# Aspects of intellectual property protection in relation to seed crops, floriculture and medicinal plants that may impact on policy and legislative developments in South Africa

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## DECLARATION

The research presented in this report was carried out whilst employed as the Registrar: Plant Breeders' Rights in the Department of Agriculture, Forestry and Fisheries under the supervision of Prof J.N. Eloff and co-supervision of Prof L.J. McGaw in the Phytomedicine Programme, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria.

I, the undersigned Noluthando Netnou-Nkoana, declare that this thesis submitted to the University for the degree of Philosophiae Doctor, is the result of my own investigations except when the work of others is acknowledged. The views expressed are my own views and do not represent the views of my employers. This thesis has not been submitted to any other institution.

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This thesis is dedicated to the loving memory of my late father, Penny Arthur Netnou (14 February 1946-30 July 2014), my friend, my hero, my protector. Phumla ngoxolo mNgwevu, Zulu, Tshangisa, Snuka, Rhudulu ugqatso ulufezile. Makubenjalo!!.

## PUBLICATIONS

The following publications have appeared from this work:

Netnou-Nkoana, N & Eloff, JN. 2012. The South African floricultural industry and the Plant Breeders' Rights Act: A short review. World Patent Information 34:224-228.

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Some of the proposed legislative amendments, in particular around the farmers' privilege, were presented in the following workshops:

a) National Stakeholder Workshop held in Pretoria on 22 May 2013.

b) Plant Breeders' Rights Bill and Plant Improvement Bill: Knowledge and Information Exchange Workshop held in Cape Town on 31 March-01 April 2015.

## ABSTRACT

The Plant Breeder's Right (PBR), also known as Plant Variety Protection (PVP), is a form of intellectual property afforded to breeders of newly bred plant varieties. In South Africa, intellectual protection of new plant varieties is afforded through the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976) as amended in 1996.

The writer has been Registrar: Plant Breeders' Rights since November 2007. Over the years the writer has interacted with several stakeholders with interest in plant breeders' rights, including breeders, farmers, patent attorneys, growers, plant breeders' rights administrators from other countries and civil society organisations. Although South Africa has had Plant Breeders' Rights legislation since 1976, it has been observed that this piece of legislation is relatively unknown and often misunderstood even by the users of the system. In engagements with various stakeholders, it has been established that there are conflicting views amongst the stakeholders on pertinent issues related to the plant breeders' rights system. There are views, among others, include: that the plant breeders' rights system is only relevant and benefits breeders from big multinational companies such as Monsanto and farmers can never benefit in such a system; that the Plant Breeders' Rights Act is synonymous with genetically modified organisms; that indigenous plants are neglected, and that the system only promotes protection of foreign varieties. The most contentious issue is however around the impact of plant breeders' rights on the tradition of farmers to save, sell and exchange seed.

Very little is documented on the South Africa plant breeders' rights system, more so from the administrator's perspective. This study explored some aspects of the plant breeders' rights system that may need policy interventions and legislation amendments, such as matters around the plant breeders' rights system in relation to farmers' rights, possible dual protection of Genetically Modified varieties in terms of the Plant Breeders' Rights Act 1976 and the Patents Act 1978, as well as the participation of indigenous ornamental crops in the plant breeders' rights system.

On the issue of the farmers' rights: results of this work show that the current provision in the Plant Breeders' Rights Act deals with Farmers' Rights in a narrow sense, i.e. with the rights of farmers to save seed. It was established that this provision is inadequate for both the breeders and the farmers. A survey was also conducted among smallholder farmers from four provinces, namely Eastern Cape, Free State, Limpopo, and Western Cape. The interesting finding was that although there is so much debate around the impact of the plant breeders' rights system on farmers' rights, the majority of the farmers from this study group have never heard of the Plant Breeders' Rights Act. There are farmers who are continuing with the practice of seed saving; however some farmers have indicated that they do not save seed they believe that this practice lowers yield. Those who do save seed mostly save their traditional seed, i.e. locally adapted seed lacking formal crop improvement as opposed to modern commercial seed. Some farmers have indicated that they do develop varieties through their own selections and believe that their varieties could qualify for protection in terms of the Plant Breeders' Rights Act. It is evident that both government and the civil society organisations need to do more to educate smallholder farmers about laws and policies that impact their livelihood. Based on this study, a proposal was made to have the farmers' privilege provisions in the current Plant Breeders' Right Act amended to allow the Minister responsible for Agriculture to prescribe among others: the crops in which this provision will apply; the category or categories of farmers that would benefit; the circumstances under which royalties should be paid. This proposal was welcomed by most stakeholders and has since been incorporated in the draft Plant Breeders' Rights Bill. It is envisaged that specific details around these factors will be included in the Regulations to the Act after extensive consultations with all relevant stakeholders.

