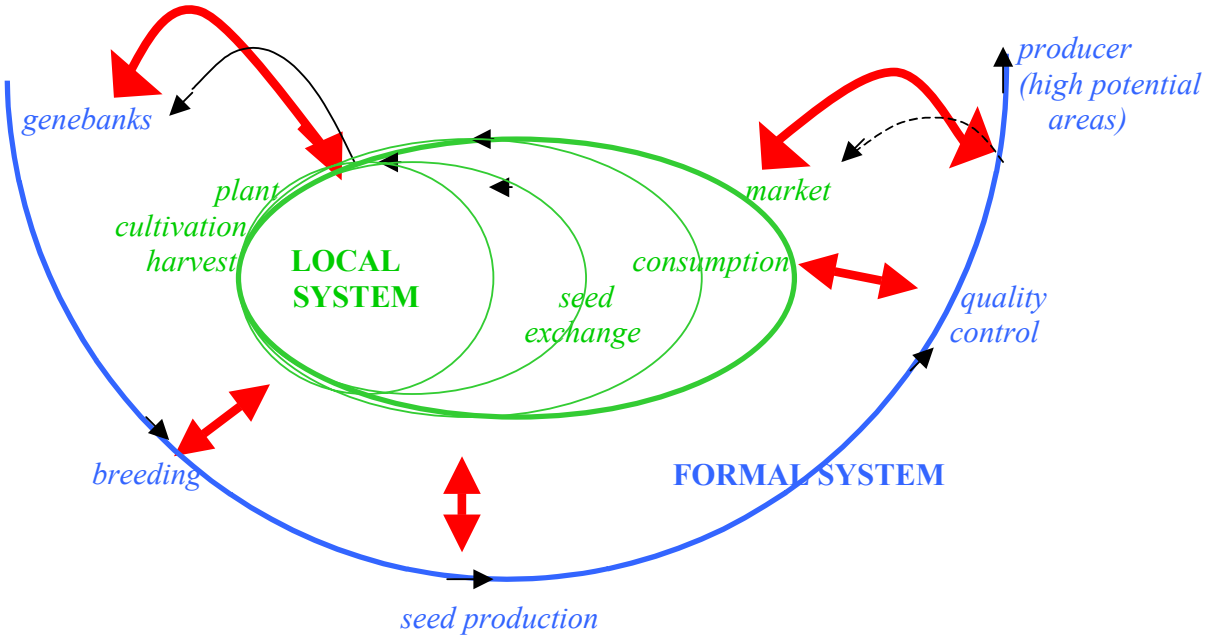


Figure 7 Where to build bridges in order to create a responsible system that responds to local knowledge, needs and preferences (based on De Boef, Almekinders and Louwaars in Almekinder 1998).

1.2 PARTICIPATORY PLANT BREEDING (PPB)

How can we broaden the plant genetic diversity and base for breeding, and simultaneously increase farmers' access and control of seed and its associated knowledge? Responding to the reality of resource-poor farmers, Robert Chambers (1997) argues that solutions are to be sought less by simplifying and standardising, and more by complicating and diversifying. To achieve this vision Chambers talks of:

> *Reversal of normal professionalism, from the universal and simple to the local and complex; of normal bureaucracy, from the top-down and standard packages to bottom-up and diverse baskets of choice; of normal careers, from moving inwards to moving also outwards; of normal learning, from vertical and didactic to lateral and experimental; and of normal behaviour, from dominance to empowerment.*

In the context of plant improvement, this vision is embodied by the so-called participatory plant breeding (PPB). In effect, PPB takes complex systems as a starting point with an aim to support rather than to replace.

1.2.1 Context meets research

By applying this approach in plant research, the focus is shifted away from packaged deals and finished products towards joint learning between farmers and formal breeders, systems thinking and a generation of innovations answering to local needs and problems. Instead of selecting between a few released varieties, farmers get access to a genetic diversity that will enable farmers, with their knowledge and experience, to select and develop the materials that are most appropriate to their respective environments and particular preferences (Almekinders 1998). Figure 8 illustrates how the PPB approach presents farmers to a wider range of genetic diversity. In technical terms, PPB refers to the re-combination of genetic diversity and selection among or within segregating materials (in contrast to PVS which is a participatory varietal selection between fixed lines) (*ibid*). In this context, it means to exploit the complexity of the G x E interaction by selecting directly in the farmers' field. In terms of development, there is a diversity of reasons for inviting farmers into a participatory plant breeding process.

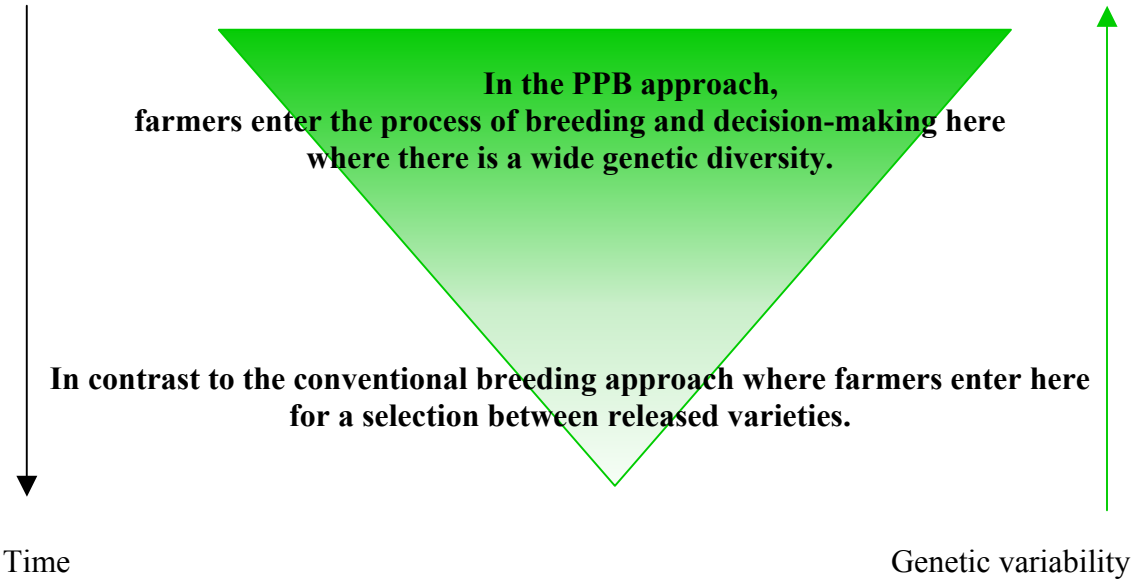
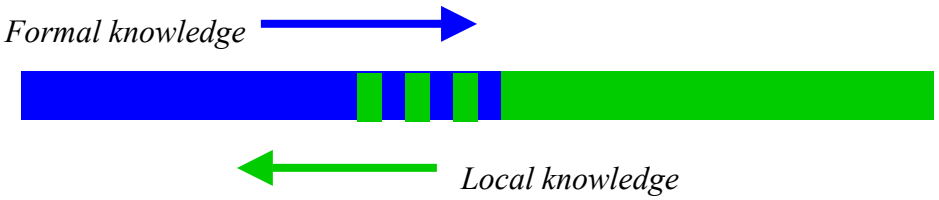


Figure 8 How the PPB approach invites farmers to a wider range of genetic diversity than conventional breeding.

The approach to invite farmers into breeding projects is a way to acknowledge farmers' knowledge, local needs and preferences. It is also seen as a complement to formal plant breeding where niche environments are not served (Almekinders and Elings, 2001:427). The idea is to develop locally adapted technologies and distribute them more effectively, and to support local capacity for generating such technologies (Thro and Spillane 2000:3). Its motivation is found in increased and more stable productivity, faster release and adoption of varieties, better understanding of farmers' criteria, enhanced biodiversity, increased cost-effectiveness, and cognitive and collaborative learning (Sperling et al 2001).

The participatory plant breeding (PPB) is the collaboration between farmers and formal plant breeders, and the learning goes in two directions. For as much as it has technical advantages it includes the strategy to empower farmers by building knowledge and organisational skills in breeding, seed production, marketing and distribution and to bring context and meaning to formal research agendas. This implies a re-professionalisation of research with new roles for the researcher as a democratic participant (Hart 1992 in Pretty 1995) and farmers becoming more involved and in charge of their development.



To assist in this interaction between different epistemologies there is usually a third actor with knowledge into both the formalised breeding and local grounds. This participant usually comes from a non-governmental organisation and serves as a

facilitator, technical assistant and/or administrator. This actor generally plays an important part in connecting the programme with financial donors, in bridging trust between partners and by strengthening the link between research and rural development.

1.2.2 Research meets development

In a world where R&D has gone participatory, collaborative projects between farmers, formal plant breeders and non-governmental organisations have great potentials in meeting not only the underlying philosophy of participatory research but also in letting research meet development. As Lawrence Busch (1995) points out "agricultural research is not a magic bullet that will automatically lead to development" neither is increasing agricultural productivity an end in itself – "it is only a means to some further end or ends, which are usually left rather vague but are often defined as development".

"Productivity for what and for whom, and what is development?"

Busch suggests a development of low-cost, participatory production systems that focus on equity and food security while providing greater control over seed production to farmers. As a means, Shanmugaratnam suggests low cost participatory research to evolve surplus generating and sustainable production systems (in Busch 1995). Kate Wellard (1993) believes that the building of linkages between researchers and farmers arises from two objectives: "the need to create more responsive research systems which cater for the needs of farmers and the strengthening of the capacities of communities to undertake self-reliant development initiatives". In Gordon Prains's (1993) words:

> *There is an urgent need to recognise the potential complementarity of global and local approaches to agricultural research and development. Given our lack of understanding of complex, resource poor systems and germplasm and breeding needs, it is logical to involve rural people as professional partners in research and development efforts. However, farmer participation in agricultural research and development goes beyond logic to issues of equity and social justice: farming families are the final users of agricultural technology and as such have most to gain (and lose) from it.*

1.2.3 Development meets conservation

By joining formal and farmer breeders, there is an increased understanding of local preferences in varietal development but also increased access to new germplasm and techniques. One breeding strategy is to introduce new segregating material to be selected by farmers based on their own preferences and in their own fields. Another approach is to improve local material by crossing formal and local material creating new varieties holding the preferred characteristics of local material but with an increased stress tolerance. The rationale is that improved performance of local varieties "make the materials more competitive with improved varieties and thereby reduce the likeliness that farmers lose interest in planting local material" (Alemekinders and Elings 2001:435). Farmers are generally interested in conserving and utilising local material, but are sometimes unable to do so due to production pressures. If a local variety is not performing, farmers are likely to discard the material. By improving the material and

increase its productivity, locally adapted gene structures and preferences can be further conserved and developed.

This approach does not only join formal and informal knowledge systems but also the aspects of conservation and utilisation of genetic resources. By conserving preferred characteristics and gene structures, the aspect of conservation lies closer to the role and realities of farmers as producers of food.

1.3 CONSERVATION AND USE OF GENETIC RESOURCES

1.3.1 Farmers' perspective

Farmers' conservation of plant genetic resources is closely related to the use-value of crops and beyond this context farmers find little reason to conserve and develop plant genetic resources (CBDC 2002b). Also, under farmers' management crops are not conserved in fix but are subject to various selection pressures, both natural and man-made, in order to meet farmers' needs, preferences and agro-ecological conditions. The on-going exchange, adoption and rejection of genetic material are natural phenomena in agriculture. Farmers do not have the possibility to keep a big seed collection and when one seed is preferred over the other, the preferred one is stored and the other one is eaten. A selection of one seed over the other could result in the loss of genotypes but this is a loss of small scale since farmers are many and genotypes are generally collectively conserved within the farming community. However, nowadays farmers are increasingly choosing between uniform varieties. This is an exchange of greater scale and thereby plant genetic diversity disappears at a faster rate.

1.3.2 Genetic diversity – potential loss

Nearly all countries report serious problems of genetic erosion. The main cause is said to be the replacement of traditional, locally adapted and genetically diverse varieties for uniform varieties of wide adoption (FAO 1996). This loss is viewed by many as a threat to food security and the sustainability of agricultural production at all levels: household, community, national and global. Yet, others argue that with the increased knowledge in genetics the loss and also the potentials of genetic diversity is quite exaggerated since comparisons of genetic structures from now and then have shown that many of the important structures are quite persistent and recurrent (Gullberg pers. comm).

There is a prevailing dichotomy of emphasis between those more concerned with the production potential of genetic resources and others valuing the genetic diversity *per se*. Naturally, these emphases are interlinked considering the multifunctionality of agriculture. However, breeders, agricultural policy-makers and environmentalists put forward different realities or emphases, making an integrated strategy for development difficult to launch. Being producers, consumers and managers of these resources, farmers often stand in the crossfire between the utility and conservative approach. In the line of fire are also the traditional and farmer varieties; both held responsible for curbing development yet praised for their genetic diversity and as such the focus of most conservation efforts.

The preferred seed system is very much connected to one's worldview on how to achieve agricultural development and the purpose of a conservation of plant genetic diversity for food and agriculture. It is true that plant breeding involves the selection of one genotype over the other and as such may provoke the loss of gene structures holding the solution to upcoming problems. On the other hand, plant improvement is dependent on a continuous supply of genetic diversity, from genebanks and from new crosses. To develop and to conserve are essential elements in plant breeding as well as in agricultural development. For this reason, the discipline ought not to be discarded based on its socio-economic context. This context, however, must be scrutinised because the questions remain: how do we improve, on what material and grounds, for what purposes and for whose benefit. Put differently, how are we to conserve plant genetic diversity *in situ*, respecting the reality of farmers, their objective to produce food and survive from one day to the other?

1.3.3 Sustainable development – overarching umbrella

If the overarching aim is a sustainable development, it is necessary to work towards a shared vision, where different interests and approaches connect with the issue of sustainability. The criteria of sustainable development are often defined as aesthetically agreeable and socially desirable, ethically defensible and economically viable, ecologically compatible and technically feasible, and culturally suitable and practically manageable (Bawden 1996). Another pillar is the equal opportunities between generations. Clearly, this is a negotiation of great complexity and it may be helpful to clarify *what is to be sustained, for how long, for whose benefit and at whose cost, over what area and measured by what criteria* (Pretty 1995:1248).

What should be sustained: agricultural production or practices, genes, genetic diversity or any combination thereof? In this context, the FAO (2003a) proposes that sustainable development of agricultural biodiversity must be understood both sectorally and cross-sectorally in an integrated and holistic manner, which takes into account biophysical and socio-economic dimensions. Moreover, sustainability is best captured when viewed as a process rather than as a specific outcome. That is, sustainable development is the fair and equitable process of negotiations between different interests. What about the negotiation between the utilisation and conservation aspects of genetic resources?

1.3.4 Conservation meets use-value

Alemekinders and Elings (2001:435) and Gilles Trouche (pers. comm) argue that agricultural development and conservation are not conflicting but complementary objectives. The Convention of Biodiversity attempts to regulate the aspects of biodiversity in a coherent, holistic manner by not only looking to conserve biodiversity for its own sake but also in relation to productivity. The CBD defines sustainable use as the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations (CBD, Art. 2). If taking this to a pragmatic level, many farmers and plant breeders support the idea to conserve preferred traits rather than conserving varieties that are low yielding for their own sake. Furthermore, the PPB approach allows the farmers to select *from* diverse populations, but also to select *for* heterogeneous varieties that better matches farmers' needs. As such, participatory plant breeding might be a tool in agricultural development but also

in the *in situ* conservation of plant genetic resources (Alemekinders and Elings 2001:434).

1.3.5 PPB meets protection

Figure 9 illustrates how participatory plant breeding meets the objectives of development, conservation and research. If we agree that this meeting between perspectives and collaborators is beneficial in improving plant varieties and in extension to improve the livelihood of the resource poor, one crucial question arises. How can participatory approaches cope in a global trend of specialisation and corporate control? How can the social, technical, economic, cultural and spiritual context of the collaboration be protected so that it continues to grow and spread to areas where it is needed? The current trend is to protect plant research through intellectual property rights. The question is whether intellectual property rights are an appropriate and sufficient protection in the context of participatory plant breeding.

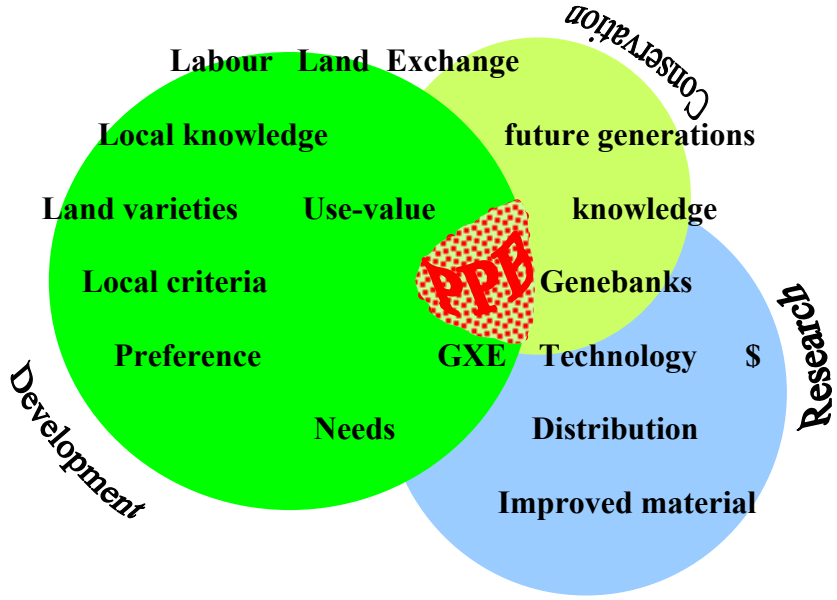


Figure 9 How participatory plant breeding meets the objectives of development, conservation and research.

1.4 BREEDERSHIP AND OWNERSHIP

To engage in the development of new plant varieties is both time and resource consuming. Normally the process from initial cross to formal release of a variety takes five-ten years and equally so if the research process is informal in farmers' fields. It may be true that gene structures are found *in situ* in nature but behind any new variety lies a process of selection, be it unconscious or planned. In whatever form or context, the resources, work, time and ingenuity invested in plant breeding can be seen as the intellectual part of the seed. It lies within the global breeding trend to protect intellectual works but although gene structures constitute the intellectual part, the subject of protection is rather the intellectual contributions of breeders than the gene structure *per se*. In other words, the subject of protection is the breeding activity, but it is achieved through a protection of the breeding result, namely the plant variety

1.4.1 Technical and legal protection

In the case of plant varieties, intellectual property can be protected either through intellectual property rights or by technological means. The latter refers to a protection where seed either lose their characteristics if resown (hybrids) or they are sold sterile (terminators). In comparison, intellectual property rights are legal rights granted by governmental authorities, usually after a process of documentation, application and registration. The technical protection is possibly cheaper and more effective than property rights in the sense that it is self-enforcing (CIPR 2002:60) but simultaneously it is a protection imposing on farmers' tradition to reuse seed. Intellectual property rights on the other hand are faced with large transaction costs. This is closely related to the abstract matters they are meant to regulate and the inherent difficulties in defining, owning and controlling knowledge, ideas and information.

1.4.2 Legal protection gaining territory

So far, intellectual property rights apply only within national borders. This, the principle of territory, creates a complex web of intellectual protections and protection systems. Today there is a spectrum of national legislation from countries granting patents on plants or genes, to countries opposing ownership in association with living matters. However, the principle of territory also creates an international pressure to establish intellectual property rights regimes in harmony with so called free trade rules. Thus, the global trend is to establish a national protection system for plant varieties by granting internationally standardised plant breeders' rights. These rights protect the intellectual contribution of those breeders concerned with developing varieties that meet certain criteria, namely the distinct, uniform and stable varieties. Thus, varieties developed within the formal sector generally gain more attention in intellectual property rights legislations.

1.4.3 Contribution vs. recognition

A large part of the human legacy of knowledge of biodiversity, its importance, and functions have been gained and will continue to accumulate across cultures through agricultural practices (FAO 2003). Farmers have been improving seed for thousands of years and seed, along with other information in relation to planting, storing and cooking, have been exchanged and reproduced over time. It was not until last century that plant breeding also became a specialised profession conducted by formal plant breeders (Thro and Spillane 2000). Still, varieties developed within the formal sector generally gain more attention in intellectual property rights legislations.

This situation calls upon a sincere revision on how to recognise and protect intellectual contributions and its contributors. The issue is perhaps even more crucial as these systems merge (when local knowledge feeds into formal knowledge systems) and when they conflict (e.g. when innovations are claimed and the true innovators are restricted in its use).

1.5 PURPOSE OF THE STUDY

The field of intellectual property rights is fast growing, in territory as well as in protective terms. Yet, there are few analyses of how the regime will affect the diversity of plant genetic resources, whether and how it can help promote research and innovation relevant to national needs and people, or how it will affect food security and the cost and access to seed for farmers. In other words, the future of small-scale farmers and their traditional seed practices is quite insecure. Taken from another perspective, as users, developers and providers of seed, farmers hold the key to an operational plant breeding system yet their participation in its development is limited. As potential holders of intellectual property rights while generally being dependent on the free flow of seed, farmers could share light into intellectual claims beyond those given by the formal sector. On this basis, the study analyses intellectual property rights in Nicaragua from the perspective of small-scale farmers/local breeders of the common bean, *Phaseolus vulgaris* L.

1.5.1 Justification for choosing Nicaragua and the bean

With the introduction of a new intellectual property rights regime comes along institutional adjustments and changes in farming practices. Nicaragua was chosen as it had just entered that process of change. The law on plant variety protection is new and a system protecting informal innovation is forthcoming. Moreover, as a country depending on small-scale farming, the practices of reusing, exchanging, selling and developing seed are part of agricultural traditions and as such essential for rural livelihoods. The restrictions brought by the plant variety protection (PVP) law on the use of seed can therefore lead to significant changes in farmers' seed practices. Furthermore, intellectual property rights arrive with a shift in agricultural systems. How this shift will affect farmers' access and control of the seed must be given serious attention. Of particular interest is the common bean as it is one of the most important crops in Nicaragua, both in means of bringing incomes to small-scale farmers and for being part of the daily dish. Thus, any impacts on the bean system will have tremendous effects regardless of any (dis)advantages brought forward by intellectual property rights in relation to other crops. Moreover, by being one of the crops under improvement in the Participatory Plant Breeding programme in Pueblo Nuevo and Condega, the choice of bean allows an analysis in the participatory breeding context. This enclosure presents an opportunity to closely follow a breeding project that brings together the formal and farmer perspective. It also gives the opportunity to take part in a genuine evaluation process of whether or not to seek plant breeders' rights. In extension, it clarifies whether intellectual property rights are an appropriate and sufficient incentive for participatory plant breeding and research for the benefit of the resource poor.

1.5.2 Opportunities and constraints of IPR for producers and breeders of beans

The first objective of the study is to analyse how intellectual property rights affect small-scale users, producers, and developers of the common bean seed. This objective includes a real case scenario from a participatory plant-breeding programme, which invites the reader into a collaborative evaluation process surrounding the opportunities and constraints of plant breeders' rights. The idea is to identify intellectual contributions in the breeding process and to communicate views and visions in relation to intellectual property rights among the participants. The study also meets up with farmers who are informally engaged in developing varieties, in the purpose of understanding more about incentives and objectives for local breeding.

1.5.3 Potentials of biotechnology

The second objective is to analyse the potential of biotechnology as a tool in plant variety protection. It is often said that biotechnology could be a means in agricultural development if only in the hands of the right people. This study applies biotechnology in the purpose of bringing genetic information to farmers.

The study investigates the possibilities of determining the legal criteria in plant variety protection (PVP) law of distinctness and uniformity on the genetic level. This analysis includes a comparison between bean lines improved within the participatory plant-breeding programme as well as a comparison between the research lines, a blend of traditional red seed and seed of another gene pool, namely the Swedish bean variety Stella.

Since this analysis is done in the framework of a participatory programme, the underlying objective is to strengthen the research project and to empower farmers by providing genetic information on varieties in development. Moreover, by examining the level of relatedness between five lines originating from the same combination but improved by different farmers under different agro-ecological conditions, the analysis could give valuable information on farmers' knowledge and selection achievements.

1.5.4 Contextual understanding

The third objective is to broaden the understanding of this abstract matter of real effects. Although the debate on intellectual property rights in relation to living matters is intense, it is taking place above the heads of most people. This is a serious problem because their impacts will affect us all.

The idea is to place and explain intellectual property rights in its context: how it relates to agricultural development, conservation of genetic diversity and farmers' reality. For this reason, the study spans from small genetic structures to large agricultural systems, research agendas, international relations and universal rights. The connecting thread between these systems (or say the red thread through the study) is inherently abstract. *Intellectuality* serves as the metro between systems and helps visualise how global trends affect the national, local, plant and genetic level.

2. METHODS

Perhaps the most constructive way of approaching the issue of plant genetic resources is to 'agree to disagree', one of the main characteristics of the Crucible II Group[1], a forum that brings together a wide spectrum of opinions with an aim to mediate different points of view on the issues of genetic resources and its associated knowledge (Crucible II Group 2001:vii). This study takes on an interdisciplinary approach for analysing the genetic, agronomic, social, cultural, economic and political dimensions of genetic diversity, knowledge and equitable relations. Although acknowledging the importance of macroeconomics and global harmonisation, these aspects will not be in focus. Instead, as a fan of applicable research, the starting point of this study lies in the reality and opinions of farmers. To take on the perspectives of farmers is important since the real challenge is, in the words of Mooney (1996:8) "to build food security from the family to the farm to the community to the nation and on to the world".

2.1 TOPICAL REVIEW

The background and theory are grounded in a review of literature and articles covering the areas of intellectual property rights, plant breeding, and participatory research. This review includes articles on the seed theme published in national press between 1999 and 2002. The legal framework was identified through a review of international agreements (TRIPS, CBD, ITPGRFA, CIAT, FTAA draft, etc), national law (seed law, plant variety protection law, biodiversity draft law) and governmental strategies on bio-politics. Key persons from governmental and non-governmental sectors were interviewed in order to check interpretations and to receive a general understanding of the legal atmosphere and long-term developmental strategies as outlined by different sectors.

Since the intellectual property rights area is new to Nicaragua, it was a theme of much interest but also of much speculation. In order to use the experience of others in a similar process, the study draws on examples from legislations and reported impacts of other countries.

2.2 FIELD WORK

The first challenge was to understand the 'reality of farmers', and to learn more about local plant breeding in Nicaragua. A participatory plant breeding (PPB) programme between farmers, formal breeders and an NGO in Pueblo Nuevo/Condega gave a unique opportunity to take part in a breeding project and gain experience both in practical terms and during capacity-building and feed-back meetings. The one-year continuous fieldwork brought understanding of the local seed- and breeding system, selection criteria, methods and knowledge, gender aspects and the ups and downs of participatory breeding projects. The participatory approach also gave the opportunity to learn more about different opinions on intellectual property rights and the sharing thereof.

The second challenge was to reveal hidden agendas. Agricultural policy in general and intellectual property rights in particular are very much political matters and clear

[1] The Crucible II Group is a group of 45 individuals from the South and North including scientists, policy- and opinion-makers or business executives from private and public sectors, and civil society organisations.

arguments or objectives can not always be found in relation to the reality one is presented with. The disadvantage was the lack of dialogue between different points of views, giving a black and white picture when reality so often is grey. In order to gain a more balanced picture of the situation, actors from various sectors and backgrounds were interviewed in a semi-structured manner (including farmers, formal breeders, governmental officers, aid staff, members of non-governmental organisations, PhD and graduate students, consumers, traders etc.). By giving the interviewees an opportunity to freely approach key terms, their line of thinking and contextual framework became more obvious. It was for instance necessary to understand how the interviewee defined development in order to understand why they preferred a certain system. The recording was done in a similar manner by noting key ideas rather than exact formulations. The use of key terms also proved suitable as it avoided the difficulties in preparing questions that would be welcomed by all parties and by avoiding direct translations, especially in a theme of such sensitivity and when mother tongues differ. Furthermore, in the quest of getting access to a full picture, it certainly helped with a multidisciplinary background. Many doors shut if you are from the wrong discipline or is using the wrong language. The third challenge was to balance information seeking with information giving.