There is a gap in policy and legislation with regard to the recognition of Farmers' Rights as envisaged in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). As such there are calls from some stakeholders including the civil society organisations that legislation on plant breeders' rights must address these gaps and/or an alternative *sui generis* (of its own kind) system should be explored as the International Union for the Protection of New Plant Varieties (UPOV) system is not tailored for developing

countries. In South Africa, legislation dealing with some aspects pertaining to Farmers' Rights is spread over different government departments, e.g. Department of Agriculture, Forestry & Fisheries dealing with intellectual property protection only in as far as plant breeders' rights; Department of Trade & Industry being custodians of intellectual property laws in South Africa and administrators of, among others the Patents Act; Department of Environmental Affairs dealing with Access and Benefit Sharing matters; Department of Science and Technology dealing with Indigenous Knowledge Systems and intellectual property protection emanating from publicly funded research institutions. More discussions are needed on South Africa becoming a member of the ITPGRFA as these will pave the way for further discussions and policy interventions addressing Farmers' Rights in a broad sense.

As far as the Genetically Modified Organisms are concerned, South Africa has approved only three Genetically Modified (GM) crops for commercialization in terms of the GMO Act, 1997, namely cotton, maize, and soybean. This is contrary to some statements made by members of the public that much more crops, including pumpkin, potato, banana and tomato are genetically modified. In terms of intellectual property protection, of the total number of GM varieties protected by plant breeders' rights per crop: 60% of varieties are GM for cotton, 61% for yellow maize, 34% for white maize and 63% for soybean. Currently there are no GM events used in these crops protected in terms of the Patents Act 1978, which effectively means that there is currently no dual protection for these crops. Dual protection is however one of the most hotly debated issues because of the impact it might have on the rights of farmers to save seed. It has been argued that in South Africa dual protection is possible. Scrutiny of the Plant Breeders' Rights Act 1976, the Patents Act 1978 and the draft National Policy on Intellectual Property shows that all are silent on the issue of dual protection of plant varieties. The Departments of Agriculture, Forestry & Fisheries together with the Department of Trade and Industry need to initiate discussions around dual protection as well the use of Technology Agreements, between technology holders and technology users, in protecting GM varieties and the impact thereof for all role players in the value-chain in order to come up with the country position in this regard.

This study showed that ornamental plants attract the highest number of plant breeders' rights applications. Of the applications received between 2000 and 2010 about 20% are of varieties developed from indigenous plants. Of plant breeders' rights in ornamental plants, 84% are owned by foreign entities. Of the 16% owned by local entities, 12% are privately owned and 4% are owned by public research institutions. Some of the challenges facing this industry include the fact that there is inadequate turnover to allow for breeding programs and research initiatives; this is exacerbated by plant breeder's rights infringements which lead to further revenue losses. Other challenges the industry face include high labor costs and lack of market information. The national Department of Agriculture, Forestry and Fisheries together with the other relevant departments, e.g. the Department of Labour and the Department of Trade and Industry need to engage more with the floricultural industry stakeholders to discuss the challenges facing the industry and come up with policies that would be conducive for the further development of the industry in order for South Africa to benefit from its unique biodiversity. Literature study has also established that breeders are keen on developing varieties of medicinal plants that are uniform and stable. This would call for domestic legislation on intellectual property protection that is aligned with legislation on Biodiversity and Access and Benefit-Sharing.

This study highlights the importance of engaging stakeholders from both the formal and informal sector and brings attention to gaps in our policies and legislation. This study has already made a major contribution in the draft Plant Breeders' Rights Bill through the inclusion of the revised provision on farmers' privilege. This revision is aimed at ensuring that the legitimate interests of the breeder are protected whilst the rights of the farmers are recognized. It is hoped that this study will make a positive contribution to future policy developments and will lay a foundation for future studies pertaining to the plant breeders' rights system and its impact in the agricultural sector.

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| | |
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| ARC | Agricultural Research Council |
| CAADP | Comprehensive African Agriculture Development Programme |
| CBD | Convention on Biological Diversity |
| DAFF | Department of Agriculture, Forestry & Fisheries |
| DUS | Distinctness, Uniformity, Stability |
| FAO | Food and Agriculture Organization of the United Nations |
| GMO | Genetically Modified Organism |
| IPR | Intellectual Property Rights |
| ITPGRFA (Treaty) | International Treaty on Plant Genetic Resources for Food and Agriculture. |
| OAPI | African Intellectual Property Organization |
| PBR | Plant Breeder's Right |
| PVP | Plant Variety Protection |
| SADC | Southern African Development Community |
| TRIPS | The Agreement on Trade Related Aspects of Intellectual Property Rights |
| UPOV | International Union for the Protection of New Varieties of Plants |

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# CHAPTER 1

## Introduction and objectives

### 1. 1 Introduction to the study

Agriculture began when early humans realized that some of the plants growing in the wild could be used for food, clothing and health care. Humans all over the world identified, selected and cultivated only those plants that were useful to them and were best suited for cultivation in their regions (Ravi, 2004). Domestication of crops started some 11 000 years ago and since then much progress has been made (Bruins, 2009). The selection of plants to give higher yield with improved qualities has formed the basis of plant breeding since man first domesticated wild plants (Kanungwe, 2009). Until the late 1800s, crop varieties were developed by trial and error selection by farmers, with seed for the next crop saved from the current crop. Very soon after the 1900 rediscovery of Mendel's insights into the laws of heredity, scientists sought to apply genetics to crop improvement. This led to the direct development of 'pure lines' of self-pollinating crops. Pure lines are uniform, breed true to type and contain consistent and identifiable traits that can be transferred to other plants (Dutfield, 2008). Today, plant breeding uses techniques from simple selection to complex molecular methods to integrate desirable traits into existing varieties to meet human needs. Plant breeders work with all kinds of crops, such as agricultural (or field) crops, horticultural crops (including ornamentals), forage and turf crops and forest crops. Numerous contributions have been made by plant breeding over the years and plant breeders have focused on increasing the yield of varieties, on resistance to biotic and abiotic stress and tolerance to abiotic stress. Other factors that have been altered for the benefit of mankind are: earliness, taste, size, nutritional and crop quality, firmness, shelf-life, plant type and harvestability (Bruins, 2009).

## 1.2 Literature Review

### 1.2.1 Plant Breeding

The world population is growing, arable land and other resources are scarce. It is estimated that the world's population will increase from 7 to 9 billion by 2050 (FAO, 2011). An increasing population requires an estimated 70% increase in food production by 2050 to meet the requirements of the Declaration of the World Summit on Food Security. With the limited availability of productive land and natural degradation of agricultural land, simply planting more crops is no longer a viable option. Therefore, new varieties of plants need to be developed through plant breeding that generates an increase of yield without relying on an increase in land area (Neethu-Francis, 2015).

Plant breeding, the art of improving the genetics of plants, has been around as long as man has planted and saved the seeds of the best plants for the next year's crop. This early form of man-made selection enabled the gradual evolution of cultivated crops (Blair, 1999). Plant breeding has brought the world numerous benefits in the areas of pharmaceuticals and agriculture. The purpose of plant breeding is to produce new varieties which are known in the scientific community as "cultivars". A cultivar is a clearly distinguishable group of cultivated plants which, when reproduced under control, retains its distinguishing characters (Derzko, 1994). The role of plant breeders is to use germplasm resources to develop new varieties which respond to particular environments and which meet consumer demand. It is mainly the plant breeders, along with other agricultural researchers and extension services, who have provided the world's population with plentiful food, improved health and nutrition and beautiful landscapes (Jördens, 2009). New varieties of plants with improved yield or providing resistance to plant pests, etc. are also an essential factor in increasing productivity and product quality in agriculture, horticulture and forestry (Thiele & Claus, 2003). Agriculture can be considered to be the foundation of civilization, and in a similar way, plant breeding can be considered to be the foundation of agriculture (Bruins, 2009).

### 1.2.2 The Green Revolution

Between 1970 and 1990 the Green Revolution (use of high-yielding varieties in combination with inorganic fertilizers, pesticides and herbicides, and intensive irrigation) brought about greatly improved crop yield in many, but by no means all, parts of the new developing world, which led to dramatic increases in the yields of global staple cereals (maize, rice and wheat) (Bhagavan & Virgin, 2004; Nuffield Council on Bioethics, 2004). While the term 'Green Evolution' originally described developments for rice and wheat, the term has since referred to the development of high yielding varieties for a number of other major food crops important to developing countries. These include sorghum, millet, maize, cassava, and beans (Hazell, 2009).