2.3 PARTICIPATORY AND SYSTEMIC APPROACH

The study was conducted in the ethos of participatory research. In this respect, it aimed to first listen and then proceed into discussions and collaborative learning. The approach to combine objectives with a participatory plant-breeding programme was important as one study alone has difficulties in meeting the criteria of true participatory research. By leaving the technical objective to be negotiated with the research partners was an important approach as it contributed to the research process and at the same time built trust and consistency in the discussions along the intellectual property theme.

2.3.1 Genetic analysis

After discussions with the participants in the PPB programme it was suggested that a genetic analysis on the research lines would be valuable both for the participants and the scientific community internationally. The analysis was to show the levels of genetic uniformity and distinctness in bean lines. The method used was PCR based RAPD (Polymerase Chain Reaction based Random Amplified Polymorphic DNA) whereby amplified DNA samples of plant individuals were tested for electrical charges. By examining banding patterns, it would then be possible to determine whether DNA sequences vary in between individuals. The plan was to use local resources at the National University of Agriculture (UNA). However, the analysis was finalised at the collaborating Swedish University of Agricultural (SLU), which in turn made possible a comparison between laboratory environments and more distinct gene material.

2.3.2 Intellectual discussion

After bringing on the intellectual property issue, it was felt important to bring on the issue among the participants in the PPB project without limiting the discussion to legal rights of control, that is, to go beyond the formal possibilities and project objectives as these may not answer to the preferences of today or the possibilities of tomorrow. The strategy was to give the farmers the opportunity to reflect upon these issues and make farmers part of the decision-making from the very beginning. The initial discussions

aimed more towards understanding farmers' moral rights and the claims thereupon; who were the true innovators and on what premises were the innovations to be used and distributed. By turning the focus on moral rights, plant breeders' rights were subsequently explained and presented as a possible option for the future. During a Mesoamerican meeting between participatory breeders, these issues were further elaborated much to the help of differences in seed systems, institutional supports and values.

These discussions were continued amongst individual plant breeders, from the formal sector as well as innovative farmers in the North Central parts of Nicaragua. To further understand the implications of plant breeders' rights (from the perspective of the rights-holder as well as for the user of protected varieties), the ones with titles or applicants were asked for objectives and attitudes towards the informal seed market and future royalties and enforcement.

A systemic approach helped in analysing the interactions between systems from the small of genes to the large of universal rights. In favour of explaining the larger pictures, important details may have been lost. However many studies have been conducted on systems in isolation. This is why this study instead aimed to cross over systems in order to present a more holistic view. Another idea was to present a vision by using the experience from the participatory project as an inspiration for an alternative seed system.

To bring a living process down on paper was indeed the hardest task of all. Hopefully, much of the result is left in the field and in the minds of people. This written report aims to be a general discussion guided by the experiences from the fieldwork during the year of 2002.

3. INTELLECTUAL PROPERTY RIGHTS (IPR) – GLOBAL AND CONCEPTUAL BACKGROUND

3.1 INTERNATIONAL (DIS)AGREEMENTS

The issues of intellectual recognition and food security are matters of international relevance and essence. Agriculture is dependent on a global flow of genetic resources. Genetic information is of high interest in global trade and big business. There is therefore a growing collection of laws regulating the rights in relation to genetic resources and its associated knowledge, including rights of ownership, intellectual property, stewardship, access and national sovereignty (GRAIN 2002a). At the same time, there is a growing pressure of harmonising these rights between laws and within the international community. Nonetheless, because biodiversity is multifunctional there seems to be as many perspectives as grounds for disagreements.

3.1.1 Resources in public or private domain

According to a principle in the Convention on Biodiversity (Art 3), States have the sovereign right to exploit their own resources pursuant to their own environmental policies. Thus with the signing of the CBD in 1993, natural resources went from being the property of humankind to becoming State property. The rationale was to deal with the Tragedy of Freedom in the Commons, the situation where individuals tend to overexploit. The intellectual property part is another subject matter. Some argue that intellectuality is of public property while others argue that it is a highly private matter.

The division of public and private domain is the foundation of any intellectual property rights. IPR is a means to remove from the public domain certain subject matters defined by law into the private domain where they may not be copied, used or exploited without the prior authority or consent of that owner for as long as this right subsists (GRULAC 2000). The prevailing ground for disagreement is that living matters are distinct from say artistic works or computer models. Firstly, they *are* the essence of our survival. Secondly, it is easy to conceptualise the real and abstract but in reality, it is difficult to separate the seed itself from its intellectual part. While someone may claim a plant, animal or microorganism as his or her exclusive property, the living matter will continue to reproduce regardless of permission.

Which knowledge can and should be protected or not is much an ethical issue but it is also a matter of technical feasibility. According to the Crucible II Group (2001:70) technical feasibility depends upon variables including (1) the scope of knowledge the law is intended to cover, (2) the conditions for the protection included in the law, (3) the rights conferred on rights-holders[2] regarding the covered knowledge and (4) whether or not the law is meant to be retroactive. These variables are essential for any enforcement and legal security; still they are often left behind in the legislative process because of

[2] The term 'rights-holders' will be used instead of 'ownership' as the latter often is interpreted as ownership to material things instead of ownership of rights. Also, the possessive term will be used in the general discussion on farmers varieties, this to ease the reading and not to indicate any moral claims or ownerships.

their great complexity and matters of conflicts. These issues are therefore often left unresolved in the international negotiations.

3.1.2 Multilateral agreements on multifunctional matters

Although genetic resources and their associated knowledge are matters of national sovereignty, there is an international pressure towards a harmonised protection regime. Prior to the GATT Uruguay Round of trade negotiations held between 1986 and 1994, intellectual property rights were mainly administered by the UN organisation WIPO (World Intellectual Property Organisation). The aim of the Uruguay negotiations was to shift the regulatory focus away from WIPO to the World Trade Organisation (WTO) and therein permit the use of trade-based remedies to enforce international intellectual property rights standards (Ekbar 2001). Since WIPO treaties' lack effective enforcement mechanisms this was said to constitute a barrier to world trade, an opinion mainly voiced by developed countries and transnational companies. These discussions resulted in the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) included within the family of treaties administered by the WTO. To date, TRIPS is the most comprehensive multilateral agreement on intellectual property (Ekbar 2001).

With TRIPS, the international community has given green lights to intellectual property rights associated with genetic resources (see p.23), followed by acceptance in the Convention on Biodiversity (CBD, Art 16) and its newer extension, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA, Art. 12.3d). Legal texts aside, the international community is by no means in agreement. Ikechi Mgbeoji (2001) helps draw the parting:

> *"Law and institutions created and/or controlled by states with powerful and influential commercial and industrial interests (such as the TRIPS) maintain the view that the patent system is an instrument useful for sustaining biological diversity and indigenous peoples, and for protecting genetic diversity. On the other hand, international law and institutions created and/or sustained by the United Nations, including the CBD, have been far less sanguine about the purported beneficial impact of an expanded patent system on bio culture and indigenous peoples."*

Somewhat in the crossfire stand the CGIAR centres and the germplasm held in trust for the benefit of the international community. Although these centres hold only about 10% of the global entries, they are important since the collections are reputed to be the most complete, best documented and best preserved globally (GRAIN 2002b). As the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) is coming into force, the germplasm held in trust enters the mulitlateral system.

The International Center for Tropical Agriculture (CIAT) is one of the CGIAR centres holding 31 400 accessions of the Common Bean of which almost all are designated material, *i.e.* held in trust for humanity (Koo et al 2002). The status of the material collected before the signing of the FAO agreement in 1994 is still unclear. This is why CIAT encourages germplasm donors to permit the designation of material pursuant to the agreement (CIAT policy II: 2). According to the agreement with FAO, CIAT will not claim legal ownership over designated germplasm, nor will it seek any intellectual

property rights over that germplasm or related information (CIAT IPR policy, V: 2). Nonetheless, the centre may seek to protect products of its research by obtaining appropriate intellectual property protection. In seeking intellectual property rights, it is guided by its commitment to serve the resource poor rather than by opportunities to obtain recurring revenues (CIAT IPR policy, III: 12). According to their IPR policy, CIAT will endeavour to produce and distribute research products that are "free and clear" of restrictions imposed by third-party intellectual property rights (IV: 2). But is it possible to protect geneplasm coming from CIAT?

Designated germplasm is made available to recipients under conditions set forth in a Material Transfer Agreement (MTA) where all recipients must agree not to claim legal ownership or seek intellectual property protection over the designated germplasm or related information (CIAT IPR policy, V: 4). This, however, confers to the material as it arrived to the centre. The CIAT policy on intellectual property rights as well as the ITPGRFA concern material in the form received. Receivers may seek protection after alterations or rather according to the national intellectual property rights regime. This means that components of the germplasm accessions (such as individual genes) and derivatives (selections made from the plants or descendents of crosses) may be legally appropriated by anyone through IPR (GRAIN 2002b). The centre therefore has poor control over the material once held in trust.

The dilemma of the centres is to ensure a free flow of genetic material (to anyone) while safeguarding the interest of the resource poor. The centres have a strong voice in the intellectual debate and their stand is crucial in terms of remaining with the trust and responsibilities once given.

3.2 PLANT VARIETY PROTECTION (PVP)

3.2.1 TRIPS and plant varieties

There is vast knowledge in relation to genetic resources. In relation to these, TRIPS reads:

> *TRIPS (Article 27.3b)*
>
> *Members may 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.***

Plants can therefore be excluded from patent systems but plant *varieties* must be provided with some form of intellectual property system, either patents or an effective *sui generis* system (a system especially designed for its purposes). However, none of the key elements, such as 'plant variety' and 'effective' has any globally accepted definition. These crucial elements remain susceptible to domestic politics and interests (Mgbeoji 2001). Thus, the mandatory requirements could preserve significant leeway for national governments to work out the manner in which they will balance protection of intellectual property rights against other international obligations and national objectives (Helfer 2002).

3.2.2 UPOV and Plant Breeders' Rights

Most developing countries are choosing the *sui generis* option with some kind of plant variety protection law and the provision of plant breeders' rights (GRAIN 2002a). The global trend is to adopt a PVP law copying the regulations of the UPOV Convention[3]. UPOV is an intergovernmental organisation with objectives to protect new varieties of plants by intellectual property rights. Its first Act was drafted in 1961 and was later revised in 1978 and 1991. The Act of 1991 is stricter than the older version in so that it leaves less flexibility for the implementation of plant breeders' rights in national law.

Many of the new members of UPOV are born out of so called TRIPS-plus agreements (CIPR 2002:62 and GRAIN 2003a). GRAIN talks of 90 such agreements where United States and Europe are putting direct pressure on developing countries to adopt and

[3] UPOV (Union internationale pour la protection des obtentions végétales) and its International Convention for the Protection of New Varieties of Plants is found on www.UPOV.org.

enforce higher standards of intellectual property protection than the WTO prescribes (GRAIN 2003a, b). Usually, the industrialised counterpart takes an active role also in the legislative process by presenting and promoting a finished draft copy. This line of attack is strongly critiqued for undermining national sovereignty and local democracy.

The regulations of UPOV are often criticised for answering more to the reality of the drafting countries, *i.e.* developed countries with certain socio-economic, agrarian and scientific-technological structures (Cervantes 2002). In spite of many opponents, the web of patents and other intellectual protections are spreading rapidly. Since knowledge is non-exhaustible but rather thrives by its utilisation, the rationale is not found within the tragedy of the commons but in the commitment to protect intellectual contributions, or perhaps in the nature of things.

3.2.3 Grounds and consequences

According to the Universal Declaration of Human Rights, it is a State's commitment to ensure "the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author" (Article 27). This obligation is repeated in the International Convention on Economic, Social and Cultural Rights (Art 15.1c). However, according to Helfer (2002) the policy goal of granting intellectual property rights to plant varieties is founded principally on an instrumentalist approach; the protection should provide adequate incentives for breeders to invest in breeding but the ultimate goal is not to reward creators but the enhancement of social welfare. The plant breeder is to recoup his or her investment by exclusive rights and herein avoid others, so called free riders, from freely copying seed without sharing the cost of breeding. In return, there is an improvement and release of new varieties. Opponents say this is nonsense, intellectual property rights is a way "to control the market, the competition, full stop" (GRAIN 2003d).

To implement an intellectual property rights system initially designed for the seed systems of developed countries has its motives, and will therefore have its consequences. In the context of developing countries it carries the risk of disrupting the collective way of thinking and behaving as well as restricting farmers' rights to reuse, exchange and sell seed, the very practices that form the basis of their traditional role in conservation and development of plant genetic resources (CIPR 2002:68). These traditional rights are generally sought for through exemptions in the rights-holders control.

3.2.4 Exemptions in Plant Breeders' Rights

There are two common exemptions where the rights-holder is restrained from demanding payments for the usage of protected varieties, the breeders' and farmers' exemptions. Without the authorisation of the rights-holder, breeders may freely use protected varieties for breeding purposes and farmers may engage in traditional practices such as saving and reusing seed for private purposes (Helfer 2002). The rationale behind these exemptions stem from the counterbalance of plant breeders' rights and the good of society at large and, according to CIPR (2000) what regards the farmers' exemption, on the rationale that the intent is further production of *grain* and not reproduction for sale of *seed*.

The exemption for farmers to reuse protected seed without any authorisation or payment is implicitly secured in the UPOV Act 1978 since it only concerns commercial activities whereas the newer Act of 1991 leaves it to the national law to secure farmer exemptions. That the right to reuse seed has shifted from a natural right to a legal exemption is much criticised by farmer movements, much so because the right becomes "subject to political decision-making and prone to restrictions in the future" (van Wijk 1995). Accordingly, restrictions on the farmers' exemptions come in several forms (GRAIN 2003d):

- farmers are prohibited from saving seed of certain crops
- only certain farmers (e.g. those with a specific farm size or income level) can enjoy the privilege
- farmers have to pay an additional royalty to the breeder for any seed that they save on the farm
- farmers can save seed, but not exchange it (they can only grow it on their own farm)
- farmers can save seed and exchange it, but they can not sell it
- farmer can save, exchange and sell seed, but only without using the name of the variety

3.2.5 Plant Breeders' Rights vs. Farmers' Rights

When farmers compete with rights-holders on the market of the protected seed, there is a conflict between farmers' rights and plant breeders' rights. The rights of farmers are not intellectual property rights but are often in tension with intellectual property rights. Farmers' rights stem from the past, present and future contributions of farmers in conserving, improving and making available genetic resources and the rights are increasingly being recognised in international law. According to the preamble of ITPGRFA, farmers have the right to save, use, exchange and sell farm-saved seed and other propagating material, and to participate in decision-making regarding, and in the fair and equitable sharing of the benefits arising from, the use of plant genetic resources for food and agriculture. These rights are fundamental to the realization of farmers' rights. Some jurisdictions prohibit informal exchange and sales of protected varieties, activities that are considered part of traditional agriculture. Farmers' rights also clash with intellectual property rights because many farmers and farming communities wish not to claim exclusive rights in plant varieties and/or have not been able to do so in the varieties they have developed over time.

3.2.6 DUS criteria vs. breeding agenda

Most laws on plant variety protection usually set up two aspects of the requirements for the protection of a variety, the technical requirements and the administrative-legal criterion. The latter refers to a unique denomination and novelty in regards to the time of commercialisation. The technical requirements, known as the DUS criteria, state that a plant variety must be distinct from other varieties, uniform and stable over generations in order for it to gain legal protection (CIPR 5.3b with modifications):

1. *Distinctness*: a variety must be clearly distinguishable, in one or more characteristics, from any other variety whose existence is a matter of common knowledge at the time when protection is applied for. This requirement ensures inter-varietal identification.
2. *Uniformity*: a variety must be sufficiently uniform in its distinguishing characteristics, such that different individuals of the same variety are reasonably similar. This requirement ensures intra-varietal uniformity.

3. *Stability*: a variety must be stable in its distinguishing characteristics, *i.e.* it remains unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle. This requirement addresses varietal identification across time.

How IPR affects research priorities is a crucial question since its justification lies in giving incentives for breeding for the good of society. As such it steers breeding in a certain direction. The DUS criteria however are criticized for not answering to agricultural demands. According to a literature review by Rangnekar (2002) three problems are noted with the DUS criteria:

(a) The exclusive focus on distinctness of characteristics is considered a low threshold for 'inventive step', which tends to enable the easy grant of protection (e.g. cosmetic breeding).
(b) The demand on uniformity is an excessive burden that has, at times, deleterious effects on biodiversity.
(c) The high demand on stability is considered an economic deterrent to the quick release of new varieties. On the demand on uniformity,

In addition, farmers usually seek more genetically heterogeneous seed material, which makes it more adaptable and suited to their agro-ecological environments.

The DUS criteria that define what knowledge can be protected exclude all but a small proportion of total knowledge on genetic resources. Some members of the Crucible II Group argue "in this way, they preserve a necessary, utilitarian balance between restricted areas of protected knowledge and the freely manoeuvrable public domain" (Crucible II Group 2001). Others in contrast seek to modify existing intellectual property rights and the DUS criteria to permit farmers themselves to claim exclusive rights in plant varieties they develop informally (Helfer 2002).

3.3 *SUI GENERIS* COMMUNITY RIGHTS

Another approach to protect informal innovations apart from modifying existing plant variety protection law is through so called s*ui generis* community rights that are rights designed especially for informal knowledge systems. The highest declaration in a forum of indigenous peoples states "indigenous peoples are entitled to the recognition of the full ownership, control and protection of their cultural and intellectual property. They have the right to special measures to control, develop, and protect their sciences, technologies and cultural manifestations, including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora…" (Draft Declaration on the Rights of Indigenous Peoples, in Crucible II Group 2001:37).

3.3.1 Holistic protection on moral grounds

Where protection of intellectual property means enforcing private, exclusive economic rights to a specific creation in order to prevent others from using or reproducing it, protection of traditional knowledge, necessarily implies protecting the whole social, economic, cultural and spiritual context of that knowledge so that it continues to be produced and reproduced (GRAIN 2003e). Although the latter has clear social benefits

and therefore in theory could stem from the instrumental approach, the political and/or agricultural reality suggests that farmer innovations do not need the same incentives or protection system. Instead, granting these intellectual property rights are more related to the moral commitment to compensate innovators and to protect human (intellectual) rights. "Indigenous and local peoples have a right to have their knowledge protected, not because protecting it will create incentives for more innovations, but because it is theirs" (Crucible II Group 2001:96). Under the rationale that rights are rights, and should not be undermined by utilitarian considerations, some members of the Crucible II Group (2001:106) argue that it does not matter that one potential result of creating strong rights for a wide range of knowledge would be to tie up the system. 'Why should we trust formal sector innovators with strong rights, and not indigenous and local communities', they ask.

3.3.2 Rights of benefit sharing

Sui generis community rights are often included in biodiversity laws and are generally considered to counter balance breeders' rights and industrial innovations, giving legal rights to fair benefit-sharing rather than exclusive rights of control. For instance, when an outsider wishes to access innovations there is a need for a prior informed consent (PIC) from the innovators and in this, contracts are to be established on future rights. Although not intellectual property rights, the Crucible II Group argues "there is very little conceptual or justificatory distance between the creation of access laws that include PIC provisions for indigenous and local communities and the creation of intellectual property protections for their benefit" (Crucible II Group 2001:41). This approach meets the vision of the CBD for fair and equitable sharing of benefits and the need to reward and support farmer contributions to plant genetic resources through benefit sharing mechanisms, such as payments, technology transfers and collaborative research programmes.

3.4 PARTICIPATORY RIGHTS

Although the goals of participatory plant breeding are wide-ranging from enhancing biodiversity to empowering marginalised farmers, one of the main purposes of PPB is to develop new plant varieties (Weltzien/Smith et al 1999:xi). These varieties may sometimes be of interest for commercialisation and/or protection by intellectual property rights, patents or breeders' rights. When plant varieties are improved in collaboration between various actors the question may arise who the actual breeder is and who, in case protection is desired, might be the holder of intellectual property rights. Thus, collaborative programs raise new questions and challenges for recognising collaborative innovations in Intellectual Property regimes (Crucible II Group 2000:11). Then again, participatory plant breeding provides the opportunity of following the practical process of innovation and to guide a fair benefit sharing based on actual contributions (Weltzien/Smith et al. 2000).

3.4.1 Joint breedership - joint ownership

International agreements and national law are very vague on the linkage between the quality of collaboration and the legal rights flowing from it. Breeding as such is a broad term, stretching from genetic engineering to evaluation in the fields, and it may

therefore be difficult to decide who the legal breeder is. What is clear though is that for making any claims on intellectual property rights, there is a requirement of some sort of intellectual contribution.

In reality, there is a range of options to define 'joint breedership', from a permissive approach (one creative contribution) to a restrictive approach (a creative contribution to a very specific stage, such as the development of DUS varieties). As international agreements leave poor guidance to the relation between collaboration and property rights, it is a question for national law and/or contracts to determine the contributions required to establish joint breedership and its consequences for intellectual property rights. On this, the term collaboration is sometimes found in national law but it is seldom specified which contributions at which stage of the process establish 'joint breedership'. This allows participants to decide upon the future sharing of right. However, it is generally so that the legal field is lagging behind the technical aspects of collaboration. (CGIAR PRGA 2001)

Almekinders and Elings (2001:436) argue that the "recognition of farmers' contribution to the development of the variety is an ethical issue, but may be of less practical relevance than questions on who will be responsible for the submission and costs for the variety maintenance and basic seed production". With the introduction of breeders' rights, the situation is put into a new light. Nowadays farmers' contribution also brings questions of who decides upon whether protection should be applied for, of who would be responsible for the submission and costs of application and maintenance, and who would have control over decisions and be the collector of royalties if protection is applied for. It seems as if the participatory programmes going on worldwide have either said no to intellectual protection on ethical grounds or they stand on the doorsteps evaluating pros and cons of breeders' rights. A review by the CGIAR System wide Program on Participatory Research and Gender Analysis shows that in formally led programmes, varieties have either been fed into the formal system without acknowledging the input of farmers or released and diffused informally to farming communities (Weltzien et al. 2003:112). The issue is very complex as it spans over ethics, group agreements, and genetic diversity all the way to economic speculations in a non-linear way.

3.4.2 Quality of participation – link to intellectual property claims

In the intellectual property rights context, participation must be linked to some degree of intellectual contribution. Sperling et al (2001) suggest three elements relevant for analysing the *quality of participation* of farmers and researchers: the degree and stage of participation, and the functions performed by the participants (CGIAR PRGA 2001). These elements will clarify who does what in the collaboration, and in turn makes possible an analysis of property sharing arrangements. However, as case studies of PPB show these elements often change as the program matures, and that research processes are iterative rather than linear (CGIAR PRGA 2001). The elements below are therefore time-dependent, an aspect which must be taken into consideration in any analysis. The elements marked with * suggest intellectual contribution relevant for plant variety protection.

Quality of participation

i. *Degree of participation*
*Consultative (Information sought from farmers/ other clients, scientist-led)
*Collaborative (Task sharing along lines determined by formal research program)
*Collegial (Researchers support farmer-initiated/managed program)

ii. *Functions performed by participants*
*Technical expertise
Organisational skills
*Information giving (trade-offs and preferences
Teaching/ skill building (extension
Field labour
Provide inputs (land, *seed, funds, etc)

iii. *Stage of involvement in breeding process*
Defining overall goals
Defining breeding targets (*e.g.* identification of farmers' plant ideotype and most valued characters)
*Generating variability
*Selection in early segregating populations
*Variety testing
*Variety evaluation
Seed multiplication/ distribution

3.4.3 Joint breedership – joint benefit sharing

The approach of participatory plant breeding aims at joining breedership with joint benefit sharing. Again, to closely follow the practical process of innovation could be a guide to fair benefit sharing based on actual contributions (Weltzien/Smith et al 2000). In participatory plant breeding, roles are often reversed from classical breeding. In many PPB cases, farmers are in charge of the last innovative contribution, building upon the works of formal breeders and the accumulated innovations by generations of farmers. As such, farmers could legally reap the benefits of many former innovators by using the PVP provisions and in this their contributions would integrate into the legal approaches for intellectual recognition in plant improvement. Again, it is a system opposed by many fellow farmer movements.

3.5 JUST RIGHTS

Plant breeders' rights and patents are often blamed for only recognising the last contribution, or for crediting the people in power to design rules and regulations to their own benefit. It should be underlined that most IPR are not benefit sharing; they focus on the last inventor and credit the contributions the system has decided to credit. Are these just rights?

3.5.1 Justice as fairness

According to Plato justice is what is to the advantage of the powerful (in Barry 1989:4). John Rawls on the other hand sees justice as fairness where the fairness of the circumstances under which agreements is reached is transferred to the principles of justice agreed upon (Barry 1989:265), *i.e.* if laws or contracts were negotiated in a fair manner any reading would be just. Thus in this sense, justice emerges in a situation, as a course of conduct that is accepted by all parties. To allow stakeholders to participate in the legislative process in a fair manner is therefore crucial for making rights just. Figure 10 illustrates the dynamics between perspectives included in the decision-making process and the perceived justness of the law.

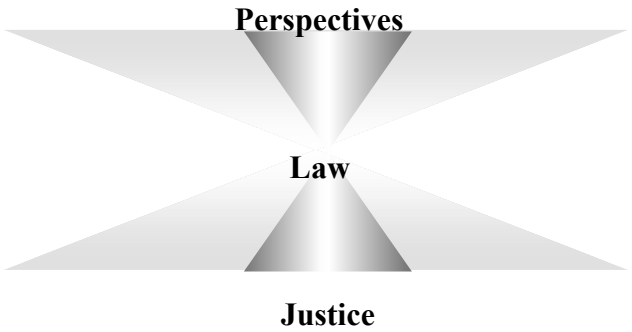


Figure 10 The more perspectives included in a decision-making process, the more just will be the outcome…

In reality, the participation of indigenous, local and farming communities in the legislative process is limited and the sphere holding scientific (formal) knowledge has had the privileged of designing most laws on plant variety protections. Third world countries (which are rich in biodiversity) consistently propose amendments in the TRIPS requirements to include information on the origin of the material and its associated knowledge, prior informed consent (PIC) from governments/communities, and proof on fair and equitable benefit sharing (Byström and Einarsson 2002:33). In short, to make intellectual property rights compatible with the CBD objectives of sharing the benefits of genetic resources and its associated knowledge in a fair and equitable way. How this is practically done is beyond the scope of this paper[4], however these issues are intrinsically interlinked:

"*When one seeks to reconcile the knowledge, innovations and practices of indigenous and local communities with intellectual property, the main problem seems to be a lack of recognition of the special interests of the indigenous communities and the design of systems for monitoring the use of their works according to criteria suited to the subject matter to be protected. In the same line of thought, it is also important to take due account of the principles of justice and equity that should preside over the sharing of benefits of any practical, commercial or industrial result that might emerge from the intellectual efforts of indigenous and local communities."*

(GRULAC 2000)

[4] For an excellent overview on the issue and an Argentinean case, see "Access to and Intellectual Property Rights over Genetic Resources with a Special focus on fair and equitable benefit sharing" by María Dolores Pigretti Öhman, the International Institute for Industrial Environmental Economics, Lund University, 2002.