According to Mayet (2010) the consequences of the Green Revolution have been strongly contested with many divergent and conflicting views resulting in highly polarized positions. The least contested area of debate is probably the issue of yield increases. Here most commentators appear to agree that in highly manipulated environments in ecologically productive zones, with access to irrigation and the correct application of the inputs from Green Revolution High Yield Varieties would produce higher yield than traditional varieties under similar conditions. Early supporters of the Green Revolution varieties claimed that boosting production would raise the incomes of farmers, thus raising them out of poverty. Proponents argued that the poor benefited from low crop prices since lower food costs would improve their welfare. Critics of the Green Revolution argued that technologies that required purchased inputs –improved seeds, fertilizers, and pesticides –would inherently favour those with money over the poor, who would eventually lose their land and be forced to migrate to burgeoning urban shantytowns (de Grassi & Rosset, 2003). Proponents have based their opinions on the history of the well documented agricultural process that emanated from modern plant breeding, improved agronomy and the development of inorganic fertilizers and modern pesticides (Tshuma, 2015).

The Asian countries managed to put in place policies that led to rapidly rising agricultural activity. These included support for among others the development and release of high-yielding varieties of rice and wheat (Demeke *et al.*, 2014). While the Green Revolution increased the production of the main staple cereals by several factors in Asia and Latin America, it was unable to establish itself in sub-Saharan Africa, for a variety of reasons, where agricultural productivity remained low (Bhagavan & Virgin, 2004). According to deGrassi & Rosset (2003), the Green Revolution has failed in Africa, not only because of political and economic inequalities, but because uniform technologies are ill-suited to the continents' ecological conditions.

Pillar IV of the Comprehensive African Agriculture Development Programme (CAADP) is leading moves to revitalize, expand and reform Africa's agricultural research and development effort. Investments are being made by national governments, donors and private funders in research institutions to develop improved seeds and soil technologies for a Green Revolution in Africa (FAC CAADP Policy Brief, 2011). Some critics claim that the CAADP aims to increase agricultural productivity in Africa principally by promoting a 'conventional farming' model associated with the Green Revolution. This model emphasizes the use of expensive external inputs, such as chemical fertilizers and pesticides, and improved and/or hybrid seeds, often provided in packages to farmers, sometimes in contractual arrangements with companies, frequently with improved access to credit and part-privatised extension services (Curtis, 2012). The African Centre for Biosafety (2014) argues that Malawi has been hailed as a Green Revolution success story, but a closer look reveals farmers trapped in a cycle of debt and dependency on costly external inputs, and an eroding natural resource base. Denning *et al.* (2009) identified future challenges in sustaining a Green Revolution in Malawi and these included unreliable rainfall and climate change, high fertilizer prices and post-harvest losses. In the South African context, Tshuma (2015) explores the need and suitability of the Green Revolution in South Africa highlighting the merits and demerits of these technologies in this country. He argues that South Africa should not push for the introduction of the Green Revolution approach in the country as its

demerits outweighs its merits, unless proper research is done and cultivars suitable for the resources the country currently has are developed. He further calls for all stakeholders to sit down and craft the best strategy to fight food insecurity and poverty in rural areas whilst also promoting rural development and the self-sufficient citizenry.

Some GM protagonists argue that the next cycle of significant rises in productivity can only be ensured by largely resorting to genetically modified agriculture, now dubbed by some analysts as the 'Doubly Green Revolution'. This claim is contested by GM antagonists, who point to the success of several currently employed non-GM techniques in delivering productivity increases (Bhagavan & Virgin, 2004). Increasing the agricultural productivity in Africa thus calls for broad policy and strategic frameworks that encompass agro-industrial and agribusiness services along with farming. The agricultural system's transformation will have the most impact when innovators have the explicit perspective that the Green Revolution and agro-industrial and agribusiness development must go hand in hand (Asenso-Okyere & Jamaneh, 2012). Reduction of hunger and poverty in Africa cannot happen unless Africa achieves a radical transformation of its agriculture. Africa needs its own Green Revolution, and to achieve this, appropriate supportive policies must be in place (Demeke *et al.*, 2014).

### 1.2.3 Intellectual Property Rights (IPR)

Plants and plant products have many commercial uses in agriculture, horticulture, industry and medicine. Given their commercial importance, a tremendous amount of research has been undertaken to develop new plant varieties (Agris, 1999). Global practices surrounding the use of intellectual property protection for agricultural innovations are rapidly evolving. The issue of how IP is used to protect new varieties of plants is one of critical importance in the modern world (Jefferson *et al.*, 2014). Historically, systems for the protection of intellectual property were applied principally to mechanical inventions of one kind or another, or to artistic creations (Commission on Intellectual Property, 2002). Before the advent of modern technologies in the agricultural

sector, inventions based on living organisms (like the breeding of new varieties through hybridization, back crossing and selection) were considered as natural and obvious discoveries that could rarely be copied and did not warrant any protection or patenting (Chandrashekaran & Vasudev, 2002). The assignment of Intellectual Property Rights (IPRs) to living things is of relatively recent origin in developed countries (Commission on Intellectual Property, 2002). The past few years have witnessed a significant worldwide strengthening of IPRs in plant breeding. This strengthening is the product of a growth in the number of countries that grant such rights, an expansion on the number of inventions that can be protected, and a broadening of the scope of protection offered by extant IPR systems (Louwaars *et al.*, 2005).

Breeding new plant varieties is a laborious and time-consuming process. Depending on the species, it takes about 7-10 years to get the first cross to the marketable variety (Dutfield, 2008), with plant science companies investing approximately 15% of their annual turnover in seed-related R&D activities (Ministero dello Sviluppo Economico & WIPO, 2015). Plant breeding requires considerable investment in time and resources, research in plant biotecholology and plant breeding is expensive with a cost of around one million euros to produce a new variety (Jördens, 2009, Le Buanec & Ricroch, 2014). The resulting seed products face the risk of being easily reproduced and 'copied' by competitors, necessitating the need for some form of enforceable commercial protection for plant breeders (Jördens, 2009, Nhemachena *et al.*, 2016). Competitors could capture the variety and sell seeds either identical or with minor improvements at a lower price because they do not have to recoup the development costs, or in the case of species capable of self-reproduction, users could reproduce it for their own use without paying the original breeder. Under these conditions, the innovator could not recover costs, it would have no incentive to continue with research efforts and no genetic progress of varieties could be expected from the private sector. To avoid this situation, the breeder must be able to protect his new varieties (Le Buanec & Ricroch, 2014). New plant varieties are afforded legal protection to encourage commercial breeders to invest the resources, labour and time needed to improve existing plant varieties by ensuring that breeders receive adequate remuneration when they market the propagating

material of those improved varieties. According to Helfer (2014) once breeders are assured that their rights will be protected in other states, breeders will be more willing to make their new varieties available in those states (assuming they have access to a distribution and marketing infrastructure).

The establishment of an IPR regime requires consideration of the balance of economic interests. If an IPR regime is too weak it will not provide sufficient incentives for invention or for the orderly development of the industry. On the other hand, poorly conceived IPR systems may assign excessive privileges, restrict access to knowledge, or limit enterprise growth and diversification, and society at large may not benefit from the granting of the rights (Louwaars *et al.*, 2005). In the private sector led economic paradigm, a well-functioning global IPR system is considered to be an essential enabling requirement for the agri-food system to become and remain fit for purpose, which amongst other things, means becoming and remaining competitive in an international trade context, as competitiveness is considered to be a necessary condition for guaranteeing sustainable growth, more and better jobs and respect for environment (Ministero dello Sviluppo Economico & WIPO, 2015). Lack of plant variety protection system, in particular, is often considered a major constraint for the limited or non-engagement of multinational and domestic private seed companies in seed markets of developing countries. It is often anticipated that strengthening the plant variety protection system would encourage private sector investment in plant breeding and diversification of the seed sector, making more varieties available to the farmer (Bishaw & Gastel, 2009).

Botanical innovation resulting in the creation of new plant varieties is afforded legal protection through Intellectual Property Rights (IPRs) –specifically plant breeders' rights (also called Plant Variety Protection) and patents (Fuavao, 2003). A distinction needs to be made between the intellectual property rights and the physical object in which they are found. For instance, a new plant variety may contain a number of intellectual property rights –a patent over a gene, plant breeders' rights over the variety itself and/or

trade mark over the name of the plant (ACIPA, 2008). The adoption of the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) obliges developing countries to adopt protection of plant varieties either by patents or other means. In South Africa, the Patents Act 1978 (Act No. 57) excludes from patentability "any varieties of animals or plant or any essentially biological process for the production of animals or plants, not being a microbiological process or the product of such a process" (s. 25(4)(b). The protection of new plant varieties is regulated by the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976). These two pieces of legislation are administered by the Department of Trade and Industry and the Department of Agriculture, Forestry and Fisheries respectively.

### 1.2.4 International Agreements

There are many different international agreements that discuss issues around intellectual property rights and biodiversity. The most pertinent for this study are the Agreement on Trade-Related Aspects of Intellectual property Rights (TRIPS), the Convention on Biological Diversity (CBD) and the International Union for the Protection of New Varieties of Plants (UPOV) Convention.