3.5.2 Justifications

Some make a distinction between good and bad intellectual property rights. These voices oppose a privatisation of genetic resources and its associated knowledge by private industry, but in the same breath advocate the protection and exclusive rights of indigenous and local peoples' knowledge (comments during the Mesoamerican conference, Managua 2002). Such protection is often referred to or thought of as defensive or passive protection with the aim to reduce biopiracy. Swanson (cited in Banerjee) argues that intellectual property rights on living matters is a very rational approach to the resolution of the biodiversity problem:

> *To a large extent, the extension of 'intellectual property' regimes to include natural resource-generated information simply levels the playing field between those societies which are more heavily endowed with human capital and those that are more heavily endowed with natural forms of capital.*

What this quote fails to recognise is that intellectual property regimes born in a playing field of inequitable power relations are unlikely to have an equalising effect. Under these circumstances, it is important to look beyond the judicial system and reflect upon the motives for providing such rights. Those opposing intellectual property rights in relation to living matters do this not only on moral grounds but also because they put little faith into a system designed by and for the stronger party. As such, they believe that even so-called good intellectual property rights are a capitulation to a system with few intentions of protecting the interest of informal innovators.

Ultimately, the impacts of intellectual property rights on genetic resources are directly related to the seed system, its level of technology, breeding, seed exchange and genetic diversity. As a preview, the concept of justice as fairness serves as an indication of what is to come.

4. NICARAGUA – THE GROUND TO EXPLORE

Nicaragua's history is paved by erosion of biodiversity, knowledge and inequitable relations. It has lived through colonisation, exploitation, deforestation, dictatorship, revolution, civil war and natural disasters. In the backwaters came its fair shares of agricultural reforms; from export crops and State support in the 1960-70's, to State control, co-operatives and green revolution in the 80's, to state withdrawal and liberalism in 90's (Marin and Pauwels 2001). This process did not only include changes in the agricultural system and crops but also a change in the very people owning, managing and cultivating the land because of expropriations, migrations, occupations and reoccupations. The strategy of today is to formalise the agricultural sector. This is a part of *the route to modernise rural Nicaragua*. The road though, is long and full of pitfalls. The ten years of revolution, embargoes, State control and civil war were devastating for the agricultural development and the recuperation is hampered by natural disasters, falling export prices and inconsistent policies. Both the State and its citizens rely on outside help, be it the World Bank, aid organisations or Nicaraguans working abroad (20% of the population according to CIPRES 2003a). Most Nicaraguans survive through aid, reciprocity and small profits as goods and services change hands. The informal market is large and people still rely on informal networks and safety nets to a large extent.

Figure 11 Map of Nicaragua (CIA 2003)

Table 1 Nicaragua in figures and rule

Nicaragua in figures

Area: around 130 000 km^2
Capital: Managua (around 1, 1 million, 2000)
Population: 5.4 million (UN 2003)
Labour force: 1.7 million (CIA 1999)
Unemployment rate: 23% plus considerable underemployment (CIA est. 2001)
Inhabitants/km^2: 39 (2000)
Natural population growth: 2,3 % (2001)
Literacy: 67 % (1999)
Ethnic groups: Mestizo (mixed Amerindian and white) 69%, white 17%, black 9%, Amerindian 5%
Language: Spanish (English, Mesquite, Sumu and Ramas)
Religion: Catholics 80 %, Protestants
Natural resources: lumber, fish, seafood, some gold, silver and cupper
Budgets: revenues: $726 million and expenditures: $908 million, including capital expenditures of $NA (CIA est. 2000)
External dept: US$6.1 billion (CIA 2001)
GDP: 12,3 billion US dollars (CIA est. 2001 of purchasing power parity)
GDP- real growth rate: 2,5% (CIA est. 2001)
GDP/capita: US$473 (2000)
Sector share in GDP: agriculture 32 %, industry, construction and mining 22 %, service and others 46 % (2000)
Exports: US$609.5 million f.o.b. (CIA est. 2001)
Export goods: coffee, shrimp and lobster, cotton, tobacco, beef, sugar, bananas; gold (CIA)
Export partners: US 57.7%, Germany 5.3%, Canada 4.2%, Costa Rica 3.3%, Honduras 3% (CIA 2000)
Imports: US$1.6 billion f.o.b. (CIA est. 2001)
Import partners: US 23.9%, Costa Rica 11.4%, Venezuela 9.9%, Guatemala 7.9%, Mexico 5.9% (CIA 2000)
Currency: 1 cordoba = 100 cevantos = US$14, 9 (June, 2003)
Membership in international organisations: UN, OAS, CACM, WTO, IMF, WB.

Source when not given: Countries in pocket form (Länder i fickformat), No 704, 2002, the Swedish Institute of International Affairs

Nicaragua in rule

Government type: Republic
Executive branch*:* *Chief of state and head of government:* President Enrique Bolaños Geyer and Vice President Jose Rizo Castellon (since 10 January 2002).
Cabinet: Council of Ministers appointed by the president.
Elections: President and vice president elected on the same ticket by popular vote for a five-year term.
Election results of November 2001: Bolaños Geyer (PLC - Liberal Constitutional Party) elected president - 56.3%, Daniel Ortega Saavedra (FSLN - Sandinista National Liberation Front) 42.3%, Alberto Saborio (PC - National Conservative Party) 1.4%; Jose Rizo Castellon elected vice president
Legislative branch: Unicameral National Assembly (93 seats; members are elected by proportional representation to serve five-year terms): Liberal Alliance (ruling party - includes PLC, PALI, PLIUN, and PUCA) 42 seats, FSLN 36 seats, PCCN 4 seats, PCN 3 seats, PRONAL 2 seats, MRS, PRN, PC, PLI, AU, UNO-96 one seat each.
Judicial branch: Supreme Court (16 judges elected for five-year terms by the National Assembly)
Legal system: Civil law system; Supreme Court may review administrative acts

Source: CIA 2003

4.1 ROUTE OF DEVELOPMENT

Nicaragua holds enough natural resources to feed its population. Situated in the heart of the tropical Central America with favourable climates, fertile soils and the region's lowest population pressure and most extensive social division of land, Nicaragua could support rural life quality. Yet politics and natural disasters have placed the country at rank 118 based on the Human Development Indicator, with 50% of the population living below the national poverty line (UNDP 2002).

Nicaragua has traditionally relied on a few mineral and agricultural exports to sustain its economy. Historically, the national wealth benefited only a few elite families of Spanish descent, primarily the Somoza family, which ruled the country with US backing between 1937 and the revolution in 1979 (BBC News 2003). Nowadays, the national wealth is on sale on a market where prices often do not cover the cost of production (CIPRES 2003b).

4.1.1 From Somoza to Bolaños

The Sandinistas, a leftist intellectual guerrilla with strings to Marx, Castro and Che Guevara initiated the revolution against Somoza. In 1978, the opposition against governmental suppression and corruption had spread to all classes of society and the civil war was a fact. In 1979, the incumbent powers were overthrown and the Sandinistas moved into State office. During the revolution in the 1980's, the Sandinistas began redistributing property and made huge progress in the spheres of health and education (BBC News 2003). They also created co-operatives and supplied them with vehicles, animals and seed. Along with material resources came a large number of rules for commercialisation and harvesting. These were meant to control market forces but as such, they also affected farmers' decision-making and incentives.

The revolutionary government also supported the green revolution and an agricultural development of large scale and high input farming. The Sandinistas' leftist orientation however attracted US hostility, which in turn led to trade sanctions and a US-sponsored counter-revolution, the Contras (*ibid*). Parallel to US embargo and the following necessity to farm for its own subsistence, the Nicaraguan agriculture intensified and soils were overexploited and filled with chemicals.

Eventually, the war wore down on people and in this process the Sandinistas lost most of the almost unanimous support they had once received for liberating Nicaragua from the Somoza dictatorship. In consequence, the Sandinistas lost the first free election in 1990 in favour of a more liberal party headed by Violeta Chamorro, the widow of a murdered opposition leader during the Somoza regime. Doña Violeta, having the crucial US support and soothing character came to unite parties and led the nation into peace and politically towards the right. During her governance, subsidies were cut and cooperatives started to fall apart. Co-operatives did not only lack resources and a common vision, but were also faced by legal and land tenure problems. More so, State withdrawal and its lack of regulations and credit systems resulted in large price fluctuations which hit hardest the most vulnerable, the small-scale farmers (Marin and Pauwels 2001). Although peace brought some economic growth, lower inflation and lower unemployment, the country was soon to be hit by the Hurricane Mitch in 1998. This killed thousands, rendered 20% of the population homeless, caused billions of

dollars worth of damage (BBC News 2003) and turned fertile land into rocky landscapes.

In November 2001, Enrique Bolaños was voted into office as candidate of the governing Liberal Constitutionalist Party. He had served as vice-president under President Arnoldo Alemán since 1996, but has since then sought to distance himself from Alemán's stained reputation and gone in the lead to fight against corruption (BBC News 2003). In August 2002, a large corruption affair made its way to the former president Alemán who still partly governed the country as head of the National Assembly. Alemán was charged with money laundering and embezzlement during his term in office and was placed under house arrest after legislators voted to strip him of immunity from prosecution (*ibid*).

4.1.2 Rural development

Around 44% of the Nicaraguan population are rural. Although being the largest employer the rural area includes the majority of poor (Marin and Pauwels 2001). The governmental actions lack an integrated rural strategy and interventions are weakened by poor coordination and continuity, in labour and in visions (Ligia Ivette Gómez, Nitlapan-UCA 2001). As a result, most of the work towards rural development is in the hands of non-governmental organisations. These have, in a practical sense, taken over State responsibility. In some areas, mainly those affected by Hurricane Mitch, practically all families are involved in some sort of aid program, receiving their hens, fruit trees and capacity buildings from outside. The NGO CIPRES (2003a) says that the poverty is so critical that one notices a change in the political agenda of the international agencies: nowadays everyone talks of the poverty, the extreme poverty, and the hunger and poor nutrition. Agendas are caught between soothing extreme poverty through food aid programs or the slow yet sustainable objectives of democracy, participation, empowerment, food security, income generation and improved livelihoods. Many nationals in the field of rural development believe that food aid is only fortifying the dependency and wish to shift the agenda towards productive areas and their commercialisation (Nuñes Soto 2002 and Lanuza pers. comm).

4.1.3 Agricultural development

Any development in a country based on agriculture goes through the rural and agricultural sector. In Nicaragua, the agricultural sector is an important source of food, income, employment and foreign exchange; it stands for around 30% of the national GDP and 68% of export incomes (MAGFOR 2001).

In comparison to the other Central American countries, agricultural productivity is low. In 1999, the level of production was only 90% of the historic peak in 1978 just before the revolution, yet the area under production had increased by 25% (Marin and Pauwels 2001). Along with a continuous restructuring of the agricultural system and limited resources for agricultural research and extension services, the civil war, natural disasters and movement of people working within the agricultural sector have resulted in a loss of embedded farmer knowledge. The ratio of grain production and area under production is still decreasing and so is people's security to maize, rice and beans (MAGFOR 2001), the basic meal for the Nicaraguans together with plantains, eggs and cheese.

Rising agricultural productivity can directly improve the livelihoods of rural people, urban consumers and the national budget (CIPR 2002). Whether producing for household needs, domestic or export markets, there are grounds for improving the agricultural sector and its extension service. The question is: *in what way?*

4.1.4 Formal development

During the revolution in the 1980's, Nicaragua tried to follow its own mode. It was a revolution in the spirit of Sandino, the national hero who once fought for a Nicaragua in charge of its own development. Sandino was killed together with the ten thousands of lives later lost in the revolutionary war. Nicaragua's people have fought world powers and the majority will fight no more. In times of globalisation Nicaragua is following the path of others, in much a path of unknown consequences. From a situation where most farmers cultivate for subsistence, the agricultural minister presents calculations that Nicaragua would profit from importing food instead of producing it (Aurelio Llano pers. comm). Nicaragua is currently spending a third of its export income on importing basic foodstuff (CIPRES 2003b). This is done in a country with opportunities of producing for national self-sufficiency in foodstuffs with lands for cattle, beans, rice, and maize but with poor capacity to compete with US and European products benefiting from subsidies and dumped prices.

The Ministry of Agriculture and Forestry (MAGFOR 2001) believes the main problem in grain production lies in the management on farm level, especially in the usage of seed of poor genetic quality, the cultivation of mixtures of land varieties and improved varieties and production in areas not suitable for particular crops. The ministry therefore calls for a change in technology and in the areas selected for the production of grains. This change in technology also implies a cultural change well recognised by the ministry; farmers need to abandon traditional practices of reusing seed and instead buy new certified seed each season. The strategy is to strengthen the formal system, *i.e.* the chain consisting of scientific plant breeding, a regulated seed production by specialised producers and an organised distribution or marketing of the seed to farmers as defined by CBDC (2002). The strategy is visualised through the Seed Law of 1998 in which the seed system is to be formalised and programs like *libra por libra* where farmers are offered to exchange grains for certified seed. As part of this trend towards formalising the system of seed production and commercialisation is the newly established plant variety protection law and its breeders' rights.

4.2 PLANT BREEDERS' RIGHTS

4.2.1 IPR package in harmony with WTO and UPOV

For a century, the Patent Law of 1899 regulated the Nicaraguan legal field of intellectual property rights. In April 1999, a new package of laws was presented for the National Assembly that was to meet the obligations of trade agreements with the United States and World Trade Organisation (WTO). New intellectual areas were included and among them was the innovativeness behind plant varieties. Six months later, the Law on plant variety protection (PVP) was adopted and the innovativeness of breeders received

legal protection and rights of control over new, distinct, uniform and stable varieties by the provision of plant breeders' rights (PBR).

Nicaragua is a member of UPOV 1978, yet the country chose to implement many of the stricter provisions of the 1991 Act. The Nicaraguan Law gives rights-holders the control basically over all acts involving the seed of a protected variety (production or reproduction, preparation for the purpose of reproduction and multiplication, commercialisation, exportation, importation and donation). With the exemption for farmers' private use and breeders' improvement of the protected variety, these acts all require the authorisation from the rights-holders. In compliance with the 1991 Act, rights-holders also remain in control over essentially derived varieties (varieties closely related to the protected variety).

The application process sets up the technical requirements of DUS and the administrative-legal criteria as mentioned before (Art 16-20). The novelty criterion as regards time of commercialisation is set to less than one year in Nicaragua and 4 years on foreign market (Art 17). UPOV does not state criteria or methodologies for the examination process but instead gives directives (see UPOV's system for examination, document TG 1-2). Nicaragua has chosen to give the applicant much responsibility in conducting field trials and presenting data. This is a cheaper system and more suitable for a registration office with limited resources where applicants are to present results from field trials and other information clearly demanded by the office. The examination has three steps (Chapter V):

1. Exam of form: Administrative step to check application and denomination. The denomination check includes a review of CD – ROM Plant Variety Database and other documentation.
2. Technical exam of DUS criteria normally documented by the applicant.
3. Technical assessment by a committee that may ask for additional information, field trials or laboratory work for the purpose of comparative analysis. The committee constitutes of (MIFIC 2002):

    1. - Director of Seed, MAGFOR
    2. - Head of Registration and Control, MAGFOR
    3. - Registrator of Intellectual Property, MIFIC
    4. - Head of the Department for the Protection of Plant Varieties
    5. - One representative from MARENA
    6. - One representative from UNA
    7. - One representative from UNAN (University of León)
    8. - One representative from INTA

The application demands a publication in the Daily Official Gazette to make known to the public that someone is intending to protect and claim a variety (Art 46). However, to protect a variety is not a one-step ordeal. The rights-holder must annually submit information, documents or material to prove that the variety maintains as it was once protected and pay US$ 330 each year (Art 57, 85). The protection is valid for 20 years (Art 22). Nicaragua adopted a flexible system where all species can be protected. There are however technical limitations since each species requires its own routine. Today, there are routines for rice, beans and maize but the idea is to develop routines for other crops as applications drop in (Zelaya pers. comm).

4.2.2 Legislative process under bilateral pressure

As mentioned before many of the new UPOV members are born out of TRIPS-plus agreements and Nicaragua is no exception. Here the intellectual discussion started in January 1998 when the President Arnoldo Alemán met and agreed with the former US Ambassador Lino Hernandez to provide a system of intellectual property rights and herein adopt the UPOV convention as national law.

In the drafted Bilateral agreement, Nicaragua agreed to "provide adequate and effective protection and enforcement of intellectual property rights" (Art 1). This in accordance with TRIPS requirements, but the bilateral draft continued: "to provide adequate and effective protection and enforcement of intellectual property rights, each Party shall, at a minimum, give effect to the substantive provisions of the UPOV Convention" (Art 2). The National Assembly adopted this bilateral agreement some months later. By doing so, it limited Nicaragua's possibilities to adopt a unique system answering to national circumstances and interest and rushed the country into an intellectual property rights regime, disregarding the facts that the TRIPS granted a longer preparation time and that the 27.3b article is still under revision (see page 24).

In August 1998, during a meeting organised by the Ministry of Environment and Natural Resources (MARENA), several organisations learned by chance, as Magda Lanuza puts it, that the Nicaraguan government had committed itself to join UPOV (Lanuza et al 1999). In April 1999, Alemán introduced a PVP bill that was a mixture of the two acts UPOV 1978 and 1991. Seven months later, the National Assembly approved the very same bill as law.

Who opposed and who was in favour?

In large, the interest groups resembled the advocates and opponents identified by Jaffe and van Wijk in a study over PVP laws in Argentina, Chile, Colombia, Uruguay and Mexico (van Wijk 1995).

Advocates of the PVP law:

(1) Domestic seed companies which want to protect their new plant varieties in order to obtain royalty income,
(2) Domestic public agriculture research institutes which face considerable budget reduction and are looking for additional income sources (INTA),
(3) Subsidiaries of foreign seed companies which want protection of their varieties and breeding lines in order to enter the Latin American seed markets,
(4) Foreign governments, which aim at an overall strengthening of intellectual property protection in Latin America (US-Nicaragua Bilateral Agreement).

Opponents were representatives from civil society, opposing the privatisation of biological resources and traditional knowledge, but more so opposing genetically modified organisms/transgenetic crops (Lazuna et al 1999). Most opposition focused on the issue of transgenetics rather than Plant Breeders Rights' of legal control over the seed market (article review, 1998-2001). Magda Lanuza (pers. comm.) stated that this was regrettable but at the time the law was debated, few actually realised the difference. The law may indirectly attract transgenetic material to Nicaragua because of the provision of intellectual property rights, but this could rather be an issue for a

biosecurity law or protocol. Nonetheless, the fact that the two sides were discussing different issues gave a situation of two.

The public did in fact not understand or rather was little informed about the plans and potential effects of intellectual property protection in the seed industry and farming in general. These were issues for the environmental and intellectual elite with poor public awareness. Though Nicaraguans are generally politically engaged, grass-root mobilisation is weak due to a lack of democratic traditions and necessary infrastructure for information and participation. Today, foreign aid money runs much of the lobbying and campaigning for public awareness from a top-down approach. Even so, during the time of the legislative process, any opposition would have had problems making its voice heard.

Who voted and who appealed?

The PVP bill arrived at the National Assembly with the label 'urgent' since in Alemán's words "Nicaragua already is a member and signatory of UPOV" (Lanuza et al 1999). The civil society was ravished by the untruthfulness of this statement and over the pretension to approve a law without any public discussion. NGOs, ecologists, representatives of the universities and indigenous peoples jointly alerted the National Assembly. This interrupted the urgency procedure and allowed the opposition to present alternative versions to the Environment Committee (Lanuza et al 1999). Among these were (Lanuza et al 1999):

- The exclusion of transgenic germplasm
- Broadening of the farmers' exemption to cover the use of the harvest
- A registry under the Ministry of Agriculture to guarantee national sovereignty over genetic resources
- A linkage with the development of sui generis laws for the protection of plant varieties under Article 27.3b of TRIPS
- Subordination of the PVP law to Nicaragua's rights and obligations under the Convention on Biological Diversity

As a result, the National Assembly approved a first reading including several of the amendments presented by civil society (Lanuza et al 1999). This mobilised the pro-UPOV forces in favour of the government's original draft. According to voices in opposition of the draft, the US threatened to exclude Nicaragua from the Initiative of the Caribbean Cuenca and to deport all Nicaraguans living in the US. An analysis made for Forum Syd (Byström and Einarsson 2002) supports the extent to which a country can go in bilateral negotiations. In October 1999, the law was up for vote in the Assembly. After 40 minutes plenary discussion the changes were rejected and the Assembly was left to vote on the bill that had originally been presented (Pommier, IRAM pers. comm.). It was a close decision where the majority votes came from the governmental party and its liberal allies. According to Lanuza et al (1999), MIFIC had distributed a document in the National Assembly saying, "The plant variety protection is a matter of intellectual property rights, which in turn have nothing to do with the use and commercialisation of seed". Although the government with arguments of improvements in agricultural production and technical capacities supported the PVP law (Lazuna et al. 1999), all sectors including civil and governmental, say the law was a direct result of international pressure and not any domestic demand for intellectual property rights. The

Humboldt Centre describes the decision as 'witnessed' by representatives from the religious communities, indigenous people, ecologists, farmers, and consumers (Humboldt Centre 2001:2) as "a case of bilateral pressure to go beyond international obligations, which in themselves already are heavy" (Lanuza et al 1999). In September 2001, the National Assembly ratified the UPOV 1978 membership.

The PVP law have been appealed in the Supreme Court of Justice. The claim was brought forward by a broad spectrum from the civil society, claiming that the PVP law and UPOV membership are unconstitutional, violate the General Environmental Law and contradict the CBD (Centro Humboldt 2000b). These appeals are still pending, some say frozen because of political interests of individual judges.

Honourable President…
We ask that the Law for the Protection of New Plant Varieties be withdrawn. We also implore Nicaragua to cancel its application for accession to UPOV. We hope that, instead, Nicaragua may promote the development of sustainable agriculture, collective intellectual rights and the rights of farming and indigenous communities. Nicaragua should resist the privatisation of life forms and work for the exclusion of biodiversity from TRIPS.

(Part of campaign letter, in Lanuza et al 1999)

4.3 THE COMMON BEAN AND ITS SEED SYSTEM

Some 8 000 years ago, the Common Bean *Phaseolus vulgaris* L., was still a wild growing vine of the highland of Middle America and the Andes. Since then the species has been going through phases of domestication, evolution under cultivation and mutation, selection, migration and genetic drift and today it is one of the major food crops grown worldwide in a broad range of environments and cropping systems (Gepts and Debouck 1991). These processes still take place in different places of the world with distinct wild populations as original material. This results in a species of great diversity with great spectra of colours, shapes, taste, and growth habits. Nicaragua is in the centre of this diversity, and the Common Bean is also a central part in the Nicaraguan meal, often eaten three times a day. The Nicaraguan preference however is quite particular, the small and shiny clear red bean of the Mesoamerican grouping.

4.3.1 Beans in general

The Nicaraguan bean market offers a beautiful blend of red nuances, a mix not only colourful but full of genetic diversity. Take a pick, but the pickier you are the larger the pocket book you need. The traditional small red will cost you more than the darker, bigger varieties developed by the national breeding programme. But please while you are there, look beyond the market place and step into the fields and meet the variety that never reaches the urban consumer. Alongside formally bred varieties cultivated for the market you will find more of the local blend, neatly sown in different lines or in a random pattern of distinct plants and colours. This is where some farmers develop their own varieties and where varieties take on local names, such as the black and white *poneloya*, one of the earliest varieties of the season and in this lies the name, long awaited after a long and dry summer and therefore a sure eye-catcher.

The average farmer sows around three varieties on plots of 1-4 ha, but later in the season you might have problems seeing distinct plots and varieties for all the plants. Beans cover around 60% of the agricultural land, from the lowlands to steep hills in the mountains. Nicaragua has two bean seasons; four if you are in a lucky spot, so whether or not you are a bean eater, Nicaragua's beans, fresh, tasty and gas-free, will be your converter. From a producer's perspective, it is not a production of high profits but rather a production dependent on growing conditions and tolerance to heat, pests and diseases.

Table 2 shows bean production during the three seasons of *Primera*, *Postrera* and *Apante* in 2002/2003. Missing is the season of irrigation, *Riego* from February through April, but because few have access to irrigation this is a small season in comparison. The production under *Apante* is limited to the rainy environments in the South and Atlantic coast.

Table 2 Bean production in Nicaragua, 2002/2003

Season	Area under bean production (000 ha)	Expected bean production (000 000 kg)	Yield* kg/ha	Yield* qq/mz**
Primera (May-Aug)	56	45	848	13,1
Postrera (Sept-Dec)	85	65	744	11,5
Apante (Dec-Jan)	114	68	621	9,6
Total***	254	178	758	11,7

* based on harvested area/production
**qq and mz are national measures, see transformations below.
*** Note that figures are twice as high as Nitlapán review in 1996 (Marin and Pauwels 2001:20).
Source: MAGFOR statistics 2003

Table 3 Transformations

Transformation	Transformants per average
1 manzana (mz) = 7 029 m^2 1 hectar (ha) = 10 000 m^2 = 1.4 mz 1 libra = 454 grams 1 quintal (qq) = 100 libras = 45.4 kg 1 qq/mz = 64.7 kg/ha US$ 1 = 14.5 Córdobas (C$)	3 mz (average farm) = 2.1 ha 1.4 mz (average bean production area per farm) = 1 ha 10qq/mz (average bean production) = 614 kg/ha 25- 35 qq/mz (good bean production) = 1590- 2270 kg/ha 3 -5 C$/libra (average grain price) = 300 -500 C$/qq = 0.45 – 0.56 US$/kg 700 C$/qq (average seed price) = 1.1US$/kg 0.5 qq/mz (average seed usage) = 32 kg/ha 1 seed (average seed multiplication rate) => 45 seeds 3 beans = 1 gram

4.3.2 *Criolla* – a mixture of beans

The older varieties are normally referred to as *criolla*, literally a mixture and a mixture of traditions *per se*. Generally, the *criolla* is a mixture of types but having gross agronomic uniformity, a collection Chahal and Gosal (2002:83) refer to as land varieties. How great a mix the *criolla* actually represents differs from farmer to farmer

(and the extent to which the seed interacts in the cycles of plant-back, consumption, seed exchange as illustrated in figure 2).

Most farmers participating in the study held land varieties uniform when it came to seed colour and size, flowering and maturing period. The general idea though is that most farmers store and plant seed randomly and if any, selection is made at the time of sowing based on seed colour and size.

Newer varieties released from the national breeding programme INTA are so far normally kept isolated from the older varieties. The newly released varieties are bigger and darker red or black. In general, these varieties are reused only once or up to three-five years before they are exchanged for new seed of preferably more resistant varieties. More over, farmers give these varieties less attention. Farmers speak of adaptation to local agro-ecological conditions but more often they talk about the problem of degeneration, *i.e*. the material looses its qualities.

Although newer varieties usually are held separate, their seed sometimes join the *criolla* collection (mechanical mixing between different types of beans is in itself a *criolla*) (Oscar Gómez pers. comm). Some farmers also continue selecting from within formally released varieties, to the extent that the material is finally considered a traditional variety and thus acquires the name *criolla* (Bravo, INTA and farmers pers. comm). Below is portrayed how formal varieties diffuse into the local seed collection.

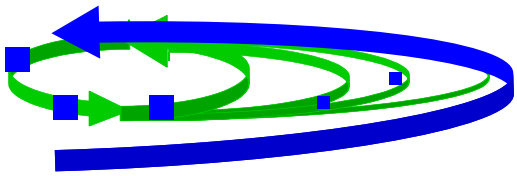


Figure 12 How formal varieties (outer arrow) blend into the local seed collection (inner circles).

4.3.3 Trade-offs between formal and local

The newer, formally bred varieties are claimed to have higher yields and resistance to diseases. Still, the older bean varieties have something the formal breeders do not seem to get right *i.e.* the small red grain. The red colour is a highly complex trait that tends to get lost when crosses are made (Beebe pers. comm, in Thro and Spillane 2000:16) and this happens when crosses are made with disease resistant varieties like the DOR combinations, which are darker and bigger than the preferred little red bean. Because of the lack of known resistance to diseases, there is no longer any formal production of crosses with *criollas* (such as Estelí 150). Please note the dark trend in table 4 of releases between 1979 and 2001.

Table 4 Formal bean releases in Nicaragua, 1979-2001

Year of Release	New Name	Original Identification or Code	Genealogy	Seed Colour or Market Class
2001	INTA Nueva Guinea	Negro Tacana	(DOR 364 x G 18527) x (DOR 365 x LM-30-630)	Black
2001	INTA Cardenas	DOR 500	(DOR 364 x G 18521) x (DOR 365 x LM-100)	Black
2001	INTA Estelí	CM-12214-25		Red
2001	INTA Rojo	EAP-9510-77	MD-30-75 x DICTA 105	Red
2000	INTA Canela			Red
1999	INTA Masatepe		DOR 364 x SEL 1077	Red
1999	INTA Jinotepe			Red
1996	COMPAÑIA	RAB 463	G 18244 x MUS 6	Small red
1994	CNIGB 93	DOR 391		Small red
1993	COMPAÑIA 93	PVA 692		Small red
1993	DOR 364	DOR 364	BAT 1215 x (RAB 166 x DOR 125)	Small red
1990	ESTELI 90A	CNIGB 1-90	Orgulloso x BAT 1654	Small red
1990	ESTELI 90B	CNIGB 2-90	Orgulloso x BAT 1836	Small red
1990	ESTELI 150	CNIGB 3-90	Chile Rojo x RAO 36	Small red
1985	REVOLUCION 85	HT 772202	Porrillo Sintetico x S 257-4	Small red
1984	REVOLUCION 83A	BAT 1217	G 4791 x G 3657	Small red
1984	REVOLUCION 84	BAT 1514	BAT 93 x BAT 1155	Small red
1984	REVOLUCION 84 A	FB 8383	BAT 1155 x BAT 304	Small red
1983	REVOLUCION 83	BAT 1215	G 4791 x G 3657	Small red
1983	REVOLUCION 79A	BAT 789	G 4122 x G 3988	Small red
1981	REVOLUCION 81	A 40	G 4495 x G 7131	Small red
1979	REVOLUCION 79	BAT 41	G 4122 x G 3988	Small red
1979	REVOLUCION 82	HONDURAS 46		Small red
1979	BRUNCA	BAT 304	G 4495 x G 5711	Black

Source: CIAT

4.3.4 Dark trend

For its rarity and popularity, the small and red *criolla* still have a higher price on the market. In the Mayoreo market in Managua, beans are sold per pound and most vendors sell two kinds of 'varieties': red beans at 5 cordobas/libra and black beans at 4 cordobas/libra. Although referred to as black bean it is rather purple like a DOR. The red kind includes *criollas* but also bigger grains from formal but redder varieties. Some of the red diversity has direct origins in the farmer practice to sow mixes but perhaps more in middlemen stretching the red line for larger profits by mixing darker seed with red. As the farmer sits down to calculate incomes, it is more profitable to cultivate formal varieties considering that these varieties usually give higher yields. *Criollas* are therefore increasingly sown for household purposes while the formally bred go to the market. The outcome is that the urban population may eat cheaper but darker beans and farmers lose their relation to the seed.

Many breeders and salespersons believe this to be an inevitable trend (Kauffmann, INTA and salespersons at Mayoreo market). "Farmers must understand the importance of genetic improvement as an income generator and consumers must alternate their taste in accordance to productivity." After all, they say, the very black bean is more tolerable, high yielding, nutritious and tasty. Many farmers are also interested in new varieties, colours and markets. It almost appears as if liking the black bean is something thrillingly naughty, like flirting with the complex relation to Costa Rica and its taste for black beans.

4.3.5 How traditional is the *criolla*?

It is difficult to provide accurate data on the existence of true land varieties (gene material originating in Nicaragua and developed in farmers' field) versus the adoption of formally bred varieties. The origin of the seed used in the field is an issue though in times when formally improved varieties are heavily promoted on behalf of *criollas.* If farmers are to adopt newer varieties, older varieties are likely to be replaced and discarded. Thus, the question is whether these older varieties constitute a national and traditional seed treasure or whether the exchange is from one formally bred variety to another.

People promoting certified seed, but also other unbiased actors, claim that there is not much of a seed treasure to be lost since what farmers today refer to as *criollas* have in fact been *acriolladas,* undergoing creolisation. That is, varieties introduced in the 1950-60's from the US, have been added to or have substituted the national collection (PROMESA and IRAM pers. comm). This exchange is on going. Auerelio Llano, head of INTA's bean section says there hardly exists any true bean *criollas* but that these have largely been exchanged for INTA varieties. Others from the environmental sphere like the Humboldt Centre, Magda Lanuza and the National University of Agriculture (UNA) believe these statements to be exaggerations. Sure, Oscar Gómez from UNA says, many varieties introduced in the 1950-60's are still found in the fields but these varieties were few and are only a small part of the great diversity still existing in the field.

Depending on how *criolla* is defined, the level of adoption of formal varieties will be accordingly. According to the Regional Programme of Beans (PROFRIJOL) the share of area sown to formally improved varieties was 30% in 1996. Adoption is probably higher the closer to cities, the more relation to aid organisations and research institutes, and perhaps the bigger the farm and commercial objectives. Figure 13 shows a regional comparison on the usage of land varieties versus formally improved varieties in 1996. Since then, the area under production has increased as well as the use of formal bred varieties (Gómez pers. comm).

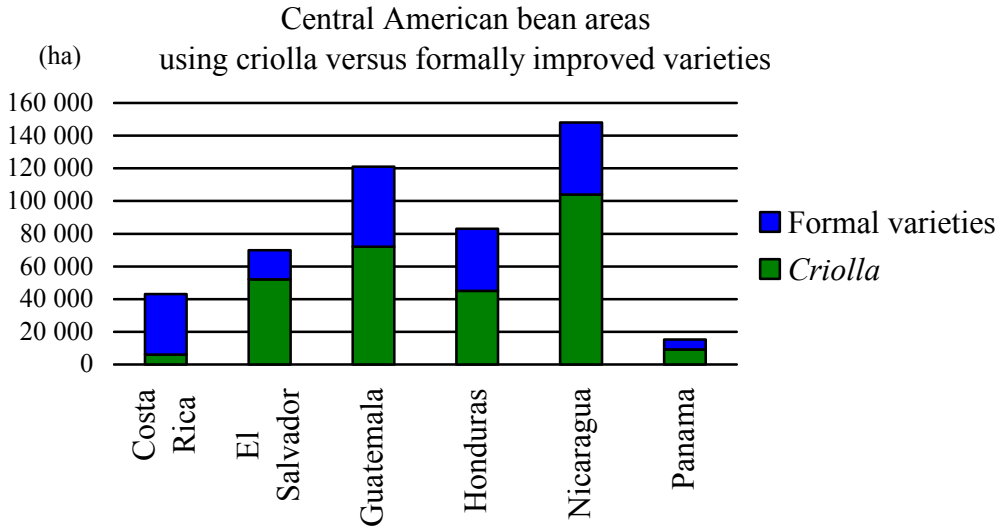


Figure 13 Area under bean production using land varieties or formally improved varieties in Central America, 1996 (PROFRIJOL).

4.3.6 Seed (in)security

The essence of any grain production is the availability and quality of seed. Farmers sometimes keep cultivating land varieties because it is the only seed they can access, but often because these are closer to farmers' knowledge and demand less management, time and inputs yet producing for household needs and preferences. Still, free seed supply and low maintenance aside, some land varieties have reached the stage where producing them gives negative return up to the point where farmers sow them only for the conservation of the national seed treasure (PRODESSA, ADDAC and farmers pers. comm).

Moreover, in times when farmers struggle to survive the next day there are few seed left for resowing after a long and dry season without production. In many families, seeds intended for sowing are prioritised as food. Seeds for the first season are therefore often accessed through the local market or from anywhere possible and reused only in the second season. This seed is seldom produced for its seeding purpose but refined by informal traders and sold without any quality control. Since the seed market is unreliable, the control of what plants arise is accordingly.

Farmers must not only prioritise food over seed saving, but seed storage *per se* is according to Aurelio Llano, INTA the biggest problem in the line of production. That seed need tender love and care is generally not recognised. Grain and seed tend to get the same treatment, ignoring that the quality of the material of reproduction is a main factor towards good yields.

In a situation where seed is either prioritised as grains or grains are refined into seed there are two complementary approaches to increase seed security:

a. To increase the control over seed production and assist farmers in accessing externally produced seed.
b. To support farmers in producing, storing and reusing seed.

The figure below again shows the staple from figure 13 and the question is how the share between formal varieties and *criolla* will look in the future. Has there been an increase in the use of varieties developed and produced by the formal sector or is the *criolla* still dominating in the field? The major question is what distribution best secures farmers' access and control of seed, and how to get there.

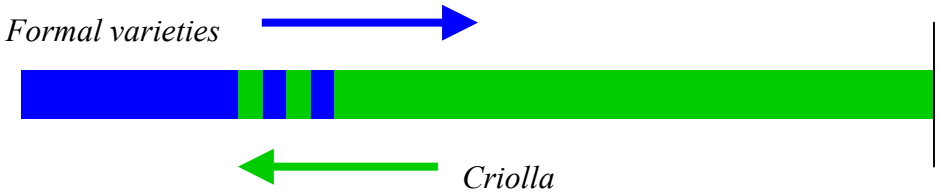


Figure 14 In 1996, the *criolla* was used on 70% of the bean land. The arrows show the increase of one type on behalf of the other.

This paper will first explore the interaction between formal and local seed and then analyse the role of intellectual property rights in shaping the future seed system.

4.3.7 Seed system under formal control

In the formal system, seed production is regulated and controlled, varieties are registered, producers and seed are certified with MAGFOR and seed bags come with stamps of certification.

For the purpose of a seed production under control, there are five formal categories of seed in Nicaragua (Kauffmann, INTA, pers. comm): *Genetic/breeder* seed, *basic/foundation* seed, *registered* seed, *certified* seed and *authorised* seed. The three first types are used in the seed multiplication process with different standards of purity. In early 2002, there were seven registered bean varieties, see table 5. Certified and authorised seeds are produced by controlled, certified and authorised seed producers, who generally sell the seed to companies who in turn sell it to farmers for grain production. In addition, there is the category *apta*, a category INTA wants to eliminate due to its poor quality (six or more multiplications).

Table 5 Registered bean varieties, 1997-2002, and the availability of formal seed.

VARIETY	SEED CATEGORY	Availability Feb 2003		Coverage	
		kg (000)	qqs	ha	Mzs
INTA MASATEPE	REGISTERED	5 .4	120	105	150
	CERTIFIED				
INTA JINOTEPE	REGISTERED				
INTA CANELA	REGISTERED	28	620	545	775
	CERTIFIED	76	1 682	1478	2 103
INTA ESTELI/DOR 364	REGISTERED	4,5	100	88	125
	CERTIFIED	40	882	775	1103
	AUTHORISED				
INTA ROJO	REGISTERED				
INTA NUEVA GUINEA	REGISTERED				
	CERTIFIED				
INTA CARDENAS	REGISTERED				
TOTAL		155	3404	2990	4255

Source: Seed Dept, MAGFOR

4.3.8 Low certified demand

The market of certified seed in Nicaragua is new and small with estimations around 10-15% of the total seed supply for grains, lower in the case of beans. In comparison to maize, improved bean seed is considered expensive (800 C$/qq or 1.2 US$/kg). This price is very high when one knows that seed can be accessed fairly well on the informal market or reused from the own harvest for 400-0 C$/qq. Certified seed is also sold in large amounts whereas small-scale farmers prefer buying smaller amounts just before the sowing time to match the chosen variety to the expected features of the growing season. The reason for the low demand for certified seed according to Bravo, INTA is not only financial. Bravo believes that the tradition of buying and using seed (and not grain) was lost during the revolution when there was a lack of commerce and resources (pers. comm).

Moreover, considering that land varieties are said to store and reproduce at a higher rate than commercial varieties (Herrera and Gómez pers. comm), the question is whether new seed must be accessed externally for every season or whether farmers can choose to invest in new material when they see it fit. If land varieties are to be exchanged for commercial seed it is necessary to make sure that the seed will reproduce or that farmers will be able to access seed externally for each season.

4.3.9 To certify demand - *libra por libra*

In the agricultural year of 2002/03, a national campaign was launched in favour of certified seed. The *libra por libra* scheme is a programme of technical assistance and exchange of poor quality seed (grain) for certified seed to a cost of 3 million US$

(MAGFOR 2003a). The programme reached 102 445 small-scale farmers and 100 000 ha with 59 552 qq certified seed (MAGFOR 2003a: MAGFOR year 2002/2003) of which 8000 qq (363 tons) were bean seed (MAGFOR 2002). The purpose according to MAGFOR is to raise the awareness of the importance of seed quality and in continuation, farmers will adopt the use of quality seed for sowing and therein increase yields, labour productivity and food supply for the household and local market. MAGFOR (2002) visions that if farmers use and buy new seed every season, food security will increase and so will income-generating production.

Since the promoting consultant PROMESA had US connections, NGOs accused the whole scheme for running the errands of Monsanto. Both INTA and the USAID PROMESA denied this and claimed that they worked for higher yields and food security for the good of the Nicaraguans. PROMESA was also informing about and promoting certified seed at universities to change the attitude among those directly involved with farmers (e.g. UNA seminar and IPR courses). José Manuel Bravo, INTA also reassured that the seed for exchange were seed that can be found in the regular market and not any transgenetic seed, which was the accusation by some NGOs (pers. comm). Continuously, Bravo denied the accusation of biopiracy (rumours said exchanged seed were sent to US gene banks). This seed or grain rather, Bravo said, will go directly to food aid programmes. The element of exchange was to avoid handouts and instead create a feeling of responsibility. Since Nicaragua's history of aid dependency and high inflation has given an attitude of remittance, the factor of material exchange was to change this attitude by obliging a personal contribution. The exchange however was much criticised because farmers would exchange seed that reproduced for seed that would not and farmers would be caught in a system where seed had to be bought every season (Lanuza pers. comm). Julio Gómez (ADDAC pers. comm) wonders why organisations working in the rural areas were not consulted when the *libra por libra* scheme was prepared. "As it is designed today it will not solve the problem of seed insecurity because it is only the farmers with seed savings who can exchange", he says critically. More so, he continues, vulnerable farmers will be the ones buying into the propaganda of seed business since older farmers with more knowledge in selection and reuse processes are more negative to buying hybrids. Julio's Gomez's personal opinion is that *libra por libra* is a struggle against *criollas* and that the underlying purpose is to take away farmers autonomy in favour of seed companies' profit.

Other organisations are more positive towards the exchange program. One agronomist from the project FondeAgro in Matagalpa said farmers were happy to exchange since certified seed gives higher yields. He points out that the exchanged amount of seed is only good for around 1.5 manzanas and the farmers continue sowing *criollas* on the rest of their land. The farmers can therefore compare characteristics and performance directly in their own fields.

In practical terms, aid organisations or INTA extension officers handed out coupons and payback was supposedly to be realised after harvest. For the second season of *Postrera* 2002, PROMESA was no longer an actor and the material exchange was transformed into price reductions where the farmers were to pay 20% of the market price for

certified seed. The organisation facilitating the distribution of coupons was also responsible for giving technical assistance in relation to the usage of certified seed. That such technical assistance was often lacking and seed was delivered after optimal sowing date were only part of the critique pointed towards the seed exchange programme.

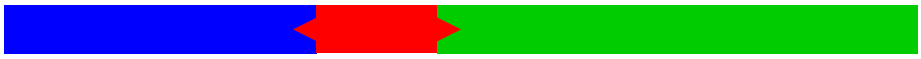
Many farmers still hold the opinion that improved seed is mainly suited for favourable areas. To change this attitude, PROMESA tried its best to organise field days and present field trials where improved seed produced more, and was financially more profitable even in marginal areas (Seed fair, Matagalpa and Estelí, 2002). Nelson Navarro from the seed company APROSEN says bean *criollas* per average produce 18 qq/mz and certified seed 40 qq/mz. If these estimations and studies are correct and if the results will reproduce over several seasons, it will nonetheless be difficult to break through the mistrust of farmers in adaptation and quality control in certified bags. "Certified seed is only business" said one larger-scale farmer at a seed fair in Estelí. "When using farm-saved seed, the whole profit goes to the farmer", he argued. Nonetheless, he agreed that certified seed could give a higher production, but that this is a somewhat risky investment that not many can afford.

Oscar Gómez, UNA believes that INTA employees should talk clearly with the farmers and explain not only the boundaries of varieties but also the requisites needed to produce. More so, to make clear that if the farmer cannot follow the requirements or the farm does not hold the right conditions it is better not to spend money buying the seed because ultimately, the improved variety will produce just as much or less than the seed adapted to the farm.

4.3.10 Support to farmer seed system

Parallel to the scheme to increase farmers' access to externally produced seed is the strategy to support farmers in producing, storing and reusing seed. This is an approach taken on especially by UNA and NGOs involved in organic farming. One strategy is to establish local seed banks with clear descriptions on days to maturity, resistance, colour and cooking abilities. The purpose is to create a dynamic form of so called *ex situ* and *in situ* conservation. When conserved in national or international collections, at universities or institutes, the road is long between seed bank and field since access is formalised and intellectual property rights could be a constraining factor. With local banks, diversity is conserved *ex situ* but closer to the prime users. The farmer borrows seed at the time of sowing and returns the same or more after harvest time. This gives clear advantages of close, free, secure and direct access to seed while storage and quality control can be arranged with common funding. In addition, the farmer does not need to enter the market with all it includes of price fluctuations and risks of buying seed of poor quality. A secure access to seed of good and known quality allows the farmer to sow when preferred, and cultivate and experiment based on known parameters.

Participatory plant breeding is another strategy to support local capacities while generating improved varieties based on farmers' criteria and preferences. This approach join the formal and local system and can be seen as creating a new distribution scheme in the zone of transition. In Nicaragua, there is currently two PPB programmes: a CIAT project in rice and sorghum established in 2002, and the Participatory Plant Breeding Programme in maize and beans in Pueblo Nuevo and Condega.



4.4 PARTICIPATORY PLANT BREEDING IN PUEBLO NUEVO/CONDEGA

4.4.1 Agricultural background

Pueblo Nuevo and Condega, situated in the region of Estelí in the north of Nicaragua (see map on page 33), are communities with long traditions in cultivating beans and maize. In 1972, tobacco was introduced when two tobacco companies saw potentials in the fertile soils close to the river. The cash crop soon became popular among the farmers and tobacco, maize, beans and later also tomatoes were cultivated in a rotating system. Soon came pests and viruses, especially the whitefly and with it the golden mosaic. Tobacco is relatively resistant to the golden mosaic but the whitefly extremities make the tobacco leavess black. In order to limit harvest failure a large amount of pesticides was sprayed around the area (Herrera pers. comm). The whitefly also spread from the tobacco to nearby crops, and while the tobacco was tolerant, beans, maize and tomatoes were severely affected.

The Golden Mosaic and breeding for resistance

Although land varieties generally have acquired genes for resistance to common diseases and pests (Chahal and Gosal 2002:83) they hold low resistance to new diseases. According to Almekinders and Elings (2001:429) the relation between plant diseases and seed quality is an area in which farmers' knowledge often falls short. Many farmers have poor knowledge in selection methods and they usually select from the bag of grains based on seed size and colour. Another reason for land varieties' low resistance to newer diseases could be the sudden and powerful spread of viruses to which a selection process can not keep up.

One such example is the whitefly *Bemisa tabaci* Genn. and the golden mosaic it carries. The whitefly is one of the main pests in tropical and subtropical regions. The tiny white fly may cause direct damage such as plant nutrient loss, physiological disorders and honeydew excretions or act as virus vectors for *eg.* the golden mosaic (Brown 1994). Lacking immune cultivars and a virus that is uncontrollable by agrochemicals, the main target has been the fly itself (Morales 2001). High doses of insecticides have globally resulted in resistant whiteflies and contaminated agricultural environments and products. According to Francisco J. Morales (2001), breeding for disease resistance has proven to be a complementary and sustainable control method. Morales states that there is both direct and circumstantial evidence indicating the existence of adequate genetic variability in the primary and secondary gene pools of most cultivated species. This variability, Morales argues, can be exploited within and between cultivated species and their relatives using both conventional and advanced crop improving techniques, such as molecular marker assisted selection.

Problems of seed quality

The golden mosaic virus is still one of the largest problems in the area and in the lower areas where it flourishes; grain production is often unprofitable and subsequently abandoned. The effects of the virus stand in direct relation to weather conditions, and the farmers of Pueblo Nuevo have poor control over the virus and production levels. In reality, 80% of the beans for consumption are today bought from the market. Apart from decreasing yields the disease also limits seed saving. The virus is not seed borne but affects seed quality. Affected seed is therefore not saved for the next cropping season. Where formally released varieties are reused for some seasons, local varieties lack resistance and are in the process of disappearing. Oftentimes, seed is bought in the market for every new cycle, or donated from one of the many non-governmental organisations in the area. This seed is referred to as certified seed of poor quality control and farmers say they have poor knowledge of its adaptability to local conditions. There also exists local exchange; seed is exchanged for labour or other resources such as food. Overall, poor access to seed is perceived as a large problem.

Problems of climatic changes

The area was severely hit by the Hurricane Mitch in 1998. The once fertile land around the river in Pueblo Nuevo was filled with stones, rocks and trees and almost 100 ha of the best agricultural land were lost. Nowadays, people talk of climatic changes affecting agriculture such as heavy flooding in combination with longer dry seasons and severe drought. As most people cannot afford an irrigation system, they depend on the production during wet season, a season that is shortened due to a longer dry season. These climatic effects are said to be worsened by deforestation, including the land clearing for agriculture and the cutting down of trees for tobacco production. These climatic changes have direct relation to the demand for new agricultural skills. New methods and methodologies are needed to cope with a degraded landscape and changing climates.

4.4.2 Initiation of PPB programme

The non-governmental organisation CIPRES (Centro de Investigación y Promoción del Desarrollo Rural y Social) was funded in 1990 and was soon to establish a field office in Pueblo Nuevo. From a dialogue with farmers in the area it became clear that one large problem was the lack of seed, in particular seed adapted to local preferences and conditions. In 1999, on a Dutch initiative and Norwegian sponsorship, CIPRES introduced a programme of participatory plant breeding of the common bean and maize in Pueblo Nuevo and the neighbouring community of Condega. Today the programme engages 50 farmers, a formal plant breeder from INTA and the CIPRES staff.

4.4.3 Roles of participants

The formal plant breeder from INTA (Julio Molina) has the role of a technical adviser. Molina explains the methodology for selection and together with the producers decide on the type of field, quantity of seed to use, form and season of harvesting. CIPRES facilitates the research process by giving technical advice and helps in the

administration and management of meetings and data. Moreover, in the words of Molina, CIPRES is the representative of the farmers.

The breeding process itself is very much managed by the farmers. There is an experimental group of twelve farmers, nine in the case of beans. These farmers are directly engaged in the everyday activities of planting, collecting data, selecting, harvesting and so on and if the formal breeder or CIPRES give advice, the ultimate decision always lies with the individual farmer. Thus the farmers have until now selected seeds individually though largely based on the same selection criteria, which were negotiating in the initial phase of the programme.

The other farmers participating are in much a body of advisers but they will increasingly take part in the selection evaluation and process. The collective group takes part in meetings, culinary tests and discussions around the cultivation, selection and future path. More so, as they take part in the research process they are also learners on how to manage their own selection process in the future.

Words noted by CIPRES staff during a field day in Condega, 2001:

The farmer handling the parcel explained the enthusiasm behind carrying out research because it is in this phase that one as a producer realises what kind of variety one is developing and one can classify the most preferred one. That is why I have been able to reach the point where these materials are uniform and I believe I will remain with three and thereafter classify two based on weight and reproduce these to make seed available to the others in my community and sell it at a price more accessible to farmers.

Capcity meeting in Pueblo Nuevo, 2002.

4.4.4 Breeding objective

The objective is to develop one or two varieties per crop that answers to farmers' preferences and low-input management. Initially, the objective was to improve local varieties and in the case of maize, several local and improved varieties were also crossed and brought under selection and further crossings by farmers. In the case of beans, no promising, resistant local varieties could be identified. This is why the bean breeding was initiated by selecting between pure lines and by selecting within segregating populations brought from CIAT. Since then, crosses have been made at the University of Zamorano, Honduras between improved varieties and local *criollas* from the higher altitudes of Pueblo Nuevo. In the bean line, the objective is to develop a variety that is resistant to the golden mosaic and drought with high yields and grains of clear red colour and good taste. When it comes to the criterion of taste, soup seems to be the most critical dish. It appears as if heavy seed is not only preferred because prices are set per weight, but also because a heavy soup is thought of as containing much iron. Women are considered experts in the area of taste and they add that clear red is preferred for soups but the darker red is acceptable for other purposes such as making

traditional *gallo pinto* (fried rice and beans). The consumer criteria are also related to the tolerance of saving beans after cooking. The criteria of size and shape seem to be employed unconsciously rather than outspoken. Again, the size of the grain is not so important as the yield, a reason why farmers prefer heavy seed. Ultimately seed will be selected on the basis of storage abilities. These criteria are meant to answer to the preferences of the household as well as market demand.

That farmers themselves set the criteria is the special feature of PPB, said farmers and formal breeder in chorus. There are often worries that farmers base too much value on colours. Yet in this case, colours have been an important communicator in which formal and local criteria differ since farmers have shown preference in clear red where most formal breeders would have selected darker red (Molina pers. comm). Perhaps the dark trend in varieties is put in another light. The criterion of taste has been brought into the selection at a later stage, mainly due to the shortage of seed. Although the first organised culinary test failed, it was said that some lines still in the research were not perceived as having a good taste. On the other hand, farmers continued sowing lines that had been discarded in the research process, mainly because they were still considered valuable for its good taste. From the reaction and interests of other farmers in these tasty but lower yielding lines, it becomes clear that yield has perhaps taken unfair dominance in the selection process. This was emphasised when a farmer explained that a tasty, beautiful and fast maturing line had been discarded based on its lower yield with the other farmers replying '*only* because of that'. That taste came in late in the selection phase was therefore regretful for three reasons; firstly, lines may have been discarded although having superb taste; secondly, lines were kept although having poor taste; and thirdly, women did not feel as participating as fully as men in the research process.

4.4.5 Programme objectives

"Knowledge is as important as the seed". The farmers say they have gained knowledge they thought they would die without knowing. A new area has been opened up to them: the knowledge of how to select and breed towards set criteria.

> *The programme opened up a space that have been closed to us for a long time - things they (the formal plant breeders) have been able to do.*
> *(Words during a meeting)*

Capacity building and local entrepreneurship are at focus in the programme and so is the creating of alternatives to the conventional seed system. There is an outspoken desire by the farmers to develop skills and increase local interest and knowledge in plant breeding while at the same time to find ways not to depend on the conventional seed market.

In seed terms, the objective is to meet household demand in seed and grain and in extension, to multiply and distribute seed locally and nationally. Through the alliance with CIPRES the farmers have a partner dedicated to making production feasible and finding commercial opportunities, often so through cooperation. For now the idea is to release varieties informally through the network of CIPRES and for this purpose produce seed traditionally and outside of formal control. The next step of entering the formal system is under evaluation, mainly by taking the interest of the participating farmers under consideration.