#### 1.2.4.1 The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS)

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) was concluded on April 15 1994 as part of the Marrakech Agreement establishing the World Trade Organization. TRIPS is the first and only IPR Treaty that seeks to establish universal, minimum standards of protection across the major fields of intellectual property, including patents, copyrights, trademarks, industrial designs, integrated circuits and trade secrets (Helfer, 2004). The interest in plant varieties as a subject matter of intellectual property protection has led to a particular provision in article 27(3)(b) of the TRIPS agreement. Article 27(3)(b) provides that members shall provide

for the protection of plant varieties either by patents or by an effective *sui generis* system ("of its own kind" meaning "unique in its characteristics") or by any combination thereof. TRIPS along with other international agreements monitors whether domestic policy choices of participating nations meet international norms (Stein, 2005). The TRIPS agreement binds all members of the WTO (Jördens, 2005).

#### 1.2.4.2 The International Union for the Protection of New Varieties of Plants (UPOV) Convention

The most commonly used global IPR method in plants is the International Union for the Protection of New Varieties of Plants (UPOV) Convention to protect plant breeders' rights. UPOV is an intergovernmental organization that seeks to provide and promote an effective system of plant variety protection. The mission of UPOV is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society (Jördens, 2005). Thus, the UPOV system of PVP is designed to encourage innovation in the field of plant breeding, in order to promote the development of new varieties that will benefit the society (Jördens, 2009). The first International Union for the Protection of Varieties of Plants (UPOV) Convention was established in 1961 and has since been revised in 1972, 1978 and in 1991. Jördens (2005) describes in detail the original Convention of 1961 and the revisions in 1972, 1978 and 1991.

Although the TRIPS Agreement devotes only minimal attention to plant breeders' rights or plant variety protection and does not even mention the UPOV Act, its adoption has done more to encourage the legal protection of plant varieties than any other international agreement (Helfer, 2004). While the UPOV Convention is not explicitly mentioned as a *sui generis* system, the majority of States which have implemented Article 27(3)(b) up to now have adopted the UPOV system (Jördens, 2005). Despite numerous commentaries and proposals for the adoption of the *sui generis* models, only a few countries have adopted the alternatives to UPOV (Blakeney, 2011a). The plant breeders' rights model developed in The International Union of the Protection of New

Varieties (UPOV) Convention has therefore been seen as an acceptable *sui generis* system that fulfils the requirements of the TRIPS agreement in this field (Cullet, 2004).

South Africa became the tenth member of UPOV in November 1977 and is one of 74 countries with UPOV membership and is also one of only four African countries (Kenya, Morocco, Tunisia and South Africa) and one African organization, namely the African Intellectual Property Organization (OAPI) with UPOV membership. According to Dutfield (2011), a range of factors encourage countries to seek membership of UPOV. These include the possibility of accessing improved seeds and diversifying the seeds available within the country. Many developing countries also consider that UPOV membership can contribute to attracting foreign investment in the agricultural sector.

#### 1.2.4.3 The Convention on Biological Diversity (CBD)

The need to find solutions to the threats to the biological diversity in the context of habitat loss and over-exploitation, poverty, inequitable distributions of land, wealth and other benefits and illiteracy led to the drafting of the United Nations (UN) Convention on Biological Diversity (CBD) in 1992 (Singh, 2004). The CBD entered into force on 29 December 1993. It has three main objectives, viz., the conservation of biological diversity, the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The Queen Mary Intellectual Property Research Institute (2004) explains that the single divisive issue in the CBD negotiations was the relationship between intellectual property rights and genetic resources. The developing countries of the South, generally speaking the most with substantial sources of genetic resources, sought to use the CBD as a means of bargaining access to those resources for royalties, technology and resource data. The industrialised group of countries insisted that the CBD did not conflict with intellectual property rights.

The Council for Trade-Related Aspects of Intellectual Property Rights (2006) mentions two general issues concerning the overall relationship between the TRIPS agreement and the CBD:

i) whether or not there is conflict between the TRIPS Agreement and the CBD;

ii) whether something needs to be done, at least on the TRIPS side to ensure that the two instruments are applied in a non-conflicting and mutually supportive manner and if so, what.

With regard to these questions several views were expressed, ranging from the view that there is no conflict between the two Agreements and governments can implement the two in a mutually supportive way through national measures to the view that there is an inherent conflict between the two instruments, and the TRIPS Agreement needs to be amended to remove such conflict (Zerbe, 2002; Adhikari, 2005; Jordens, 2005; Nair, 2011).