4.4.6 Future path along production

What will happen when the project ends? That is, when funding ends in 2004 and perhaps also the CIPRES-farmer collaboration. The regional coordinator Rafael Guerro has good faith that the project will find new financial support. If not, Guerro believes the collaboration will continue because of the good relations that have been established between the participants. The farmers in turn trust the agronomists and organisations involved in the project and have confidence that the PPB will continue. The question is in what form the collaboration will continue, in seed production, breeding or any combination thereof.

One thing is clear, farmers will continue breeding and passing on knowledge to friends and family. Many farmers also wish to fortify the collaborative aspects, perhaps by working and selecting collectively in shared fields. There are thoughts on establishing an association between the many co-operatives and farmers involved in the project and to create a small seed company. Until now, it is viewed as a drawback not to be able to exchange seed freely as there is shortage of seed even for the research process. More over, the farmers wish to produce seed coming from their own innovativeness, in contrast to the other small but certified seed producers who multiply formally improved seed. The farmer breeders wish to continue selecting within early generations, to work with 'own' material such as the *criolla* and they wish to continue setting own criteria. By continuing the model of a few experimenting farmers and another group more involved in giving advice and reproducing seed, the programme could continue improving varieties while multiplying seed for larger distribution.

Javier Pasquier from CIPRES thinks a wider distribution can be done in collaborations with INTA and MAGFOR since it lies within their objectives to distribute seed of high adoption potential. INTA also wishes to turn seed production private to be able to concentrate on its research role. Julio Molina believes there is a large market demand for the participatory seed and the varieties could perhaps best be marketed through pamphlets made by the farmers and distributed by INTA.

The scale of distribution is yet to be negotiated. Every case has its own opportunities and constraints and it is important to keep visions within the sole purpose of the specific plant-breeding project. Farmers speak of international distribution and understandably, a wide distribution is tempting. However, since the farmers wish to create a secure seed system, then large-scale distribution also implies large-scale stability evaluation in different types of agro-ecological conditions. Today, INTA is conducting parallel research on the research line and INTA could further assist in this evaluation process through its established evaluation system and farmer contacts. An important question is whether wide diffusion lies within the objectives of the PPB project in question?

4.4.7 Integration vs. alteration

Up to this point the project has built on knowledge and has as such presented a refreshing alternative to development projects and seed improvement. But knowledge generation is about to be transformed into generating money. "We will end up a seed company with intellectual protection but I will not like it", one farmer said critically during a discussion in the field. Now is the time, the farmer argued, to make a statement that we are against capital powers and to find alternatives so that we can cope without

inputs from big business. In contrast, the farmer said, the project is about to feed into the capitalistic system and by doing so the project demonstrates that it lacks a wider vision.

Capitalism, the regional facilitator Rafael Guerro said, is the reality of Nicaragua, socialism is long gone and nowadays projects need to carry its own cost. Where the visiting Cubans promoted free sharing and collaborations in-group, Guerro explained that the Nicaraguan group lived in a different reality without governmental support or security net. The participatory project in Nicaragua can therefore not be so generous.

"It is not the people who make the yeast who eat the bread". With that, a farmer wished to explain that, “development is a process and although we are working towards better livelihoods, it is not us who will see the result”. Many Nicaraguans have left house and family and fought for revolution, sometimes they have lost all but their experience. For them a great meaning of life is to build knowledge and experience, and to work for an alternative route where development is in one’s own hands.

4.5 *DISCUSSION* - SPREADING SEED THROUGH A NEW APPROACH

There is a wish to multiply, and to be able to share. Javier Pasquier, the CIPRES coordinator, talks of the socio-economic aspects in terms of making varieties accessible to others and that PPB is much cheaper than seed production by seed companies. Today, NGOs buy large quantity of seed at large costs, costs that could be reduced if alternative forces come together in production and distribution or costs that could be reduced if the methodology of participatory plant breeding was spread rather than its seed.

4.5.1 Dynamic production of locally improved varieties

If every locale has its group of experimenting farmers connected to farmers giving advice and reproducing seed, new, improved and locally adapted varieties could reach more farmers at a faster rate. Seed production could generate local income and innovative farmers could continue learning and experimenting. This model however is conditioned. It demands an inflow of new genetic diversity through contacts with formal breeders, other innovative farmers and gene banks. It demands a well-organised and successive evaluation process and distribution scheme. In this, farmers may have to rely on or accept quality differences because of a shorter evaluation process. It also requires knowledge about and resources for administration and an income distribution from seed producers to breeders. Moreover, the model would have to work outside of formal control, thus not entirely integrate into the formal structure, or the formal system needs to be made more flexible.

To formalise the participatory breeding would make projects sustainable, even after international financing is ended. After all, participatory projects cost money. If the Pueblo Nuevo/Condega programme turns successful in the parameters of formal plant breeding, then the approach would have larger chances of finding its way into the formal plant-breeding scheme.

4.5.2 PPB opportunities and constraints

Agricultural practices have their own way. The varieties, still within experimentation or rejected varieties have already started their diffusion within the informal seed system. If other farmers show interest, they are given some seed to cultivate in their own plot. However, in general, other farmers are not interested in the research process but more so in the seed emerging from it. “Other farmers come and ask for seed but no one will ask to learn more about how to develop his or her own variety”, the participants said and concluded with “other farmers think we are a strange group.”

Trust in the system

Not everyone is an innovative farmer. Selection of the individual farmers is an important factor for the success of participatory projects. In the Pueblo Nuevo/Condega case, the staff of CIPRES had good knowledge of the farmers in the area and the farmers’ attitude towards research and ability to work long-term. Furthermore, not every formal breeder or extension worker fits into the role of participatory breeder or facilitator. In the Nicaraguan case, the PPB relies on the personal interest and attitude held by the formal breeder Julio Molina. He is supported by the bean chief Aurelio Llano, INTA and its backers, but the process would probably have fallen short had it not been for Molina’s ambition.

Everything always comes back to the word: trust. In a world of development where most development schemes end up half-done or medium enforced, trust is a key parameter in any success of sustainability. If the connection to the formal sector is weak, disrespectful or unengaged the participatory plant breeding approach will fall as short as any technology transfer. In the Pueblo Nuevo/Condega case, there is the crucial trust between participants, strongly emphasised by the warm and supportive personality of the regional PPB facilitator, Conny Almekinders. It is difficult to formalise an approach that so much pivot on trust and personal attitudes, but if farmers and other professionals in the area of genetic resources would come together more often the gap would be easier to fill.

Participation as defined by farmers

The term *participation* is widely used within programs of research and development. However, although many projects are labelled ‘participatory’ few actually apply participatory methodologies in the research and/or development process.

During a gathering between participants from PPB projects in Costa Rica, Cuba, Honduras, Mexico and Nicaragua, many farmers took a personal point of view when defining participation: “When I am part of the research process it is participation, when someone listens to me and when I may set my own criteria”. Participation, one farmer from Nicaragua said, is like democracy, a word that can be interpreted in many ways. The farmers explained that according to their way to see it, participation is real when they do it, when it is realised in practical terms. Participation is also to learn, especially when scientists and farmers on ground come together to solve a problem and both sides learn and listen. A Cuban female breeder said that an important factor is when women included in the programme are respected and asked for advice.

The literature on the concept of participation, often dwells on the degree of participation based on the initial contact between participants. The question is focused on whether scientists or development workers invite farmers to join programmes initiated within and for the formal sector, whether scientists seek to support farmers' own systems or whether farmers themselves seek researchers for help in finding solutions on locally defined problems (CGIAR PRGA 2001). That initiatives had not come from the farmers themselves was not seen as negative to participation among the farmers attending the Mesoamerican meeting on PPB, "we all knew something had to be done to the situation and when we were presented with a possible solution of course we were willing to collaborate (and hope)". Or, as a Honduran farmer put it: "It is always someone else who initiates what we do but at this point we can start making decisions and when they listen, it is participatory".

Costs and benefits

Even so, we seek parameters to analyse participation and ways to weigh costs and benefits. The rationale is to improve the participatory breeding approach and to make possible a comparison between different projects and between participatory approaches and conventional breeding.

PPB is in many respects considered more cost-effective than conventional breeding. The breeding process is probably faster when using the conventional approach since different localities can be used at the same time. Then again, diffusion is probably quicker and adoption rates higher when using the participatory approach because farmers observe, discuss, pass on and adopt what they see is working. Still, considering the time and work invested by farmers, it is not so far fetched to question whether the cost of breeding has in parts been passed on to the participating farmers. On this, the farmer participants reason as follows:

First, farmers believe it is pointless to compare conventional plant breeding to participatory approaches. Conventional breeding gives neither benefits nor any access to good seed, they say. "The seed they give us have never worked." Perhaps these are overstatements as INTA varieties are found in the fields and spoken of as acceptable in many areas. Yet in other more marginal areas, perhaps this is not so. Secondly, it is difficult for farmers to estimate costs and benefits of participating before any results have been realised. Thirdly, the farmers describe their input as time well invested since so far it has paid off.

> *"It gives us seeds of varieties that will solve the problems that we had.*
> *We minimize the cost of production because we do not have to buy seed.*
> *It improves yields in our harvest."*

Apart from cheap and secure access to adapted seed of good quality, farmers talked highly of the knowledge aspect: "It was a project that became much more important than we had expected." The approach also has social benefits such as group organisation, recognition, pride and the events and exchange of experience among farmers and other participatory projects. As cost items the farmers mainly mention the time aspect (capacity building, field days, meetings and work) but also the risks of losing results to natural disasters and animals.

Fourth, is there progress? “Is there wisdom to treasure the aid? Is there willingness to work sustainably? If not, one farmer said, the programme does more damage than good.

Sperling et al (2001) suggest that key variables for analysing PPB programmes include the institutional context, the biosocial environment, the goals set, and the kind of participation achieved, including the division of labour and responsibilities. Thro and Spillane (2000:7) believe a key institutional factor in PPB is the *point of control or decision-making*. In their words: who decides the objectives, determines the approach, and specifies what results and data are needed. One often talks about *who owns the research process*. This study will develop that thought and further analyse *who owns the research result*.

5. IMPACTS OF PLANT BREEDERS' RIGHTS

5.1 INTRODUCTION AND STRUCTURE OF ANALYSIS

The first part of the analysis on the impacts of plant breeders' rights (PBR) is concerned with the impacts of providing intellectual property rights for the bean system and farmers as users of seed. The following part deals with the issue from a plant breeders' perspective, or more specifically, the second part looks upon the opportunities and constraints of intellectual property rights from the perspective of farmer breeders improving locally and individually while the third part addresses intellectual property rights issues in participatory breeding. The analysis will be followed by a general discussion in the context of national development.

Unfortunately, there are not many analyses to draw on as most studies on the impact of PVP are conducted in the context of developed countries and even here, studies are scarce and empirical and the outcomes are difficult to separate from other ongoing changes (CIPR 2002:59-60). The analysis below will mainly draw on "An assessment of the empirical evidence of the economic impact of plant variety protection in developed and developing countries" by Dwijen Rangnekar for the British Commission of Intellectual Property Rights (CIPR) and a study on the impacts of breeders' rights in Argentina, Chile, Colombia, Mexico and Uruguay by Jaffee and van Wijk (hereafter van Wijk 1995, since information is gathered from an earlier summary by van Wijk alone).

5.1.1 Law vs. actual effects

It is difficult to envision the future but so far intellectual property rights have little real importance in Nicaragua. The informal commerce is big, resources are few and those who save seed need not to buy. Laws are many but implementations is poor. While recognising national efforts to enforce laws, there is still a gap between law and outcomes. The national strategy on biodiversity (MARENA 2001) refers to the judicial order of Nicaragua as programmatic norms with a series of general principles and argues that there exist large deficiencies in the establishment of instruments and concrete mechanisms that permit its application and fulfilment. The strategy talks of instruments being adopted without the right scientific support since the investigations that should enrich the taking of these political decisions are limited. It further criticises unclear administrational procedures, referring to a shortage of capacity and stability in human resources (MARENA 2001).

In general, there is mistrust towards the formal system and a general distrust and obedience towards laws and regulations. The reasoning goes "why should we follow the rules when the government does not". Perhaps the fall of the former President Alemán and his corrupt brothers will give people new faith and trust in the system, but for the time being democracy and justice are mainly theoretical concepts. In this, intellectual property rights mean little to people when you may come away with murder if you have the right friend or size of pocketbook. Although people wish for better quality of life and seed, it is important to keep in mind that the general mistrust in the formal system could affect the success to develop it. These circumstances will largely hamper the impacts of any intellectual property rights.

5.1.2 Legal progress – one rice variety protected

In January 2003, three years after the PVP law went into force there was only one protected plant variety in Nicaragua, the rice variety ANAR 97. The rights-holder ANAR is a national association of rice farmers with unique access to germplasm for breeding. Other applicants are INTA (the National Institute for Agricultural Technology), Oscar Alemán, a Nicaraguan sugarcane farmer, and a Colombian rice federation, Fedearroz. The registration office also received a US application for a transgenetic tobacco variety, which was later withdrawn. The rice variety INTA-N1 has passed the technical exam and the next step is for INTA to publish their intention in the Daily Official Gazette and to pass the technical review of the Committee (Gloria Zelaya pers. comm). The application process is still a learning process. Or as the involved parties say "we are all beginners and we learn as time goes". And time really goes by. With no real routines, the application process is tardy, so slow that INTA's rice variety no longer is found on the market. Nevertheless, while applicants, committees and offices are getting acquainted with administrative procedures, the farmers will be the true test bunnies.

5.2 FROM THE PRODUCER PERSPECTIVE

5.2.1 Free seed

The effects of intellectual property rights are directly related to the type of seed farmers use in their sowing. Rights-holders only have control over varieties that are protected through the PVP Law. If farmers continue saving and selecting from older bean varieties, he or she should not directly be affected by plant breeders' rights since protection of older varieties is not legally possible. The word *should* is used because of recent unresolved cases of US claims on for example the Mexican Yellow Bean and the Andean Nuña. However, in the successive mixing of varieties, most farmers will eventually include protected varieties in their seed collection.

5.2.2 Private reuse allowed

Self-pollinating crops such as the Common Bean are optimal for seed saving since they produce its own image. The PVP law legally protects this private reuse: farmers' exemption gives farmers the right to use protected seed reproduction and multiplication in the own plot (Art. 12). Farmers can therefore buy seed from a protected variety and replant it as long as desired. Farmers may also sell the harvest; transaction of grains or raw material requires no authorisation.

5.2.3 Informal exchange under control

The farmer exemption in Nicaragua is strict since the PVP law obliges authorisation for informal sales or exchange of seed (Art 8 and 12). Thus, breeders' rights are breached in all cases when seed is in transaction without authorisation and payment, also when farmers exchange seed with neighbours or sell seed on the informal market.
From the right-holders point of view the second buyer is benefiting from the innovation without paying royalties and the seller is free-riding by collecting profit on someone else's investment and competing in market shares. The informal market is therefore

prone to be put under scrutiny and the PVP law provides the rights-holder with legal rights to interfere in the informal market. PBR are legal rights, not contractual. This means that when a farmer is purchasing protected seed, he or she is agreeing with the holders' rights of control.

5.2.4 Enforcement through formal and private control

The State gives the right, but enforcement is a private matter. The rights-holders must themselves play watchdog and in a sense leave breeding grounds for checkpoints. This approach resembles the Argentinean situation where rights-holders themselves actively control the seed market in an attempt to reduce the trade in seed multiplied without authorisation (van Wijk 1995). In Argentina, this has practically been solved through a collective control system embodied by a plant breeders association representing 80% of the plant breeders' organisations (van Wijk 1995). Many commentators in Nicaragua doubt that PBR will have any direct effect on small-scale informal exchange (INTA, UNA, MAGFOR, PROMESA, farmers). "Intellectual property rights are a preoccupation for the formal institutions and seed producers", says Gómez of UNA. For the small-scale farmer who produces seed for personal use or non-commercial exchange, Gómez continues, IPR is not a problem much less so in beans. One reasoning is that large seed companies or INTA do not consider it profitable or in their interest to limit non-profitable activities (Molina, INTA and PROMESA pers. comm). Still, in Argentina the rights-holders joined by the PBR authority have had great success in reducing the black market; the share of sales in unauthorised wheat seed decreased from 83% to 22% in four years, and in the case of soybean seed from 75% to 48% in two years (van Wijk 1995).

There are different types of informal markets and exchanges. The Argentinean figures are more concerned with 'organised crime' and the Latin American study found no negative effects in terms of the exchange on farmer level. The direct loser is probably the informal dealer who buys grains and sells it on as seed after some form of purification (van Wijk 1995 and Solleiro in Cervantes 2000). It is unlikely that big transnational seed companies enter villages in the search for unauthorised uses of protected varieties. Legally however, a company could claim compensation of US$ 14 000 to US$ 60 000 from the Nicaraguan farmer who probably got the seed in exchange or as donation. This is a fine farmers cannot pay and Humboldt fear the actual punishment will be imprisonment or expropriation (Lanuza in CIPRES Memoria).

In all essence, intellectual property rights are directed towards the formal sector. It is here any royalties may be claimed without setting up a large control apparatus and it is within the commercial sector royalties find their justification. The ways of compensation are regulated by contracts and the rights-holder usually gets 6-8 % percentage of the sales price. This is why an informal but legal transaction is unrealistic.

5.2.5 Quality control over seed production

The PVP law gives the rights-holders control over basically all activities involving the seed of a protected variety (excluding private use and research). Wilfredo Bejarano from ANAR says that the possibility of controlling seed production was the main reason for applying for protection on their rice variety ANAR 97. From its initial release in 1997, the variety got very popular among rice farmers, but although going under the

name of ANAR 97 it had lost much of its characteristics under years of informal production and exchange. Because of its popularity and potentials, ANAR was supported by PROMESA in recovering the genetic identity of the variety. In collaboration with INTA, ANAR reproduced pure lines of the variety and now wishes to remain in control of the genetic quality of the seed. According to Bejarano, this type of protection was something they had waited for. Now ANAR will be able to combat the illegal black market, and to offer material for the sowing that meets the minimum quality requisitions set by the department of seed of MAGFOR and thus to meet farmers' demand for good quality seed.

Poor quality seed is considered a large problem. With the protection in place, ANAR can recoup its investment so that the quality of the research is retained. Although the controlling instance MAGFOR has the responsibility of classifying and certifying seed, PBR now give ANAR more control of who produces their variety, of coordinating the inspection, monitoring and follow-ups with the department of seed, and to make sure that multiplication is based upon genetically pure seed. Bejarano also points out that a formal system stimulates the production of quality seed by assuring higher prices. The issue of royalties, Bejarano says, comes second and is unlikely to emerge since ANAR would be requesting its own associates for money.

5.2.6 Public seed

Would INTA ask for royalties from users and producers of bean seed improved within its breeding program? So far, the INTA lacks any policy on seed production and intellectual property rights but the director of the seed research at INTA, José Manuel Bravo Báez, is doubtful towards royalties or any active control of the informal market (pers. comm.). As a public institute, Bravo says, INTA does not have the same goal as private companies. However, in respect of the three varieties for which protection is applied Bravo says the reason is to recoup some of the money invested in developing new varieties: "The State needs revenues and someone has to pay for the five years of investigation related to new varieties". Bravo is aware of the (inter)national debate, "organisations say one cannot patent material coming from international organisations such like CIAT". The general agreement among breeders however is that the CGIAR centres only requirement is to be recognised in the Plant Breeder title.

If INTA is to follow the trend of the public centres in Latin America, the institute is likely to protect all its future varieties. Today these public centres consider PBR protection "an important tool to defend their existence and to remain competitive vis-à-vis the private sector" (van Wijk 1995). As a consequence "the increasing commercial perspective of the centres has a negative influence on the traditional free access to the centres' germplasm" in so that it will "increasingly deny third parties access to the traditionally public plant germplasm it administers" (van Wijk 1995). That INTA would follow this trend is expected since the studied centres initially also used to release varieties at a low cost or free of charge to farmers and licence out the production of seed to the private sector on a non-exclusive basis. INTA faces the same budget restrictions and desire to share research costs if the private sector were to benefit from its work (Bravo pers. comm). Any future collaboration with private companies would probably also force INTA to restrict access to their germplasm because unrestricted access would erode private investment. Then again, it is possible for public breeding to recoup its costs on non-commercial crops by claiming royalties on cash crops and from those

actors that are commercially stronger, such as seed producers. Bravo also suggests this as the most likely outcome, to address (and charge) producers of certified seed.

5.2.7 Royalties in seed production

In Nicaragua, the production of certified seed is mainly small-scale (60%) and the rest is produced by INTA itself and the private seed industry (MAGFOR stat. 2003). In beans, there were more than 300 registered seed producers in 2002 (Eslaquit, MAGFOR pers. comm). These producers are small scale (1-1.5 ha) and as such, they do not draw the attention of the Seed department (but if it were not for them there would be no certified bean seed). To produce registered or certified seed demands access to area, technical knowledge and some planning because beans cannot be cultivated in the seed plot a year before the certified production.

Today, INTA sells registered seed to the seed producers at a price below the real cost of development. INTA's price is 776 cordobas/qq and after multiplication the seed producer may sell certified seed at 800 cordobas/qq (or lower if sold through a middleman) (Kauffmann, INTA, and Navarro, APROSEN pers. comm). Although the current production of certified seed is low, it is described by the formal sector as a promising business (PROMESA during Seed fair, Matagalpa, 2002). Since certified yields are expected to be high (0.8 qq seed produces around 35-45 qq), it could be a way to add value to production even after subtracting the increased cost per area that the producer must pay MAGFOR. Nonetheless, the production of certified seed is described by farmers 'as risky as any business' because at the end of the day, the seed might not be approved by MAGFOR and the farmer would have to sell the seed as uncertified or as grains, which gives a lower price (300-450 cordobas/qq). If the seed in question were provided with intellectual property rights, the seed producer would have to seek authorisation from the rights-holder and perhaps pay an additional royalty fee. Considering the economic situation of seed producers, it is questionable whether INTA will be able to recoup any research costs from this group. Another question is whether citizens are to pay twice (that is, if INTA was to collect revenues on tax basis and not from aid support).

Plant variety protection could attract domestic production of foreign seed because breeders (or multinational companies) would feel secure in being able to control and collect royalties on seed production. Legal protections could therefore increase domestic seed production of foreign varieties thus giving job opportunities, limit seed imports and perhaps increase quality control. In other cases, when the producer competes with the market of the breeder, international transfer might be denied or conditioned with export restrictions (van Wijk 1995). PVP law could therefore serve as an effective non-tariff trade barrier, which ought to be an odd consequence of regulations originating in free trade agreements. Then again, it is quite standard that these regulations serve to protect certain markets on behalf of others.

5.2.8 Few varieties released

Xavier Eslaquit describes the advantages of the PVP law as an increased interest in the production of improved varieties, also by foreign companies that now may introduce varieties within a system that protects their intellectual property rights. That the provision of PBR leads to an increase in the number of new varieties released is a

common claim in the literature but Rangnekar (2002) questions whether the increase in numbers is correlated to an increase in agronomic value.

From a study review by GRAIN (2002c), it seems impossible to say whether PVP leads to improved varieties or merely to a proliferation of varieties that differ in little more than name. The low threshold for distinctness seems to lead to the release of varieties only cosmetically different. Thus, breeders tend to adopt strategies of product differentiation and planned obsolescence rather than genuine improvements in agronomic traits (CIPR 2002:61, Rangnekar). INTA has by no means reached this point but is rather occupied with the fact that varieties applied for are becoming obsolete in the field before protection is approved. The so-called copycat breeding is limited in the Nicaraguan PVP law by extending the control of plant breeders' rights to essentially derived varieties (Art 9, 11). A variety is essentially derived if it derives principally from the initial variety and at the same time conserves its essential characteristics. Two closely related varieties should therefore be difficult to protect within the intellectual system.

What is then the chance of intellectual property rights inviting private varieties of beans, perhaps even foreign? As a starting point, the vast majority of bean seed is produced nationally and today no importation is conducted through formal channels (MAGFOR stat. 2003). However, Bravo of INTA says it is likely that the national strategy to strengthen the formal market will attract foreign seed companies and accordingly increase the multinational share on the seed market, in around 4-5 years. In this, the provision of PVP may play a part but perhaps more important are other regulations and policies affecting foreign invention. In the case of R&D expenditure by multinational seed companies in Argentina, companies indicate that the rise in R&D budget was mainly "due to changes in economic policies in Argentina and the need to improve their competitiveness" (van Wijk 1995). In the Nicaraguan context, Monsanto says it is to await the protocol on biosafety before introducing transgenetic crops (Cruit, PROMESA pers. comm).

It is thought that the multinational enterprising in developing countries is likely to occur more because of an increased use of hybrids than because of the incentive of granting plant breeders' rights (van Wijk 1995). Simultaneously, if intellectual property rights were incentives enough for multinationals to invest in technologies aimed at the developing world, there would be plentiful of hybrids adapting to developing conditions. Since hybrids cannot be copied, they come with an inherent intellectual property protection and in addition, they need no additional costly process of legal protection. Yet, as Busch (1995) queries, "where are all the investments in hybrid maize production in the developing world?" Still, self-replicating plants like beans make innovations particularly susceptible to exploitation and PBR might be the long awaited incentive to enter Nicaragua. Put in a different manner, are beans of interest for foreign rights-holders considering its replicability and uncontrollable market? Moreover, beans are not among the group of foreign favourites like fruits, flowers and vegetables. In conclusion, as Busch argues, the invention argument may hold but that IPR will be the incentive for multinational corporations to invest in developing nations is simply not supported by evidence.

5.2.9 Barrier to shifting seed source

The obvious yet overlooked aspect is the real impact of intellectual property rights: do they increase farmers' access to improved varieties? High technical standards and the increased time and costs of making available new varieties have its effect on research budgets. Reduced budgets might shift public breeding towards IPR crops. Monopolies on the production of seed, and the absence of competition could increase prices (Eslaquit pers. comm and Rangnekar 2002).

Van Wijk (1995) argues that the overall result of PBR for the diffusion of seed might be an increased number of farmers reusing seed. Farmers might choose or be forced to recycle when the informal market is controlled and royalties increase formal seed prices (*ibid*). Solleiro (1995) believes protection will serve rather as an entry barrier where well-off farmers will be able to access improved varieties while resource poor remain without. PBR could therefore uphold the division between those who reuse and those who access new seed technology each season. This would be an effect contrary to the objectives of the national strategy for agricultural development.

5.3 FROM THE BREEDER PERSPECTIVE

During the debate leading to the approval of the PVP law, the director of MIFIC said that one of the advantages of the law was that farmers would be able to further develop introduced, improved varieties. This statement is much conditioned by the breeders' exemption and who is included therein.

5.3.1 Breeder in legal terms

Firstly, the breeder in question for intellectual protection is the physical person who has developed and obtained a variety meeting the requirements of being novel, distinct, stable and uniform (PVP regulation, Art 2). Secondly, the sphere included in the breeders' exemptions is held wider: anyone involved in genetic improvement including farmers, centres of investigation and breeders (*ibid*). That is, if a farmer is to legally improve protected varieties there is a requirement of genetic improvement but in order to gain legal protection the improvement must meet the DUS and novelty criteria. One could therefore conclude that *the PVP law acknowledges any genetic improvement as worth protecting but only DUS development are subject to plant breeders' rights.*

5.3.2 To select within uniformity – impacts on agricultural practices

Formal and future protected bean varieties are to meet the DUS criteria. Many farmers will continue selecting within these varieties but what is the effect of selection within uniform varieties, and why is it made?

Firstly, farmers are traditionally producers, consumers and improvers of plant genetic resources for food and agriculture. Secondly, selection is made based on phenotypes, characteristics we can observe and value such as plant vigour and seed colour. A plant's phenotype is however not the direct image of its genotype. The same seed and genotype would not produce the same plant and phenotype on Swedish soil as in Nicaragua since

phenotypes are very much affected by its environment. Genotypes however are not. The grains of the plants produced under different conditions will genetically remain the same, even after many seasons of replanting. Yet, based on field characteristics a farmer could prefer one plant to the other and reuse its seed in the next sowing, thinking he or she is actually improving the material. Is there a real impact of selection, or is the effort in vain? The chances of successively improving the material through selection depend upon "the extent of genetic variation and the strength of relationship between genotype and phenotype *i.e.* heritability of the characters to be selected" (Chahal and Gosal 2002:84).

Yield and other economically important characteristics are strongly influenced by environmental factors and therefore more difficult to improve by the selection conducted by many farmers (Chahal and Gosal 2002:87). Agronomists of PROMESA argue that the material is unlikely to change even if farmers were to select individual plants. If genotypes are uniform, the selection of seed A over seed B will have no consequences since they are inherently the same. However, in the early 1900s W.L. Johannsen showed that commercial bean varieties include a variety of pure lines but more importantly and supporting, after these have been identified no further selection can be made as progenies will regress towards the mean of that particular pure line (Chahal and Gosal, 2002:74-81). This experiment was based on seed size and it is generally so that the relationship between genotype and phenotype is stronger when it comes to colour and size of the seed. If a farmer were to identify pure lines within a bag of commercial seed by successively selecting preferred characteristics, the question is whether this pure line would be considered distinct from the original variety. A rough estimation is that it would take a variety 20 or more years to become distinct under farmer management (Gómez pers. comm).

Under natural conditions however even pure lines undergo changes. For a crop of only 5-10% natural cross-pollination, natural crossings are rare but happen, especially if sown mixed with other genotypes. Genotypes may also suddenly change, that is undergo mutations. Chahal and Gosal (2002) argue that since mutations are recurrent most favourable mutations have already put their favourable marks on existing crops, but they will not rule out that new favourable mutations may answer to emerging problem. (Chahal and Gosal 2002:81-82). Thus reusing uniform varieties could produce new bean varieties, but only under close observation and effective selection.

Thirdly, stability is defined within a certain domain. If brought outside of that domain, varieties will probably show different characteristics. If developed under more favourable conditions, varieties are likely to show less favourable characteristics in a less favourable environment. The question is whether a selection can bring out the best of the material. Is the instability genetic or is the variability a result of genetics meeting the environment? These question marks will be left hanging in the air.

What should be said though is that although farmers may legally engage in developing protected varieties, the 'new' variety is likely to be considered essentially derived from the protected variety (even though derived from mutants). This means that innovative farmers are in any case restricted from commercialising the variety. How about protecting those varieties developed from free varieties?

5.3.3 Farmer varieties – other objectives

The Nicaraguan regulation (Art 2) defines the process of breeding as the techniques and procedures that permit the development of novel, distinct, stable and uniform varieties. Thus, there is no legal requirement of crossing in order to attain breeding, which means that selection is breeding also in the legal meaning. Many varieties developed by farmers are distinct, uniform and stable. Should or could farmers seek protection for their informal innovations? Presented below are two examples of innovative farmers, their improvement process and thoughts on Plant Breeders Rights.

Magdaleno Perez – bean breeder

Magdaleno Perez, a farmer breeder in Santa Rosa, Ocotal, has developed a bean variety out of a seed he observed as distinct from others in a commercial seed bag (pers. comm). The seed, Don Magdaleno says, was not stable but demanded years of selections until it reached the uniformity of today. According to Don Magdaleno, the variety is clearly distinct from other varieties on the market and it is easy he says to distinguish this variety from others since the plant stem and flowers are pinkish. It is easy but equally necessary, he continues, to keep the variety pure; something he also demonstrates by discarding plants with white flowers found in his plot. Don Magdaleno seems disturbed that other farmers allow the variety to degenerate. It is such an easy step, he explains, to only select pinkish plants for seed collection and thereby assure its quality of unique resistance to diseases and high yields.

Isidoro Zeledón – maize breeder

Although it is easier to keep self-pollinating crops pure, these are more difficult to cross and therein create new diversity to select within. With maize, crossing is easier but more difficult to control. In 1993, Isidoro Zeledón Meza a farmer breeder in the Estelí area, crossed the improved maize variety NB-5 with Olotillo, a variety said to originate from the Pacific area of León (pers. comm). Zeledón had bought the NB-5 from a seed company in 1992 and observed its many good qualities. But he also noted that the husk did not completely cover the ear of the cob or as they say in Nicaragua, the variety showed a crazy head[5]. The bare head, Zeledón explained, invites and stores pests and diseases and allows water to enter and leave the cob. The NB-5 was therefore vulnerably to diseases and pests, had low resistance to drought which in turn affected the quality and overall yield of a variety that otherwise was very high yielding with large grains. Zeledón had in the previous season observed the flowering date of the variety Olotillo brought from León by a friend and could therefore plan the sowing of the two varieties aimed for the crossing. He chopped the male part off the improved variety and let the *criolla* pollinate the lot. The cross was successful and Zeledón

[5] The problem of incomplete ear-cover by the husk can appear when improved maize varieties bred at high plant densities are planted at low density in less favourable environments (Almekinders and Elings 2001:426).

observed a 60% decrease in incomplete covers. He was also pleased in seeing the cobs becoming larger and the vegetitative phase shorter but there were still some rotten cobs and crosses that did not properly fertilise. Zeledón selected plants for further breeding based on the development of the plant and cob, and then he selected cobs based on its seed structure. The latter is a criterion only important when producing seed, something Zeledón had learned by agronomists.

In 1994, Zeledón planned and conducted a second cross between the initial cross NB-5 x Olotillo and Olote Morado, which was a new variety to the area. The variety is fast maturing but originating from a drier area, San Lorenzo. At this time Zeledón was unaware of the origins of the Olote Morado and he regretfully discovered that half of the lot came out stained with colours, from white to black in one single cob. The Nicaraguan preference is again quite particular, tortilla of white maize is the cuisine and Zeledón had to work two extra years to recover the uniformity of white grains. During these years the lot was open to pollinate freely.

In 1997, the non-governmental organisation INSFOP and its Farmer University (UNICAM) entered the picture. UNICAM helped in validating, comparing and distributing the variety within and outside of the community, a variety that now produced 45 qq/mz, an increase by 10qq/mz from the initial cross. The variety was a mixture of pinkish and white plants/straws but 90% of the cobs were white. By the year 2000, after eight years of breeding, the variety had gained recognition for its qualities and UNICAM urged Zeledón to come up with a name for this new variety that was still going under the name NB-5. The variety was named ZEL –00 and today it has a wide adoption in the Estelí area as well as a diffusion up north to the area of Don Magdaleno, to Somoto, Ocotal and Mexico, and to the east of Matagalpa and Jinotega.

Breeding strategy of ZEL -00

NB-5	**X**	**Olotillo**
+ very good yields + good cob + good size of grain + good vigour of plant - incomplete ear-cover		+ covers top
NB-5 x Olotillo	**X**	**Olote Morado**
- long maturity period		+ short maturity period - coloured grains

Selection of (NB-5 x Olotillo) x Olote Morado → **ZEL -00**

Intellectual freedom

In Don Magdaleno's ideology there is no such thing as intellectual property rights. His work becomes valid with the popularity and spread of the variety. In this sense, Don Magdaleno has recouped his efforts of developing, comparing and multiplying. The variety is known and popular in the area with great potentials of further distribution. Both Don Magdaleno and Zeledón are today connected to UNICAM, the farmer 'university' and the varieties are distributed with the help of the university and the associated NGO INSFOP. But what happens if a seed company starts multiplying and making money on the variety: "That would be their problem", Don Magdaleno said.

Zeledón does not wish for intellectual protection and if so, INTA has made it clear that the breeding process must be done all over again. This although Zeledón clearly can describe the breeding process, its crosses and knows how to keep the variety uniform, stable and distinct. Yet, a breeder from INTA thinks it would be wise for Zeledón to seek protection, not to make money but to gain recognition for the breeding work. On this Zeledón says he does not wish to hinder the distribution of the variety, but "what I cannot accept is if a commercial seed company make money without consulting me". Zeledón seems to think that the worst problem is not financial but rather the quality aspect in so far that he would not feel good about farmers accessing ZEL -00 without showing the proper characteristics: "I can only guarantee the seed that I have myself produced".

5.4 FROM THE PARTICIPATORY PERSPECTIVE

The PPB in Pueblo Nuevo/Condega has entered the evaluation phase and is soon to release new improved varieties. This raises many questions surrounding the production of seed, distribution of seed and benefits, and the plant breeders' rights. Although these issues have been discussed from the beginning, the breeding process has now reached the point where participants more clearly can see where the research is leading and can therefore sketch possible scenarios for the future. In a sense, it has reached the stage when participants must come to an agreement for the future path in order to strengthen the participatory plant breeding. We therefore talk not only about the production and the possible/preferred scale of distribution but also about how to continue the participatory research, with whom and using what material. The discussion below is focused on intellectual contributions and the pros and cons of plant breeders' rights (PBR).

5.4.1 Joint ownership in legal terms

The Nicaraguan law on plant variety protection allows for joint ownership and it encourages applicants to specify each contribution but it does not state which contributions are required for a partner to be included (Art 15, 31). The general rule is that the right-holders are the ones who have created or discovered AND improved the material up to the point where it is considered a DUS variety (Art 1). Rights are equal between the contributors if partners have not agreed otherwise (Art 15, 31). Thus, partners are free to design their own contracts on how to share rights and benefits.

5.4.2 Rights and benefits – an open issue

The Pueblo Nuevo/Condega programme is a typical case where institutional aspects are lagging behind the technical aspects of collaboration. PBR were new or perhaps a non-issue when the programme was launched. Since it was the first PPB in the country, there were no national examples to learn from. Along the process, it also becomes clearer why legal and other institutional issues are so called laggers. Since the process is participatory and dynamic, it lies within the ideology not to be able to foresee the direction of the process and the exact outcomes. Such related aspects are lagging because decisions are closely dependent upon emergent breeding results. It is therefore difficult to decide upon issues directly connected to the result such as distribution scale and ownerships. Neither contracts nor decisions have therefore been made on the legal issue.

5.4.3 Intellectual contributions

In the Pueblo Nuevo/Condega case, intellectual contributions have been provided by different participants at different stages in the research process. More so, there are different contributions in each breeding strategy, from varietal selection to selection in segregating populations. What regards the bean material, CIAT and the University of Zamorano, Honduras have made crosses and early selections. INTA has also been involved in the selection process in the early generations and more so in the breeding towards pure lines, and is now mainly facilitating the process together with CIPRES. Farmer breeders successively select in the field and the other farmer participants give advice and select based on seed and consumer preferences. Aside from these intellectual contributions is the contribution of the farmers and formal breeders who developed the germplasm constituting the parental lines. These include farmers developing *criollas* in the northern parts of Pueblo Nuevo and farmers and breeders in other countries. Arguably, it is the farmer breeders who bring the material to the DUS criteria (if met at all).

Table 6 depicts the quality of participation. It is important to remember that these elements are shifting with time and that although initiative came from above, farmers start taking control over decision-making as the programme evolves. “When we start understanding, we make the decisions”.

Table 6 Quality of participation in the PPB of Pueblo Nuevo/Condega

i. Degree of participation

Consultative (Information sought from farmers/ other clients, scientist-led)
Collaborative (Task sharing along lines determined by formal research program)
Collegial (Researchers support farmer-initiated/managed program)

The first initiative came from the Netherlands, which in turn proposed to the national NGO CIPRES to start a PPB programme. CIPRES supported the idea and presented it to some fifty farmers in Pueblo Nuevo/Condega. After two years of collaboration, the farmers increasingly take control over the decision-making process related to ii. Thus, the degree of participation is moving towards collegial.

ii. Functions performed by participants

Technical expertise: Farmers, CIPRES, INTA
Organisational skills: CIPRES
Information giving (trade-offs and preferences): Farmers but CIPRES facilitates.
Teaching/ skill building (extension): CIPRES, INTA and farmers who increasingly explain methods. Farmers also show interest in farmer-to-farmer extension.
Field labour: Farmers
Provide inputs:
Land: Farmers and CIPRES
Seed: INTA, CIAT, University of Zamorano and farmers
Funds: NORAD, Norway

iii. Stage of involvement in breeding process

Defining overall goals: Farmers, INTA and CIPRES.
Defining breeding targets (*e.g.* identification of farmers' plant ideotype and most valued characters): Farmers, INTA and CIPRES.
Generating variability: Farmers, INTA, CIAT, Zamorano
Selection in early segregating populations: CIAT, INTA, farmers (F3,4)
Variety testing: Farmers, INTA
Variety evaluation: Farmers
Seed multiplication/ distribution: Farmers, CIAT (and INTA).

5.4.4 Intellectual claims

Formal perspective

Julio Molina, the breeder employed by INTA says that INTA will make no claims on ownership and neither will CIAT. It is good policy though, he says, to recognise CIAT for supplying germplasm and making crosses in the documentation surrounding the varieties. Gilles Trouche, CIRAD and Lazaro Narvaez Rojas from INTA, both working in the CIAT project argue that if INTA had only facilitated the breeding process by

providing methodological guidance, INTA would have no claims on intellectual property rights. When, as in this case, INTA has provided germplasm and initial selection, the intellectual issue is put in another light. The most logical solution though is to recognise INTA just as CIAT is to be recognised for providing germplasm. Furthermore, if INTA wishes to produce and distribute varieties improved within the project, the most respectful solution is to exempt INTA from paying any royalties.

Most participants seem to think that the farmers alone should be the holders of any plant breeders' rights. CIPRES and Molina suggest that the farmer more involved in the breeding of the chosen variety should earn more recognition, perhaps stand as a title holder with more percentage in the profit, and that the group of 50 collaborative farmers would be favoured otherwise, perhaps through exclusive rights to produce seed. CIPRES could initially work as the farmers' representative, a task later handed over to a future association of the participating farmers.

Farmer breeders' perspective

So far, most farmer breeders in the project are positive towards protection of the varieties improved through the project. The farmers say the aim is to spread improved seed of good quality and they think the system of protection will secure this. From the start, the difference between registration of a variety within MAGFOR and the protection procedure at MIFIC was however not clear. It appears as if both registration and protection have been presented as the goal, given that the technical aspect of DUS was met. 'What are hindering us from ownership one farmer asked, saying that they would for sure reach the technical requirements'. Apparently, there had been no discussions on PBR from the perspective of control or whether the project would benefit from a protection in real terms. In this, most farmer participants trust CIPRES to make the evaluation and decision. Most participants, from farmers to the INTA breeder, trust CIPRES with this responsibility as CIPRES 'act for the good of the farmers'. It is clear that the final decision on whether protection is to be sought or not, lies with the farmers. However, this decision will foremost be based on the information and recommendation given by CIPRES. The role and opinions of the facilitating organisation and INTA for that matter is thus very crucial to the final decision. Information is value loaded and CIPRES has already given the direction. As a partner and part owner of the research process, CIPRES may independently of the cost-benefit analysis, decide upon its own ideological standpoint. As said, it is an organisation for rural development and research. The research and capacity building aspects are therefore heart issues for CIPRES but it has also outspoken wishes for income generating projects.

Among the farmer breeders there are different ideologies and all are not pleased with the direction of the programme. One farmer said he would be pleased if the seed was to be distributed and would feel proud if farmers far away were to use the seed he had developed. "These seeds I own", he said and referred to the seeds in his hand, "but my ownership is materialistic and reaches no further. It would also be silly to say I made this since there have been so many elements and people within the project." He argues that if there is to be an owner, it should be the one making the project possible. Others in the group did not share this way of arguing. Through a discussion using the combination between the *criolla* and improved variety as an example, the participants listed the actors involved in the breeding work including themselves, INTA, CIPRES and Zamorano. What regards the *criolla* they pointed at themselves: "the producers had

done the work" they said, or more specifically the farmers of the north of Pueblo Nuevo. Finally, on the question of who owns the result they answered "We, because we have done all the work".

In contrast to the vision of CIPRES and Molina, farmers seem to want to own the variety collectively. "This is one of the nicest things about the project", one farmer said, "to own something collectively and stand as an example to the world". Trouche and Narvaez Rojas both working in the CIAT project, support the spirit of collectiveness. They discuss the possibility of collective ownership but to include the name of the main breeder. The farmers seem to have a collective sense of ownership but speak of the varieties referring to the name of the main breeder. To name the variety after its breeder but to collectively authorise and collect revenues could be an alternative if the participants can and want to seek protection in the future.

Participatory decision-making

Formal participants could wave their intellectual property claims and participants could negotiate codes of conducts in the initial phase, but is the group to decide upon intellectual property matters before farmers get the feeling of breeding? The understanding comes with the cycles of selection, and with time comes the capacity to think wider and the empowerment to argue differently. As farmers more clearly see opportunities and constraints, they will also take greater part in the intellectual discussion. For that reason it is important to keep the issue open and to make clear that there are different options. Although not intentionally CIPRES set the route towards the DUS criteria, registration and protection and by doing so, farmers align to this development without thinking much about alternatives. Although these issues are complicated, it is important to invite farmers into the institutional discussion. As one farmer said, “participation needs to come in from the start when the aspects are decided upon since the one coming with an initiative usually also comes with a vision". Farmers have clear ideas about seed systems, reproductive controls and how they would prefer working together. This information is crucial to adhere if future systems and institutions are to respond to farmers’ objectives and moral beliefs.

5.4.5 Technical limitations

PBR will only be of relevance to the programme if varieties meet or are set to meet the DUS criteria. It is too early to determine whether the legal criteria will be met, but the answer is prominent in the case of the five bean lines selected from the segregated material. These five lines have entered the evaluation phase and soon information will be available as to whether there is consistent performance between different sites. The breeding process is still aiming towards the DUS criteria, which the formal plant breeder Molina believes will be best met if the selection is made by the agronomists of CIPRES while in the farmer’s field.

Because the common bean is fertilising itself (selfing) it is rather a plant’s individual task to reach stability before the variety is considered stable. Stability must first be reached as regards each plant since, in simplified terms, if the germplasm still have heterozygous gene pairs at important loci the plant can develop in two different directions thus making the variety untrue to its description. The gametes are expected to become genetically identical under selfing within about ten generations (Chasal and

Gosal 2002:80). The lines of research are older and probably meet the criteria of stability.

Distinctness in the plant protection context is a phenotypic criterion and the variety should prove distinct from other varieties in at least one characteristic. The lines appear to be uniform in days to reach flowering and maturity and on these criteria; they also appear to be distinct from each other (see differences in the degree of maturity between five lines sown vertically in the field of Don Juan). Even so, many farmers (visiting or participating) see uniformity also between four of the five lines and this might not be so peculiar since all lines are originating from the same combination and are genetically related. The evaluation will show whether the research lines further distinguish between yields. The seed is rather uniform in shape and size and they are described as having the weight of led. The colours are similar, a purple-reddish colour, somewhere in between the red *criolla* and the darker DOR. One line in contrast, is easy to distinguish because of its small, squared seed and perhaps also because plants can be sown more closely. All lines however are said to be resistant to the golden mosaic and tolerant to drought. On this basis, and with higher yields and seed distinct from INTA varieties, the bean material does have a legal case.

5.4.6 *Discussion:* opportunities and constraints of PBR in PPB

Firstly, it should be remembered that different actors might hold different interest in the PPB scheme, and although being different they need not be conflicting. The Pueblo Nuevo/Condega programme includes many different actors largely working in the same direction but with different aims. The sharing of benefits could therefore be perceived as fair although only some actors gain intellectual property rights.

Main interests in PPB

Farmers:	Improved livelihoods through seed, income, knowledge, recognition and trust
INTA:	Diffusion and adoption of seed
CIPRES:	Rural and sustainable development
CIAT:	Agricultural development
Zamorano:	Research

Opportunities of Plant Breeders' Rights

With PBR farmer breeders would be recognised for their work and presumably be protected from biopiracy. It would give legal control over activities including the seed, except for the exemption of farmers and breeders. Farmers would have a right to keep

all seed production within the co-operative. With the help of the formal sector, farmers gain knowledge of how to meet legal requirements (distinct, uniform and stable) and may integrate this knowledge into their agricultural practices if so wished. In theory, knowledge about formal requirements on breeding would give farmers the same opportunities as formal breeders. An NGO can help with administrative issues, legal requirements for collective ownerships and so on. The protection could strengthen local co-operation and innovativeness.

PBR could generate income, as a percentage would reach the owner when seed is sold (formally). Money wise, royalties are around 8% of seed sales prices and cost of registration around US$ 630 (forms C$ 62, application C$ 2500, and title C$ 6250) plus cost of research and maintenance during the subsequent period of protection. There is also a need to register the variety with MAGFOR to the cost of around US$ 500 (Molina pers. comm).

Constraints of Plant Breeders' Rights

Apart from financial and administrative constraints and needs of creating legal entities, it should be questioned whether the DUS criteria answer to farmers' criteria and if the scale of distribution makes a protection worthwhile. The variety must be kept uniform for the length of protection and innovative farmers would devote their time to a few varieties instead of improving 'varieties' each season. The legal aspects demand legal knowledge and administrative work that would complicate and slow down the breeding process. Plant variety protection is a slow process while the life span of varieties is short.

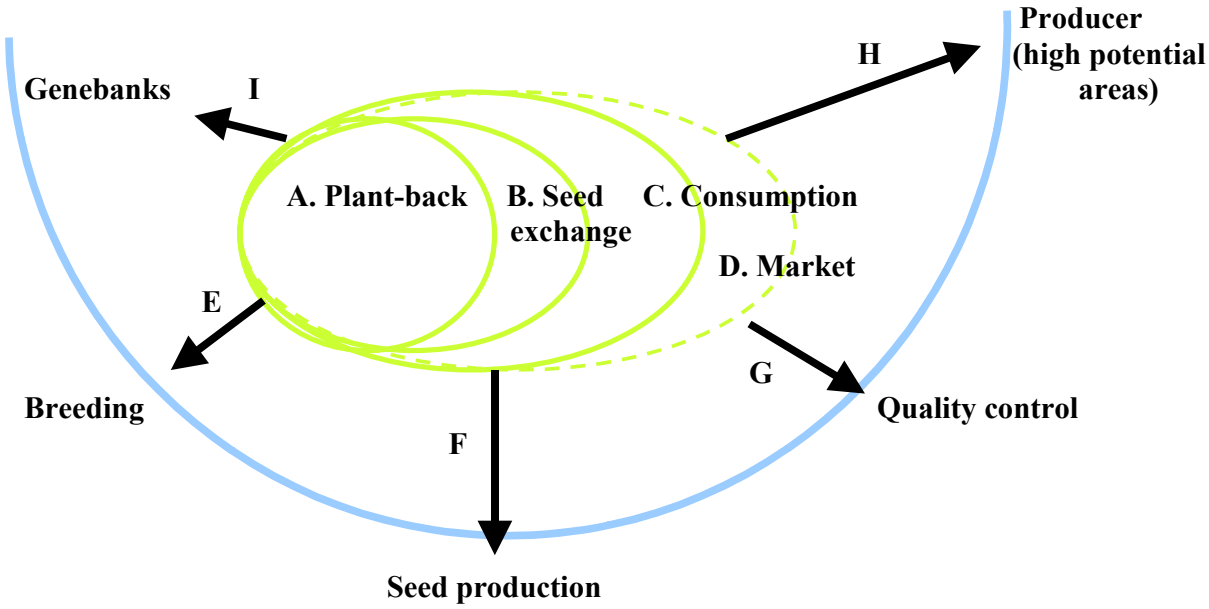


Figure 15 How the intended diffusion affects the decision-making in Plant Breeders' Rights (PBR): If the seed is to stay within the local system in cycles A, B and C (and perhaps also D), farmer participants wish not to restrict the flow thus PBR is redundant. PBR is relevant when seed are to integrate into the formal system (arrows). Whether the breeding first merges into a formal breeding scheme (E) or if farmer participants seek PBR directly, they would gain control over the formal seed production and could for example collect royalties when certified seed is produced. Although quality control (G) is a standardised procedure, the rights-holders would be able to authorise preferred producers. If the participants were to produce seed themselves (H), PBR is perhaps not needed (see discussion below). In relation to genebanks (I) and foreign breeders, the participant would favour from a law on benefit sharing.

Repute protection

To enter the present protection system, farmers' knowledge and innovativeness would integrate into the formal system, not the other way around. An alternative is to put trust in a more traditional protection system.

In a process of dynamic production and fast release, the association will gain reputation based on seed quality and well-adapted varieties. This is more important than any control they may gain in relation to plant breeders' rights. If farmers believe it to be economically viable to buy seed every season from the association then they will do so. If not, the participants have made clear that they have no desire to restrict any reuse, exchange or small-scale sales. If other seed producers start producing varieties coming from the participatory plant breeding, the participants would have few possibilities to prohibit the production and could be out-competed on large-scale advantages. In this perspective, a good reputation will be the best protector.

Intellectual protection in general

Plant variety protection is only a small part of the intellectual contributions in question for recognition and protection in PPB. Depending on the development of legislations around intellectual property rights, patents and the s*ui generis* intellectual community rights may be relevant in the future (see community rights chapter).

The issue also concerns copyrights of PPB publications and as such, this paper is directly involved in the intellectual discussion. In copyrights there is no need for application; words are directly protected whereas ideas are not. Like in many publications, the intent is to share copyrights but as the print version reaches public, it is processed beyond the criteria of copyrights. Research results however are to be shared in the best code of conduct.

Another intellectual issue is the knowledge and skills the programme generates. For instance, the farmer participants said that they could take on the role of teachers of (participatory) plant breeding. In fact, one farmer said that he in a way feels obliged to share information when people with interest want to learn more. However, it was agreed that it would be only fair to financially acknowledge time and expenses in relation to these capacity meetings.

PPB builds IPR understanding

By inviting farmers in the process behind formal varieties, there is an increased acceptance of intellectual property rights. Farmers involved in the Participatory Plant Breeding programmes have gained an understanding of the long and time-consuming process behind formal varieties and have therefore become more positive towards paying royalties and keeping protected varieties pure. Still, they say, the one with the title needs to be more humble.

5.5 *DISCUSSION:* FROM THE DEVELOPMENT PERSPECTIVE

There is no question that Nicaragua is in need of incentives for, and investments in, research and development. The country suffers from a lack of funding, infrastructure and human resources. There are few private breeders in the formal sector and INTA is relying on foreign aid money for its breeding work. More so, the brain drain was not halted with the end of the war but is still a limiting factor on the intellectual level and for continuity in research and development. Another problem of continuity is that funds and policies often follow the political situation. It is likely that the fall of Alemán and the country's more serious attitude against corruption and informal markets will attract foreign investments and make them more consistent.

5.5.1 International reputation

The bilateral agreement with the US and the following PVP law was seen by the governmental sector as an important step to gain international reputation as a serious and trustworthy country. Ambrosia Lezama, head of MIFIC, said for instance that for Nicaragua it is very important not to appear on a negative list and "the bilateral

agreement allows us to continue demonstrate that we are a serious country and that we wish to work by honest rules" (Corea 2001). Lezama argued that by working in an adequate and legal manner, Nicaragua will gain reputation for doing so and through the IPR implementation Nicaragua is sending out signals not only to the US but also to the rest of the WTO countries as being a serious country that complies with what it promises. Although the governmental side spoke of IPR bringing foreign material and technology to Nicaragua, the real background as all interviewees described it was the international pressure for trade harmonisation.