### 1.2.5 National Arrangements

#### 1.2.5.1 Legislation

In South Africa, there are different national pieces of legislation that have been enacted to give effect to the international agreements discussed above. The most pertinent for this study are the National Environmental Management: Biodiversity, 2004 (Act No. 10 of 2004): the NEMBA, the Plant Breeders' Rights (PBR) Act, 1976 (Act No.15 of 1976) (as amended), the Plant Improvement Act, 1976 (Act. No. 15 of 1976), the Genetically Modified Organisms Act, 1997 (Act 15 of 1997) (as amended), the Intellectual Property Rights from the Publicly Financed Research and Development Act, 2008 (Act No. 51 of 2008) (IPR Act) and the Patents Act, 1978 (Act No. 57 of 1978).

#### 1.2.5.1.1 National Environmental Management: Biodiversity, 2004 (Act No. 10 of 2004): the NEMBA

This Act provides for the management and conservation of South Africa's biodiversity; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; and the fair and equitable sharing of benefits from bioprospecting involving indigenous biological resources. Chapter 6 of the NEMBA, in particular, aims to: regulate bioprospecting involving indigenous biological resources; regulate the export from the Republic of indigenous biological resources for the purpose of bioprospecting and any other kind of research; and to provide for a fair and equitable sharing by stakeholders in benefits arising from bioprospecting involving indigenous biological resources. The Act also requires that any person engaging in bioprospecting involving any indigenous biological resources; or export from South Africa any indigenous biological resources for the purpose of bioprospecting or any kind of research needs a permit issued by the Department of Environmental Affairs to do so.

#### 1.2.5.1.2 Plant Breeders' Rights Act, 1976 (Act No.15 of 1976): PBR Act

In South Africa, breeders of new plant varieties are primarily afforded legal protection through plant breeders' rights in terms of the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976) (the Act). The Act provides for a system where plant breeders' rights are granted and registered and for the requirements which must be complied with for granting such rights. The Plant Breeders' Rights Act is currently being amended by the Department of Agriculture, Forestry and Fisheries.

#### 1.2.5.1.3 Plant Improvement Act, 1976 (Act. No. 15 of 1976): PIA

The Plant Improvement Act does not deal with intellectual property protection as such. The purpose of this Act is to regulate the recognition of varieties for entry in the National Varietal List, requirements relating to sale of plants and propagating material, and seed

certification among others. This Act is closely related to the Plant Breeders' Rights Act in that the same tests conducted for granting of a plant breeder's right are also conducted for the recognition of varieties for entry in the National Varietal Listing. For crops that are regulated both by the Plant Breeders' Rights Act and the Plant Improvement Act, applicants would send applications for the respective Acts at the same time. Like the Plant Breeders' Rights Act, the Plant Improvement Act is also being amended by the Department of Agriculture, Forestry and Fisheries.

#### 1.2.5.1.4 Genetically Modified Organisms Act, 1997 (Act No. 15 of 1997): GMO Act

The GMO Act is also administered by the Department of Agriculture, Forestry and Fisheries. The object of this act is to provide for measures to promote the responsible development, production, use and application of genetically modified organisms in South Africa; while limiting possible adverse impact on the environment, human and animal health.

#### 1.2.5.1.5 Intellectual Property Rights from the Publicly Financed Research and Development Act, (IPR Act) 2008 (Act No. 51 of 2008): IPR Act

The Department of Science and Technology, through the National Intellectual Property Management Office (NIPMO) administers the Intellectual Property Rights from the Publicly Financed Research and Development Act, 2008 (Act No. 51 of 2008) (IPR Act). The object of this Act is to ensure that intellectual property emanating from publicly financed research is identified, protected, utilized and commercialized for the benefit of the people of South Africa, whether it be social, economic, military or any other benefit. The IPR Act also makes provisions for, among others: the disclosure of intellectual property, the establishment of an office of technology transfer at institutions, the rights of intellectual property creators in institutions to benefit-sharing as well as acquisition of intellectual property rights by the State.