5.5.2 Checks and balances

Around US$ 10 million is the rough estimation of the cost of implementing a TRIPS intellectual property rights system in a country like Nicaragua (Byström and Einarsson 2002:22). Like many structural adjustments, this procedure is supported by foreign money (e.g. Sida). This cost is to be recovered over time, perhaps more from the benefits of proving reliable as to intellectual property rights in harmony with international trade agreements than any direct increases in the R&D budget. In prospect is an increase in Foreign Direct Investments (FDI) but according to a review by Byström and Einarsson (2002:22) there is no clear evidence that the correlation between FDI and IPR is particularly strong but rather a factor among others in the decision-making process. Its importance, they argue, is likely to diminish as IPR successively is standardised in all countries. Of more relevance, there is no clear evidence of IPR giving additional releases of varieties holding improved agricultural value. Even more distant is IPR:s correlation with farmers' access to improved seed.

From the perspective of INTA, it seems as if the centre would have no trouble recovering its costs without the excuse of royalties, just by increasing the price of registered seed. The reason for not doing so today and its reluctance towards charging additional costs of royalties lies in the reality of seed producers with limited resources and possibilities to invest in risky business. Given the small certified market and the small likelihood of bean seed royalties reaching outside the formal market, IPR on bean varieties is unlikely to do much to the Nicaraguan R&D budget.

5.5.3 Conditioned privatisation

The path chosen for Nicaragua is indeed led by market forces. Orlando Nuñez Soto, director of the non governmental organisation CIPRES, talks of intellectual property as giving transnational companies monopoly on biodiversity as only one of the examples where State interest and natural resources are subordinated to the interest of transnational companies (Nuñez 2002). On this matter, PhD student Oscar Gómez (pers. comm) believes the essence of IPR is nothing more than securing the market and that IPR as incentives for plant breeding is only secondary. To his support, a recent study on the US wheat sector shows that PVP has served primarily as a marketing tool (Aston and Venner 2000 in GRAIN 2002c). Other US studies suggest that PVP does not increase R&D activities but more so the area sown to private varieties and the number of mergers within the seed industry (Butler and Marion 1985 in CIPR 2002:59). This trend is also widespread in developing countries much because mergers and acquisitions are perhaps the most effective means of obtaining freedom and access to gene sequences and technologies in a world of overlapping intellectual rights and cross licensing (CIPR 2002:65). In this lies an entry barrier for innovative start-ups, and a

danger of restricting public access to technologies, information or germplasm since the public sector is not in the same bargaining position.

If looking into the near future, it is likely that the domestic breeding will continue to dominate the seed market, and therefore also the PVP applications in grains. This would be an outcome in contrast to the declaration by the Humboldt centre that "only transnationals will enter the protection process" since "our producers will not have the money nor the genius to register seed" (Lanuza in CIPRES Memoria). Even so, multinational companies do not have many seed breeders or intellectual property rights to acquire in Nicaragua but rather seed companies, which takes us to another issue. Although monopolies are legitimised through PBR, monopolies on the exploitation of plant varieties have outgrown their subject of protection and furthered these monopolies onto the food market, both vertically and horizontally.

The privatisation trend opposed by many members of the civil society is being strengthened by the coming free trade agreement between the American countries (FTAA or ALCA in Spanish). On the intellectual matter, FTAA is only a reprint of the bilateral agreement (perhaps pushing for membership in UPOV 1991). People wishing to turn the development around have joined hands in the cause against what they say is the real background for IPR: trade interests looking to rule the world. During a forum[6] held in Managua in July 2002, over 1000 representatives from more than 350 Mesoamerican organisations met and analysed the effects of FTAA, transnational companies and the mega plans of Plan Puebla Panamá. Like many great fora, intellectual property rights was discussed in the air of non-privatisation while some participants wished for patents for indigenous and local people under the pretence that genetic resources should remain under the control of those nurturing (from) it. In a world of black and white, there are good and bad protections. For those living in the grey zone, in reality or on the edge of integration, this thin line is more difficult to draw.

5.5.4 Conditioned participation

In the context of justice as fairness, the adoption of the PVP law came about in an air of non-equitable relations and was perceived as unjust by many involved parties and remained unknown for the great majority of stakeholders. Statements like "Everyone is free to seek plant variety protection", could be reduced to "everyone with technical and financial means and desires to work towards the DUS criteria". This is the privileged sphere and under these conditions, many farmers lose command over genetic resources while plant breeders gain control. This would be a just situation if only farmers had been involved in the decision thereof. Now, that was not the case. Neither do farmer representatives have a permanent voice in the decision-making process or committee where future plant variety protections are discussed.

"Yo participo, tú participas, nosotros participamos, vosotros participáis, ellos deciden".

"I participate, you participate, we participate, they decide."
(words from the Nicaraguan Movement for Civil Participation)

[6] Declaración Política del III Foro Mesoamericano "Frente al Plan Puebla Panamá el Movimiento Mesoamericano por la Integración Popular". See http://www.foromanagua.com.ni/documentos/declaracion-III-foro-mesoamericano.PDF

5.5.5 Conditioned recognition

Others put faith in the PVP application process in achieving justice in between innovators. For instance, Carlos Henry Loáisiga Caballero from UNA, believes that the PVP application procedure will secure any intellectual contribution made by farmers. It will show, Loáisiga Caballero argues, that the variety is of common knowledge and therefore put an end to the application procedure. His colleague Oscar Gómez asks how/whether this may/can practically be proven. Varieties may include characteristics from different localities and it will be a difficult task to assign inventorships to a certain individual or community. Then again, PBR aim not to recognise all contributions but rather those making a variety distinct, uniform and stable. This may be a systemic error, but in such a case, the problem lies in the paragraphs rather than in the application process.

As a general reflection, it appears as if PBR leads to confusion perhaps even conflicts between farmers, breeders, seed companies, NGOs, ministries and governments. During a visit by Percy Smith, the Canadian farmer sued by Monsanto, the farmer drew up a scenario of neighbours telling on each other, spreading mistrust and competition. In Nicaragua, the conflicts so far lie in the breeding sector. Who is the actual breeder, who should decide whether protection is to be sought and who would receive or be asked for royalties? INTA in particular is in the centre of interest since it supports and facilitates private breeding initiatives. On this issue, Lazaro Narvaez Rojas of INTA who has been involved in many of the breeding processes leading up to protectable varieties of INTA and ANAR 97 says he makes no personal claims. However, on behalf of his employer INTA, he believes it is wiser to recognise the supportive role of INTA instead of clashing with its mandate. To ask for royalties while INTA is attempting to benefit the Nicaraguan people would perhaps not be such a fruitful idea.

5.5.6 Conditioned seed development

Monopoly for a limited time and then released for the good of society? In practical terms, rights-holders have monopoly on the whole life span of the protected varieties since to begin with, a variety normally becomes obsolete after five years and secondly, even a uniform bean variety would probably evolve into a distinct one in around 20 years.

Moreover, PBR provide protection only for knowledge answering to the formal norm and in this shut out more informal innovations. By doing so, it does not only give incentives for the development of a certain kind of plant varieties but it also provides certain kinds of knowledge a certain degree of protection and recognition. Apparently, farmer innovations must be formalised from the start before entering the formal sector. The interaction between formal and informal could be improved but would farmer breeders enjoy intellectual and individual protection? To be granted PBR, an applicant must demonstrate that the variety is new, distinct from other varieties, uniform and stable in its essential characteristics even after a number of reproduction cycles and even after years of protection. From the many talks with farmer breeders, it appears as if they seek quality protection in line with PBR requests but find little interest in intellectual protection, especially in relation to their fellow colleagues.

6. *SUI GENERIS* INTELLECTUAL COMMUNITY RIGHTS

It should be remembered that it is only plant varieties in its narrow meaning that are apt for protection within the PVP law. Any variety that does not meet the DUS criteria therefore falls outside of any intellectual protection. The question is whether other kinds of plant improvement will fall within the scope of the proposed s*ui generis* intellectual community rights included in the future biodiversity law.

6.1 SCOPE AND OBJECTIVES OF THE DRAFT

In the proposed biodiversity law the State expressively recognises and protects, under the common denomination of *sui generis* intellectual community rights, the knowledge, practices and innovations of indigenous peoples and local communities related to the conservation and sustainable use of biodiversity, and the institutions deciding upon these rights (Biodraft, Art 82:1). The draft, put forward by the Ministry of Environment and Natural Resources (MARENA), includes both tangible elements (ecosystems, species and genes) and intangible elements associated with the *access* of genetic resources found within the borders (Biodraft, Art. 2). Where PBR are granted when varieties meet the DUS criteria, the only requirement of community rights is that the knowledge, innovation and practices held by indigenous, ethnic and local communities are related to the conservation and sustainable use of biological diversity. Members of the Crucible II Group (2001:80) argue that this subgroup suffers "from extraordinary vagueness; it is hard to know what kind of knowledge is meant to be included within such a description" and that "including this kind of language in a national law could potentially lead to enormous difficulties".

6.1.1 From conservation and sustainable use to protection

Orúe (2002) argues that the drafted biodiversity law overrides its mandate set out in the general law of environment and natural resources (Art 70): protected areas, genetic resources, animal and plant species, conservation *in* and *ex situ*, and the sustainable use of biodiversity. Neither this list nor the CBD, Orúe writes, include any promotion of traditional knowledge, innovation and practices, or any community rights thereof. Knowledge *per se*, he argues, is in the public domain and can therefore not be put under anyone's control.

However 1) Intellectual property removes certain intellectual matters from the public domain into the private domain. When Orúe argues that knowledge and ideas are of public domain this would perhaps be the most preferred situation but the winds of change are blowing fearfully. Anyone thinking differently must be caught in the eye of the storm. Or, why does Orúe support the innovativeness of DUS breeders to make this journey from public to private but not as regards any informal knowledge? Is it because one is embodied by plants and the other one is not? On the contrary, Orúe argues that innovations are too real to be protected (Orúe 2002).

However 2) the importance of indigenous and local knowledge, innovation and practices for *in situ* conservation and for the sustainable use of biodiversity is internationally recognised and according to the CBD (Art. 8j) it lies within a country's obligations to:

> *"Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and* ***promote*** *their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices"* .

Now, if we agree that it lies within the mandate of the biodiversity law to respect, maintain and promote indigenous, ethnic and local knowledge, the next question is how. The Crucible II Group argues that "it is relatively predictable and justifiable to progress from recognising the value of knowledge to recognising the need to protect it" and again "there is very little conceptual or justificatory distance between the creation of access laws that include PIC provisions for indigenous and local communities and the creation of intellectual property protections for their benefit" (Crucible II Group 2001:41).

6.1.2 Plant varieties and its associated knowledge

That said it must be agreed that farmers' knowledge and innovations in relation to plant genetic resources for food and agriculture fall within the scope of the law. Even though MAGFOR successfully negotiated with MARENA to exclude the utilisation of domesticated species from the draft, it still covers plant varieties in relation to its protection and conservation, and farmers' knowledge thereof. By drawing parallels to the PVP Law, breeders' rights are more related to the protection of varieties and farmer breeders should therefore be natural holders of community rights.

By using 'knowledge, innovations and practices' one could presume that the drafters wish for a protection system of both embodied and non-embodied knowledge. In such a case 'knowledge' could be referred to as the non-embodied knowledge (giving reason to parallels to trade secrets) and innovations as embodied knowledge such as plant varieties in its broad meaning. Any variety that does not meet the DUS criteria would therefore fall within the biodiversity law as any innovation related to the conservation and sustainable use of biological diversity, if generated by indigenous, ethnic or local groups such as farmers.

6.1.3 Exclusive rights

In spite of many confusions and unclear terminologies, the Nicaraguan draft is foremost an access law that would give informal innovators a legal rights to fair benefit-sharing when their intellectual contribution is first being accessed. Contracts, supposedly drawn up during a prior informed consent (PIC) process, would determine any future rights of control. Yet, the Nicaraguan draft differs from other biodiversity laws in so far as it wishes to give community rights the status of exclusive rights, *i.e.* to give rights-holders the right to exclude others from accessing knowledge. By being an all inclusive law of exclusive rights it opens up for many questions, especially in relation to plant varieties that have been developed by many different farmers throughout generations, perhaps also in parallel in different locations. Should the one looking to access negotiate with all and could there be such a thing as individual farmer breeders? The biodiversity laws of

Costa Rica and Bangladesh (draft) for instance are more concerned with the issue of fair benefit sharing by providing non-exclusive rights to receive royalties when an outsider wishes to access an intellectual property. The Costa Rican biodiversity law (Art 78) also excludes inventions essentially derived from knowledge that is associated with traditional or cultural biological practices from the intellectual property regime.

6.1.4 ...with no breeders exemption

By reading Article 81 in isolation it seems as if community rights are stricter than PBR because they would give no exemptions for farmers nor plant breeders: "The knowledge, innovations and practices of men and women of the indigenous communities, ethnic and local communities related to biodiversity are their cultural patrimony. These can only be used with the prior informed consent given by the one with rights to issue them". However, by being a biodiversity law usually known to counterbalance PBR and industrial innovations, this draft is no exception in so far as indigenous, ethnic and local knowledge, innovations and practices are given protection but only towards the formal sector. The traditional exchange of biological resources and their associated knowledge within communities are exempted from the draft and its access regulations (Biodraft, Art 3.c, 81). The right to further improvement however is not. When informal innovations are to be accessed, formal breeders or any researcher for that matter must apply to the access procedures and herein lies a risk that the PIC or application will be denied (Biodraft, Art 81, 85). Could the formal sector forever be denied access to informal innovations?

6.1.5 Access regulations - research constraints

The legal consultant, José Orúe, and Xavier Eslaquit, the Director of the Seed Department are very critical to the draft's negative attitude towards formal plant breeding and the effects the law is likely to have on crop improvement.

To the expected annoyance of formal breeders and other researchers on biodiversity, each sample acquired must be preceded by a PIC and environmental impact study and approved by the licensing body (Biodraft, Art 61-68). These permits and environmental impact studies will surely complicate research and overload MARENA and the delegated body with administrative work. As much as routines and access procedures are needed in some cases, the research community with no commercial interest fear that these regulations could have negative impacts on the environment and agricultural development. Like the seed collection for this study, many collections of genetic resources are of small scale with no effect on biodiversity or nature, or with no purposes of exploitation. Still, it must be argued that nowadays it is difficult to know beforehand whether the research will hold commercial interests or not.

Robert Blandino, director of Extension and Social Services at UNA, says there is no ethical code of conduct at the university (or any university in Nicaragua). The only time a researcher is asked for the ethics of his/her work is when working through the Swedish SLU cooperation. Blandino says there is no routine of asking for permission before taking seed or other resources from the field; actions are rather guided by culture than law and that these cultural norms are not always justified. "There is still plenty of resources and few people". Furthermore, it is in peoples' mind that you need not to ask

before taking resources. One reason is that research may lead to improvements for humankind, such as the development of medicines.

The issue of access to seed and genetic information was however an issue in the participatory case study. Farmers had got a feeling of trade secrets and lacking routines the collections for the purpose of this study was based on trust and an outspoken desire to spread the word. This element of trust was however not formally tested when seed was brought out of the country for the genetic analysis and the question is whether any access laws will change this situation. On this issue Blandino said ironically, the only time law is applied is when taxes are to be paid.

6.1.6 Participatory research – too formal?

The question is whether participatory plant breeding projects are too formal for Community Intellectual Rights. In the Pueblo Nuevo/Condega case, much knowledge is coming from outside but the innovativeness/intellectual contribution lies within the community. One could argue that if farmer breeders are relevant for PVP then they would also be rights-holders of Community Intellectual Rights since the breeding techniques employed are part of traditional practices (perhaps not among the participants but among others like Don Magdaleno and Zeledón). The participatory innovations have advantages to informal breeding works because they are well documented.

6.2 COMMUNITY RIGHTS VS PLANT BREEDERS' RIGHTS

Could it be that farmers' innovations will have a better protection through community intellectual rights than if the farmers were to register for plant variety protection? In both cases it is the obligation of the user/access seeker to find out whether the resource is associated with any intellectual property right and if yes, contact the owner (Biodraft, Art 72, 73 and PVP, Art 79).

6.2.1 Registration – shifts burden of proof

The draft requires no prior declaration for the community rights to exist: "This right exists and is legally recognised by the mere existence of the cultural practice or knowledge related to genetic resources and biochemicals; it does not require prior declaration, explicit recognition nor official registration; therefore it can include practices which in the future acquire such status" (Biodraft, Art 82:2). From this point of view there are advantages with the community rights as farmers need not go through the costly, perhaps for them strange process to register their rights. There are however negative aspects (Crucible II Group 2001:100): "First, the community would have to prove that the knowledge the user relied upon was community knowledge. Second, in the absence of a registry, which from the user's perspective is an institutionalised searching system, it may not be fair to hold a user liable who did not actually know that he or she was utilising indigenous or local knowledge. Consequently, the community may also be in the position of having to establish that the user actually had access to, and dishonestly relied upon, their knowledge."

The registry of protected plant varieties leaves the unauthorised user accountable, dishonestly or not. That community rights do not require registration has natural reasons. Although informal knowledge systems have suffered from romanticism these types of knowledge, innovations and practice are still too dynamic and embedded and sacred to fit into a registry, and the procedure to register every part would not only be complex in time and space but also destructive to the knowledge system itself.

6.2.2 Private or public control

Any case of access also requires consent from the government apart from the PIC from the Real- and Intellectual Property Rights-holder (Biodraft, Art. 18, 63, 72 and 73). This governmental consent only concerns collective property right to intangible elements, probably referring to the knowledge, innovations and practices held by indigenous groups, ethnical and local communities and not collectively held PBR. Thus, breeders with protected DUS varieties are not priorly informed, but on the other hand farmer breeders do not have 'private' control but must be patronised by the government. Some members of the Crucible II Group (2001:108) argue that it would be better for communities if governments were part of the deal: "Why should indigenous and local communities have to get their national government's permission to do what they want with their protected knowledge when patent, copyright and plant breeders' rights-holders do not have to do the same thing?"

6.2.3 Control or benefits

Plant breeders' rights are stronger as rights-holders have rights in regards to any person in the jurisdiction and control over the exploitation of the genetic information throughout its life span (or a maximum of 20 years). Community rights on the other hand never expire but nor can they be transferred, *i.e.* informal innovations cannot be sold and remain with the status of being informal. Moreover, community rights are only concerned with the act of acquisition and from there the parties are to decide upon the further rights through contracts associated with the licensing. The conditions for benefit-sharing is not regulated in the draft, only that the access contracts shall include indications of benefits, signalling the form and opportunities for an initial, later and possible distribution (Biodraft, Art 70c). Furthermore, the PIC shall state the regalia, which in turn are to include an initial compensation and thereafter royalties on downstream commercialisation (Biodraft, Art. 78). Where other countries mandate a 50% or more financial sharing, the Nicaraguan draft has chosen to leave the negotiating to the parties while offering assistance in the bargaining process to support just distributions (Biodraft, Art 75). Equitable sharing of benefits between farmers and transnational corporations through contracts is unlikely to occur given the unbalance in powers and capacities:

> *It is doubtful whether any profit-conscious bio prospector, working within a highly permissive patent system, would pay for knowledge or genetic material that could be obtained surreptitiously, by payment of a token sum, or for free. Moreover, once the basic information is obtained, biotechnology and the contemporary patent system leave ample scope for cosmetic changes that would permit patents to be obtained on that information or genetic material. (Mgbeoji 2001)*

6.3 *DISCUSSION*

The counter-balance, *sui generis* intellectual community rights, comes with good intentions but with low technical feasibility. Though respecting that the Biodiversity draft is but a draft, the scope of knowledge, the conditions for the protection, the rights conferred on rights-holders or whether the law will be retroactive are still unclear. Also, according to the analysis by Orúe (2002), its current reading is on several points in conflict with the Constitution and in the words of Mario Ruiz Castillo, MIFIC (pers. comm), "the drafters do not seem to take into account other laws already in force". However, Ruiz does not rule out that a future biodiversity law could lead to changes in other laws including the PVP law. The draft however is yet to be approved by the National Assembly and judging from its many contradictions it is a draft that will be drafting on, due to its complex matters and because environmental concern and informal knowledge do not have the powerful guardians.

There is a deficit though, since there are no laws controlling parties from taking, using, and reproducing indigenous and local knowledge or when collecting genetic resources. However, in the breeding context, community rights in the current reading would limit informal and formal knowledge systems from coming together and in this restrict the potentials of collaborative forces in the search for improved varieties and improved seed systems. Formal and informal are complementary systems and the future lies where these capacities are combined and dually supported.

7. GENETIC ANALYSIS – A TOOL IN IPR AND PPB?

This chapter takes on a genetic angle on intellectual property rights and in this analyses the potentials of biotechnology in analysing the technical requirements of distinctness and uniformity. The analysis also examines the genetic variation in bean lines with identical origin and selection criteria but under the selection of different farmers in different environments. The breeding process of the bean lines in question took place within the programme of participatory plant breeding in Pueblo Nuevo and Condega.

7.1 PPB IN SEGREGATING BEAN POPULATIONS

7.1.1 Selection process

The crosses in question for the PPB process were made at CIAT, Colombia and brought to Nicaragua and INTA in generation F2-F3. The formal breeder of INTA-Estelí further selected the material, e.g. discarded non-red material, and the selection reached the farmers in generation F4 and F5. Six farmers were each given 15 bags of seed of three different combinations/families:

Bag 1: (MAM 38 x DICTA 17) F1 x Tío Canela
Bags 2-5: Tío Canela 75 x (catrachita x de celaye) F1 x (FEB 212 X VAX 6) F1) F1
Bags 6-15: (VAX 3 x Catrachita) F1 x Tío Canela 75.

In *primera* 2000, each farmer sown 60 rows, 15 plots of four rows, (4X130 seeds). The lines developed under farmers' management in heterogeneous environments from river banks to mountain areas. Each farmer then selected individually a maximum of 20 plants per family based on his/her preferred criteria.

In the second season, *postrera* 2000, farmers sowed one row of 65 seeds from each selected plant. From these 200-300 rows, the farmer selected and saved seed from around 30 rows. The seed now in generation F6-F7 were kept separated and marked 1-15 based on family and 1-20 based on plant (max. 75 bags/farmer). In *primera* 2001, the farmers narrowed the selection and sowed 9-15 lines in plots of three rows á 5 m (180 seeds/rows). During this season, Maria Elsa Hurtado faced problems with saturated soils and could not continue experimenting. The remaining five farmers each selected two plants from the two most preferred lines.

In *postrera* 2001, the farmer selected his favourite plant from his most preferred line. This selection was based on total yield but seed was taken from the most preferred plant with the most pods, most seed per pod, most preferred colour, size and weight of seed. Together the farmer breeders had five lines in generation F7-8. As it happens, these all come from the same combination (VAX 3 x Catrachita) F1 x Tío Canela 75. Two of these are from the same family, bag 12, and originate from the same cross as bag 7. This combination includes breeding efforts by Zamorano, Honduras, Stephen E. Beebe and Stephen R. Temple from CIAT, the national program of Guatemala and farmer innovations in e.g. the Dominican Republic (CIAT webpage and Beebe pers. comm). See table 7 for selection process.

Table 7 Farmers selection in segregating populations.

Farmer	Selection *Primera* 2001															Selection *Postrera* 2001	New Line Number
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
José Manuel González, Paso Hondo, Pueblo Nuevo	c	c	c	c	c	c	c	c	c	c	c	c			c	12	**2**
			s									s			s		
Santos Luis Merlo, Rosario, Pueblo Nuevo	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	6	**5**
						s	s				s	s	s		s		
Jairo Videa, Río Abajo, Pueblo Nuevo	c	c	c	c	c	c	c	c	c	c	c	c	c	c		13	**6**
						s						s					
Juan Feliciano García, Santa Rosa, Condega	c	c		c	c	c		c	c	c	c	c		c	c	12	**1**
											s	s					
Pedro Gómez, Lima, Condega	c	c	c	c	c	c	c	c	c	c	c	c	c	c		7	**3**
							s			s	s			s			

c: cultivation
s: selection

In the summer season of 2002, seed of the five families were sowed with the purpose of multiplication. Unfortunately, due to an extremely hot and dry summer and irrigation restrictions by local authorities, production was very low and there was a shortage of seed for the evaluation phase planned for *primera* 2002. Seed saved by the experimenting farmers therefore complemented seed for the evaluation phase.

7.1.2 Variation in phenotypes

In *Postrera* 2002 the five lines were evaluated in 45 fields in the area of Pueblo Nuevo/Condega. Yields had not been measured to give the final prioritisation when this thesis left the field, but many farmers preferred line number 1, closely followed by number 3 and 5. All lines are said to be uniform based on days to flowering and maturity, resistance to the golden mosaic and tolerance to drought. The seed is rather uniform in shape and size apart from number 4, which is considerably smaller. The colours are similar, a purple-reddish colour, somewhere in between the red *criolla* and the darker DOR. The evaluation phase will show whether the lines further distinguish between yields.

The farmers have up until now selected individually though largely based on the same selection criteria. However, after the harvest of *Postrera* 2002, the participants met for a culinary test of the five lines. Unfortunately, the preparation failed in being identical and no conclusion could be made on the basis of taste and cooking abilities on this occasion (Herrera pers. comm). Still, through discussions mentioned earlier it was evident that lines still in the research process had differences in taste.

7.1.3 Variation in genotypes

Heterozygous gene pairs make possible a great number of homozygous families (Chasal and Gosal 2002:81). When seed was brought to the farmers in F4-F5, they still presented variability and instability and still included heterozygous gene pairs. This means that although the farmers selected the same combination, the bags included related but different genotypes say A, B, C, D, E, F and G. Farmers are likely to select, unconsciously or not, different genotypes although generally selecting on the same criteria. If the preferred characteristic is A, this seed will be selected but since selection is made based on phenotype some E and G might have been included (Gómez pers. comm). This means that although two farmers have the same preference, the end line may not be the same.

Moreover, populations of beans are expected to contain a mixture of groups of individuals that are genetically uniform. According to Chasal and Gosal (2002:81), 2^n kinds of homozygous families are possible, if n is the number of heterozygous gene pairs in the initial heterozygote controlling one character. That is, if a particular red colour is governed by for example five loci, there are 32 different pure lines for this colour, from each of the seed in the initial segregating population. Although the lines in the PPB originate from the same combination they are therefore expected to be genetically different in between lines but also within lines (although the latter difference is expected to be smaller).

Furthermore, the bean lines in question are believed to have reached the third technical criterion of stability, which is preferred since the genetic analysis below includes replanting.

7.2 GENETIC ANALYSIS

7.2.1 Methods and material

PCR based RAPD

A simple technique was used to examine the relation between populations. Short regions of the DNA molecule were randomly copied and electrophoresed. The banding pattern represents a reflection of the overall structure of the DNA molecule. DNA fragments of the same size are assumed to represent the same genetic locus (Briand et al 1998). Two closely related individuals are therefore expected to produce more similar banding patterns than two individuals that are more distant in evolutionary terms (citation Brown 1995:248). This phylogenetic technique is referred to as PCR (Polymerase Chain Reaction) based RAPD (Random Amplified Polymorphic DNA) analysis.

Plant material

The seed was collected randomly in the field at the time of harvest. Seed was collected from distinct plants and kept separated. For primer screening, seed of generation F9-F10 was collected by farmers, one agronomist and the author during *primera* 2002 at Don Juan's plot in Condega. This seed was then planted in the green house from where young leaves were collected. For the genetic analysis, a similar grouping collected seed

of F10-F11 during *postrera* 2002 but this time in Pueblo Nuevo in a plot at 900 m altitude. This seed was brought to Sweden and planted at SLU, Uppsala. What regards the material for the genepool analysis, red seed was bought on the Nicaraguan food market and brown seed was accessed through SLU geneticist. This seed was also selected randomly and planted at SLU.

DNA extraction

Young leaves were harvested from each plant (app. 3 leaves, 1 cm long). When using the UNA laboratory, leaves were either frozen or used immediately in the extraction process. The material was then mortared directly in the plastic bag it was collected from where the grounded material was put in a tube. After adding a buffer the material was centrifuged and the thereafter the liquid was pipetted into a new tube and the extraction proceeded using the mini kit A from QIAGEN. At SLU, the extraction process was more effective since leaves were collected, frozen in liquid nitrogen, and grounded to a fine powder. Buffer was added and the extraction process continued using the same kit and protocol.

Reaction mixtures and processes

Reaction mixtures contained 1.5 µl plant DNA, 2.0 µl primer, 2.5 µl *Taq* 10 X buffer with $(NH_4)_2SO_4$, 2.4 µl $MgCl_2$, 1.0 µl of 10 mM deoxynucleotide triphosphate (dNTP) mix, 0.5µl *Taq* DNA polymerase (5 U μl^{-1}), and 15.1µl MQ water. Chemicals were supplied by TaqGold and Fermenta, with best result using the latter.

The reaction mixture (25µl) was placed in a thermal cycler (Techne and Hybaid) and initially heated at 94 °C for 2 min at UNA, 2.5 min at SLU and 9 min when using TaqGold. Then followed 45 cycles of denaturation through heating (94 °C for 1.1 min) when base pairs split at DNA melting point, hybridisation by cooling (30 °C for 2 min) when primers attach randomly to the templates and synthesis at extension temperature (72 °C for 2.5 min) when the enzyme DNA polymerase (*Taq*I) synthesises new complementary strands. After the amplification, the mixture was run through a final extension step (72 °C for 7 min).

The PCR products plus 5µl loading buffer (20-30 µl) were analysed through agarose gel electrophoresis. Bands representing the DNA were visualised in 1,4% (w/v) agarose gel stained with ethidium bromide. DNA was quantified by ethidium bromide fluorescence on a UV transilluminator or TV, in reference to a marker with known quantities of λ DNA (Fermenta's EcoRI+HindIII, Marker 3).

7.2.2 Selection of primers

Material from the five lines was screened against 17 primers under two different amplification conditions. The screening procedure included 50 tests using the primers B5, B6, B7, D3, D4, D6, D7, D8, D9, D11, D12, D13, D14, D15, D17, D18 and D19. These primers were chosen due to availability and their success (B category) in other RAPD on the common bean (Briand et al 1998). Primers D3 (5'- GTCGCCGTCA -3') and D8 (5'- GTGTGCCCCA -3') were chosen for their ability to produce bands in the lines as well as showing polymorphism. Table 8 shows the screening result.

Table 8 Primer screening where numbers indicate number of bands.

Primers																		
Ind.	B5	B6	B7	D3	D4	D6	D7	D8	D9	D11	D12	D13	D14	D15	D17	D17	D18	D19
11								-										
14	0		0	1				2										
22				0				7										
24								-										
25								6										
26	0	0	3		0	0					0		0					
32			0	3	0	2		2			0						0	
33								0										
34				7				3										
35								3										
52				6														
53	0	0	3	1	0			3			0							0
61			0								0						1	
63	0	0	0	5	1		0	1		0	2	0	0			0	1	
66	0	0	0					7										

By changing laboratory and extraction method, the pattern quality improved hugely and as the quality improved, the patterns showed that the selected primers were not optimal. Instead, the pattern suggests that gene structures answering to the primers are identical between lines and within lines.

These differences in visualisation probably are a result of a faster and more effective extraction process and of the quality of the chemicals being used in the PCR process. Consequently, the analysis and patterns from UNA, Nicaragua will only serve for identifying primers and will not be included in the comparison between lines. Thus, the change of laboratory environments was unfortunate because much work was done without leading to real data.

7.2.3 Genetic analysis between PPB lines

For the purpose of the genetic analysis 36 plant individuals were analysed, seven individuals from line 1, 2, 3, 6 and eight from line 5. In total 112 samples were run through gel (60 for primer D3 and 52 for primer D8 including replicates).

As mentioned, the pattern suggests that gene structures answering to the primers are identical between lines as well as within lines (see photo below of 19 individuals of three lines using D8.).

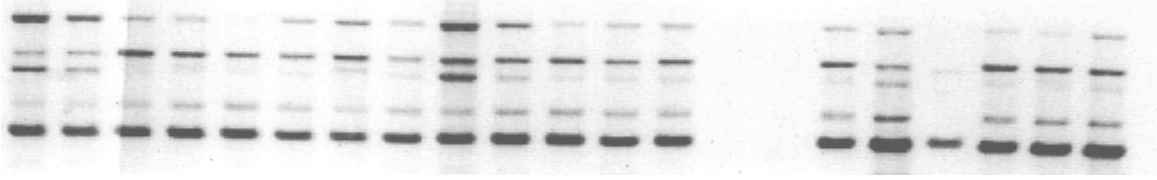


Table 9 shows that amplified fragments are missing in some samples and are present in others, but by examining the band patterns it appears that repeated tests will give the

characteristic band pattern in all the samples, if only repeated enough times. That is, fragments may be absent due to the research process and appear present when the process better conserves and amplifies the DNA fragments. The banding pattern therefore suggests that the lines under research are closely related.

Table 9 Banding patterns of PPB lines using two primers.

Plant Individual	Banding pattern with Primer D3	Banding pattern with Primer D8
Line 1		
12	I (1) I I II (4)	I I I (1)
13	I I I I II (8)	I I I I I (6)
14	I II I I II (2) I II I I II (2)	I I I I I (2)
16	I (1) I I II (8)	I I I I I (1) I I I I I (6)
17	I II I I II (2) I I I II (4) I I I I II (8)	I I I I I (5)
18	I I I I II (4) I I I I II (7)	I I I I I (1)
19	I I I II (4)	
Line 2		
20	I I I I II (4)	I I I I I I I (3)
21	I (1) I I I I II (7)	I I I I I (1) I I I I I I I (3)
21* same extr.occasion	I II I I II (1)	I I I I I I I (3)
22	I I I I II (4)	I I (3)
23	I I II (5) I I I I II (7)	I I (2) I I I I I (6)
24	I I I I II (7)	I I I I I (6)
29	I I I I II (4) I I I I II (7)	III I I I I I I I (3)
Line 3		
31		** (2)
32	I II (1) I I II (4)	I I I I I (1) I I I I I I I (3)
33	I II I I II (2) I I I II (7)	I I I I I (6)
34	I I I II (4) ** (7)	
34* different extr.occasion	I I I I II (5) I I I I II (7)	I I I I I I I (3)
35	I I I I II (4)	I I I I I I I (3)
38	I II I I II (2) (4)	I I I I I I I (3) I I I I I (6)
39	I II (1) I I I II (4)	I I I I I (1) I I I I I I I (3)
Line 5		

50	I I I II (4) (7)	I I (2)
52	I (7)	I I I I (1) I I I I I I (3) (6)
Plant Individual	**Banding pattern with Primer D3**	**Banding pattern with Primer D8**
53	I I I II (4) (7)	I I (2) I I I I I (9)
54	I I I I II (5)	I I I I I I (3)
55	I II (1) I I I I II (5)	I I I I (1) I I I I I I (3)
57		I I I I I I (3)
58	I I I I II (5)	I I I I I I (3)
Line 6		
60	(7)	I I (2) I I I I I (9)
61	I I I I II (5)	I I I I I I (3)
63	I II (1) I I I I II (5)	I I I I I I (3)
65	I I I I II (1) I I I I II (5) I I I I II (7)	I (1) III I I I I I I (3) I I I I I (9)
67	I I I II (5) I I II (7)	I I I I (5) I I I I I (9)
68	I I I I II (5)	I I I I (1) I I I I (5)
68* same extr.occasion	I I I I II (5) I I I I II (7)	I I I I I (5) I I I I I (9)
Marker	II I I I I I	I I I I
No. of tests	60	52
**When the cell shows no pattern the sample showed no clear bands.	Number in parentheses shows gel occasion.	

7.2.4 Genetic analysis between genepools

Since the research lines all came from the same combination of parents they were destined to be much related and perhaps it was not so surprising that the selected primers could not detect any differences on the genetic level. However, from the analysis above it is impossible to tell whether the lines are closely related or whether the primers represent gene structures that are present in most common bean geneplasms or plant material in general. Since the banding patterns only suggest that the lines under research are closely related, it was interesting to continue comparing the research lines with varieties further away in terms of relatedness. The gene material from the participatory breeding was therefore compared with a red *criolla* from Nicaragua and a brown seeded variety Stella. The latter is cultivated in Sweden but judging from its large size, its origins are probably found in the Andean gene pool (photo review in Gepts and Debouck 1991 and pers. comm by Gómez).

Result and discussion

The RAPDs analysis did not detect any differences between the red *criolla* and the lines under research but it did find differences in the banding pattern between red beans and the brown Stella (Table 10). In other words, the analysis could divide the material into two groups corresponding to the Mesoamerican and Andean genepool.

For this purpose, primer D8 was more efficient in visualising differences in gene structures. Primer D3 should nonetheless be ruled out since observations suggest more bands of middle size in the Stella material than in the Mesoamerican gene material. In this case it was difficult to distinguish between gene pools using D3 due to poor band quality but it is likely that repeated tests of better research quality will show differences also when using primer D3.

Table 10 Banding pattern of varieties *Stella* and red *Criolla* using two primers.

Plant individual	Banding Pattern with D3	Banding Pattern with D8
1Stella	I I I I (8)*	
2Stella	I I I II I (8) I I I II I (8)	I I I I (9) I I I I (6)
3Stella	I I I II I (8)	I I I I (9)
6Stella	I I I I (8)	I I I I (9)
8Stella	II (8)	I I I I (9)
9Stella	I I I I (8)	(9)
1Rojo	I I I II (8)	I I I (9)
2Rojo	I I I II (8)	I I I I I (9)
3Rojo	I I I II (8)	I I I I I (9)
7Rojo	I I I II (8)	I I I I I (9)
8Rojo	I I I II (8) I I I II (8)	I I I I I (9) I I I I I (6)
9Rojo	I I I II (8)	I I I I I (9)
Research variety	I I I I II	I I I I I I I
Marker	II I I I I I	I I I I
Comments	Difficult to draw conclusions due to poor band quality. Observation suggests more bands in middle part in Stella plants. The two tests of 2Stella and 3Stella show very similar patterns why better research quality might dinstinguish between genepools.	Easy to separate Meso American genepool (research varieties and land variety) from Andean genepool (Stella). Plant individual1Rojo may have been polluted with Stella DNA in PCR process.

*Number in parenthesis shows gel occasion.

7.3 *DISCUSSION*

Genetic analyses imply much resources, patience and humbleness to the results. This analysis should be valued in that perspective. From a study on the red-seeded *criolla*, Oscar Gómez concludes that molecular and phenotypic traits indicate a high level of genetic diversity within and among land varieties (forthcoming article). That the lines and varieties of this research hold genetic variation within populations and between varieties is a fact; the question is how to detect it. By using appropriate primers, it should be possible to identify a unique marker for each research line. Another question is whether it is valid. Agricultural research is left with poor resources and the question is how to best make use of funds and human capacities. That biotechnology holds solutions to some specific problem is not so far fetched. Marker assisted selection could increase selection rate and accuracy, but it would at the same time remove parts of the improvement process from the farm. The issue lies in the definition of agriculture and farmers' tasks and who is in control over the technology.

Genetic analysis aiming at examining whether different selection processes leads to genetic variation, is of an academic interest than of value for the participant in plant breeding programmes. Genetic analysis in the context of intellectual property rights is of value if protocols, primers, markers and tools were made available and accessible to all parties in need. Even if developing countries such as Nicaragua have access to equipment, they tend to have limited resources to maintain laboratories and to keep a continuous operation (Busch 1995). Nonetheless, DNA analysis in this respect could only be used as a complementary tool to common sense. Although a genetic difference could be established, it needs to be examined whether it has any agricultural relevance and whether it is sufficient for establishing a new, protectable intellectual property right on behalf of former innovators. The fear is that genetic engineering, in the context of IPR, will be used as a tool to slightly modify land varieties in order to receive and legally claim an altered marker (genetic structure).

8. CONCLUDING REMARKS

In Utopia, governments have time, capacity and resources to support and place innovativeness where it best belongs and to build along the path of sustainable development. In Utopia, powers are extension of people's free will, given to governments in trust and returned in truth. In reality, neither governments nor people exist in an institutional vacuum but in a context of international agreements among dubious driving forces looking to rule every far corner and piece of mind.

For Nicaragua, a sustainable development must be based in the rural- and agricultural sector. Instead, for development Nicaragua has chosen to rent land and labour to Asian industry. Small-scale farming, though supporting the country, is given limited interest and so are long-term strategies for conserving genetic diversity and environmental services. To understand why, there is a need to look beyond national circumstances and into the dynamics between local and global politics.

Global orders

The global order is corporate control over food and agriculture. To meet this end, countries must adopt a standardised intellectual property rights system. Nicaragua agreed to a version that undermines farmers' rights to exchange and informally sell seed. This outcome was mainly due to an international pressure, a poor understanding of its real effects and limited participation in the legislative process, not because of national demands for research incentives. In this context, Busch (1995) argues that new biotechnologies and intellectual property rights are strategic tools in the restructuring of world agriculture and as such are used to change the rules of the game in ways that are likely to be highly unfavourable to most developing nations. Although having potentials in technical and benefit-sharing terms, these tools must therefore be analysed in their social context.

While the definition of agriculture is open, the coping strategy of farmers is framed by regulations and incentives. The global order says specialisation. Farmers should concentrate on production in a narrow sense and purchase new seed for every season in order to reap the fruit of the newest seed technology developed by specialists. From a wider perspective, to integrate farmers in the sphere of specialists should in no sensible way provoke the global order of specialisation. In every community, there are innovative farmers (farmers who are more interested in experimenting) and among them are those specialised in improving seed. In cost-effective terms, it is rational to include end-users in the development of a product (especially if the end-user is an expert and will be taking on fundamental tasks in the development process). Now, farmers' innovativeness is already included in the development of every seed because of generations of domestications and improvements. At the same time, farmers' knowledge and capacities are increasingly recognised in the international debate. Still, the global order of appropriation of farmer practices is on-going and in this process the control of how and which plant material is to be developed is gradually shifting from rural households to the formal breeding sector. Farmers are at best invited into the breeding process when plant populations are already fixed, or when seed is released as uniform and stable varieties. More better-off farmers might prefer it this way. Farmers who produce industrially seek varieties that perform uniformly and respond to uniform market demands. Resource-poor farmers on the other hand have criteria that are more

complex and they usually lack resources (or desires) to buy seed and other inputs that are needed to adjust their heterogeneous environments to uniform seed (such as pesticides, fertilisers and irrigation).

There is a problem of fit, between formally improved varieties and marginal conditions, and between plant breeders' rights and agricultural practices.

The problem of seed security is also related to poor access and availability of suitable varieties. By not being the prime target group, farmers living in marginal or heterogeneous areas are likely to be excluded in distribution schemes, and when included likely to discard varieties because of low adaptation potential. In beans, the problem is that harvest results purple, not red. The problem is that the next season, grains are not even purple. The season is too short and the harvest only turns pink. The problem is that supply does not answer to demand. It would be wrong to say that the supply side, seed companies and formal breeders, do not know what is demanded or wish to meet every demand. Rather, the problem is that private breeding programs do not see incentives in breeding towards the preferences hold by the marginalized farmer. The problem is that these farmers do not have the consumers' power and therefore do not matter when breeding targets are set, and the problem with beans is that they can be reused without any new revenues reaching the developer. A parallel problem is that public breeding faces diminishing budgets and that resource-poor farmers are left on their own to cope with problems that are new, bigger, global, and perhaps even universal. These farmers have the most to win by remaining with knowledge in plant improvement because their local capacities might be the only solver to emerging problems. Simultaneously, there is an intensified pressure towards this group to purchase new seed for each season and as seed technologies are offered with promises of virus resistance and nutrition, this group is vulnerable as well as risk taking. It should be remember that resource-poor farmers in general also have most to win by an agricultural development, considering their daily struggle to move from subsistence farming to income generating production and towards an overall improvement of rural livelihoods.

Technology as such is not harmful but there is a need to look beyond technology itself and into the dynamics between technology and the forces behind it. The problem is that the so-called agricultural modernisation is generated by policies made on the international level by people living far away from any marginal reality. The problem is that it is enriching multinational companies on behalf of local economies and livelihoods. The problem is that it is a system run by international politics instead of local needs and agricultural, social or economic measurements and a system resting on subsidies and intellectual property rights.

As breeding became a specialised profession and taken out from its context, the cost of innovativeness was perhaps not increase but measured in money. Intellectual property rights came around as an instrumental approach to recoup and protect breeders' investment (an approach that is/was not needed (or desired) when breeding is contextual as part of the cost is covered by the direct benefits, in social as well as productive terms). In return of granting exclusive control through intellectual property rights there would be a generation of improved varieties for the good of society. Yet, many benefits disappear into a legal apparatus or accumulate on someone's high tower of copper coins. For small-scale farmers, plant variety improvement remains a tedious job with

few incentives other than inherent curiosity. Do intellectual property rights serve their purpose?

Protection of what and for whom?

Farmers who develop new varieties have a sense of, perhaps not ownership, but a personal responsibility that the variety answers to what is being promised, independent of how many times it may change hands. Does this call for intellectual property rights? To continue, farmers hope their seed will reach as many hands and fields as possible, as long as the seed is accessed and managed in trust. Does this call for intellectual property rights, or does it call for some sort of quality control or is it the same thing?

Numerous farmers wished for a more controlled system of seed supply and would like to be reached by formal extension services, technology assistance and improved seed. As such, a trustworthy and efficient formal seed market could benefit local seed improvement, seed access and therein food and plant genetic diversity. Judging by the name, a law on plant variety protection is on the right track. Nevertheless, by scrutinising the rights of control given to the rights-holders, the main subject of protection is the intellectual contribution rather than the variety *per se*. The rules are therefore not primarily designed for protecting the variety, but as the formal market is strengthened to enforce these rights, there is a (positive) side effect of formal quality control. Still, a system of quality control could function without intellectual property rights. The generation of improved varieties supposedly could not.

The informal sector provides most farmers with most of their seed. The formal system provides fewer, but certified ones. In many respects, the two systems hold a multitude of similitude. The largest difference is that in the formal sector, plant improvement is an end in itself. Is the monopoly given to rights-holders a fair price to pay for the generation of improved varieties? Or rather, are we to trust monopolies in achieving food security for all? On the international level, multilateral agreements are to free the seed. Thus, across borders, a clear and harmonised system of intellectual property rights could increase the flow of genetic material, as transfers are regulated and (some) intellectual contributions secured. This could be all positive since agriculture is dependent on a continuous flow of genetic diversity between borders and continents. Then again, if the pressure to provide intellectual property rights is not all altruistic, the pressuring powers expect economic benefits on the future seed market. Again, plant breeders' rights are foremost a marketing tool. They demand no improved crop performance nor exists evidence that PBR lead to an increased innovation in relation to the needs of resource-poor farmers. Thus, in the light that PBR restrict traditional practices, small-scale farmers are likely to pay the price without reaping any great benefits.

The issue of protection is larger than that of seed and genetics. It concerns agricultural systems, rural livelihoods and the identity of people. In fact, it concerns us all. Intellectual property rights as such are not harmful, but like one farmer said: the one with the title needs to be more humble. In fact, the one behind the law must be more humble. It should not be denied that breeders' rights have a point. Why should not breeders be acknowledged and paid for their work just like programmers, authors or musicians? This point becomes stronger as farmers and breeders meet on equal terms in a framework of making money. The down side is that intellectual property rights

regimes tend to ignore the existence of other relationships and ways to act in the world. As these regimes gradually impose on other knowledge systems, there is a need to look beyond knowledge as power and look into the dynamics between how knowledge is valued and protected in relation to the one in power to make judgements and design protection systems.

Local systems have many mystiques beyond the eye of a stranger, but their role in developing, producing and distributing seed is quite tangible. Local systems have been shown to work for generations yet their inherent benefits and capacities are overlooked when agricultural sectors are to develop and become more efficient. If the strategy is to modernise, to develop or to formalise, it is important to join forces and to give farmers a chance to participate in the negotiation of their own profession. It is also important to give farmers a collection of choice, and not only force them to jump on the train of seed transfer because it is seen as the only way, perhaps not forward but any way.

Many farmers have already entered the debt trap and much local material has been lost. The paragraphs of intellectual property rights law cannot take the full blame. The threat against informal exchange, local seed improvement, seed access and therein food and plant genetic diversity is rather found in the systemic shift that is taking place. Seed companies and extension services will continue promoting seed purchase from certified sources. The extended hand of US will continue changing disguise and reappear with new approaches on restructuring the seed system. Many farmers in contrast are awaiting a government that supports local innovativeness, entrepreneurships and alternative routes. With a government that trust market forces to elevate the country from poverty and low human development indexes, small-scale farmers may wait in vain. It is within this context that traditional practices are threatened, and with them the farming communities.

Conservation and progress

For many farmers the *criolla* or landrace represents a continuation of traditions brought down through generations, and as such, it is a practice not easily exchanged for seed from unknown and external sources. To step beyond the narrow field of plant variety protections, the issue is not whether traditional materials should be conserved or protected because they represent a seed treasure of collaborative efforts or because they hold good traits. *The issue is the negotiation between different interests in relation to plant genetic resources for food and agriculture.*

For one, material should be conserved if it is of value to the farmer. In this task, formal actors in conservation and plant breeding could be of much assistance in making this conservation feasible through improvements, diversified markets, etc. What regards the rest of the diversity, one cannot force a farmer to conserve poor performing varieties to the benefit of future generations. This is foremost a task of environmentalists, and a challenge for plant breeders and others to find ways where farmers voluntarily take on this task (through improvements, diversified markets, etc). It should not be denied that the joining of local and formal systems has its difficulties and could provoke changes in the two. Then again, that is the purpose, is it not? Many problems of today need to be taken on from an interdisciplinary perspective, and in this situation perhaps the solution is found by moving criss-cross over knowledge systems and by going deeper into the way we perceive life and, intellectuality.

If we were to define agriculture like it is understood traditionally, including a successive improvement of seed, the flow of seed would be freed. Farming would be an act of genetic improvement and as such, farmer activities would be exempted from any intellectual property rights. Now, under the dominant definition, seed exchange is seen in the perspective of trading agricultural inputs and as such competing with the monopoly created by laws on plant variety protection. A multifunctional interpretation on farming would have tremendous effects for the conservation of plant genetic diversity for food and agriculture and of agricultural practices. A multidimensional approach on agricultural development would have tremendous effects for its sustainability. To change farmers seed practices and to select within local material might have impacts on genetic diversity but it might also be a way to make local structures compatible and to make way for a sustainable rural development. Again, what is to be conserved and what is to be developed?

Can we agree that it is beneficial to develop a working alternative to uniformity, to give farmers a fair chance to choose seed and in continuation an agricultural system? Can we agree that this development might even include the conservation of agricultural traditions and local material? Because the next question is whether the participatory plant breeding approach is only a transitory phase until we are aligned with the agricultural systems designed by the Northern sphere.

Participatory plant breeding is not only about meeting the needs of marginal areas. It is about respecting a diversity of knowledge, generating a genetic diversity that meet the needs of its users and it is about equitable relations between plant breeders and between the global and local. In this lies the difference as we search for the best approach to protect the sphere where objectives of development, conservation and research meet. A global food system is not there to improve the livelihood of resource-poor farmers. Neither are intellectual property rights.

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Seed Law of 1998 (Ley de Producción y Comercio de Semillas, Ley No.280)
TRIPS, The Uruguay Round Agreement on Trade-related Intellectual Property Rights
Universal Declaration of Human Rights
UPOV, Act of 1978
UPOV, Act of 1991

INTERVIEWEES

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Jairo Videa, bean breeder
Uriel Orosco, maize breeder
José Manuel Gonzales, bean breeder
Maria Elsa Hurtado, bean breeder
José Gómez, maize breeder
Pedro Gómez, bean breeder
Juan Feliciano García, bean breeder

Other participants in Pueblo Nuevo/Condega and Mesoamerican Participatory Plant Breeding Programmes, none mentioned, none forgotten.

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Magdaleno Perez, bean breeder
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Several representatives from the Centre of Alexander von Humboldt, INSFOP and the Farmer University, PRODESSA, ADDAC, Club de Jóvenes Ambientalistas, CIPRES, IBIS, Trocaire, Forum Syd, Sida, Friendship organisation Sweden-Nicaragua, the Swallows, and KEPA etc.

TERMINOLOGY

Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biological resources includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.
Country of origin of genetic resources means the country, which possesses those genetic resources in in-situ conditions.
Country providing genetic resources means the country supplying genetic resources collected from in-situ sources, including populations of both wild and domesticated species, or taken from ex-situ sources, which may or may not have originated in that country.
Domesticated or cultivated species means species in which the evolutionary process has been influenced by humans to meet their needs.
Ex-situ conservation means the conservation of components of biological diversity outside their natural habitats.
Genetic diversity is an element of biodiversity referring to the variation between individuals within populations, among populations within species, and among species (UNEP web glossary).
Genetic material means any material of plant, animal, microbial or other origin containing functional units of heredity.
Genetic resources mean genetic material of actual or potential value.
In-situ conservation means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

Source: CBD, Art. 2.

ACRONYMS AND ABBREVIATIONS

ADDAC	Association for the Diversification and Agricultural Development of the Community (Nicaraguan NGO)
ALCA	Área de Libre Comercio de las Américas (FTAA)
ANAR	Asociación de Arroceros (Rice Association)
APROSEN	Asociación de Productores de Semilla del Norte (Seed Association)
BRL	Biodiversity Rights Legislation
CBD	Convention on Biological Diversity
CBDC	Community, Biodiversity, Development and Conservation Program
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Centre for Wheat and Maize Improvement
CIPR	Commission on Intellectual Property Rights
CIPRES	Centro de Investigación y Promoción del Desarrollo Rural y Social (Nicaraguan NGO)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (French research centre)
DOR	Bean type
DUS	Distinct, Uniform and Stable
FAO	UN Food and Agriculture Organisation
FDI	Foreign Development Investment
FTAA	Free Trade Area of the Americas
GATT	General Agreement on Tariffs and Trade
GRAIN	Genetic Resources Action International
GRULAC	Group of Countries of Latin America and the Caribbean
G x E	Genetic x Environment
INTA	Instituto Nacional de Tecnología Agraria
IPR	Intellectual Property Rights
IRAM	Institute de Recherches et Applications des Méthodes de Développement (French NGO)
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture

MAGFOR	Ministerio Agropecuario y Forestal (Ministry of Agriculture and Forestry)
MARENA	Ministerio del Ambiente y los Recursos Naturales (Ministry of Environment and Natural Resources)
MIFIC	Ministerio de Fomento, Industria y Comercio (Ministry of Promotion, Industry and Commerce)
NGO	Non Governmental Organisation
PBR	Plant Breeders' Rights
PCR	Polymerase Chain Reaction
PIC	Prior Informed Consent
PRODESSA	Centro de Promocion y Asesoria en Investigacion para el Sector Agropecuario (Nicaraguan NGO)
PROMESA	USAID National Seed Improvement Project
PPB	Participatory Plant Breeding
PRGA Program	System wide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation of the CGIAR
PROFRIJOL	El Programa Cooperativo Regional de Frijol para Centro América, México y El Caribe
PVP	Plant Variety Protection
RAPD	Random Amplified Polymorphic DNA
Sida	Swedish International Development Cooperation Agency
SLU	Swedish University of Agricultural Sciences
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
UCA	Universidad Centroamericana
UNA	Universidad Nacional Agraria (National University of Agriculture)
UNAG	Union Nacional de Agricultores y Ganaderos
UNAN	Universidad Nacional Autónoma de Nicaragua
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UPOV	Union for the Protection of New Varieties of Plants
USAID	US Agency for International Development
WHO	World Health Organisation