#### 1.2.5.1.6 Patents Act, 1978 (Act No. 57 of 1978)

In South Africa, the Patent Act, 1978 (Act No. 57 of 1978) excludes from patentability "any varieties of animals or plant or any essentially biological process for the production of animals or plants, not being a microbiological process or the product of such a process" (s. 25(4)(b). The Patents Amendments Act complements the NEMBA with the requirement for applicants of patents to lodge a statement disclosing whether or not an invention is directly derived from an indigenous biological or indigenous genetic resource, or is based on or derived from traditional knowledge or traditional use. The Plant Breeders' Rights Act does not have similar provisions. The breeder of a new variety however is required in a technical questionnaire that accompanies his application for protection, to provide information concerning the breeding history and genetic origin of the variety.

### 1.2.5.2 Draft National Policy on Intellectual Property, 2013

The Department of Trade and Industry published on 4 September 2013 an invitation for the public to comment on the National Policy on Intellectual Property (IP) in the Government Gazette. The purpose of this IP policy is 'to argue for the Policy to talk to other relevant national policies and international agreements that advance the aspirations of a developing nation and to co-ordinate the national and international approaches on various IP matters'. It also states that 'South Africa does not have an IP policy and, therefore, its approach to IP matters is fragmented and not informed by national policies. The lack of co-ordination also leads to the national approach being weakened on IP matters'. One of the objectives of the IP policy is to encourage a co-ordinated approach on IP matters by various government departments and other organs of state.

### 1.2.6 Policy Development

The issue of intellectual property rights arises in a number of areas within the agricultural sector. One of the key challenges for developing countries is to coordinate policy development in these areas so that they can take advantage of the benefits of IPRs while promoting their national interests (Fuavao, 2003). According to Tripp *et al.* (2007) policymakers in developing countries should view Plant Variety Protection as a tool to be adapted and used for achieving national agricultural development goals rather than an obligation imposed by industrialized countries. Meeting those goals requires an understanding of the circumstances of different classes of farmers, an analysis of the requirements of different types of commodities, and a capacity to target IPR regimes accordingly. It is the responsibility of policy makers to define the particular societal goals that IPRs in agriculture are meant to address and to develop appropriate legislation.

Cullet (2004) argues that the introduction of IPRs in agriculture raises specific concerns with regards to farmers' control over their resources and resources knowledge. In general, IPRs tend to facilitate control over seeds and related knowledge at the expense of small and subsistence farmers. This is linked in part to the royalties that farmers must pay to acquire protected seeds together with the associated restrictions on saving, replanting and selling saved seed. Dutfield (2008) further mentions that the current system of IPR protection for plants has raised concerns over their impact on food security in three areas, namely:

i) Plant Variety Protection and research priorities;

ii) the interests of poor farmers; and

iii) the availability of genetic resources for further breeding.

Among many fundamental issues for the future of human society, appropriate utilization of IP mechanisms in the agricultural sector has been widely discussed in relation to food security, economic development, biodiversity and the rights of traditional and indigenous communities (Jefferson *et al.*, 2014). In South Africa, concerns are also raised around intellectual property protection in agriculture. Some of the concerns raised include the

restrictions imposed on farmers in their practice of saving and exchanging seed, under development of indigenous crops, in particular ornamental plants, as well as the impact of possible 'dual protection' of Genetically Modified plant varieties.

The Department of Trade and Industry has published a draft National IP policy. One of the recommendations in the policy is that the PBR Act should be amended to allow farmers to reuse, resell and exchange seed in the spirit of the ITPGRFA and suit the South African conditions. This recommendation is a major shift from the current provisions of the PBR Act which do not allow farmers to reuse, resell and exchange seed. The Department of Agriculture, Forestry and Fisheries is currently reviewing the PBR Act and one of the key provisions identified for amendments in this legislation is the provision on the farmers' privilege. The two departments therefore need to liaise with one another in the spirit of the co-ordinated approach envisaged in the IP policy.

Internationally much is documented on the Plant Breeders' Rights system, however little is recorded on the Plant Breeders' Rights system in South Africa and how it affects or may affect farmers especially. Information on smallholder farmers' own experiences with regard to IPRs is scanty, particularly on the understanding of the South African PBR system by smallholder farmers from historically disadvantaged backgrounds. There are also no recent official statistics on the extent to which farm saved seed is utilized in South Africa, as well as on the trends of plant breeders' rights applications and plant breeders' rights granted for indigenous ornamental plants and genetically modified plant varieties. As cited in Wynberg *et al.* (2012a), any proposals to reform the South African legislative framework should be informed by the interests that are expressed by affected communities. In addition, the public's awareness of the reasons underlying intellectual property rules needs to be developed more effectively, so that the basis for a positive moral climate can be created.

## 1.3. Aim and Objectives

I have been Registrar: Plant Breeders' Rights since November 2007. Over the years I have interacted with several stakeholders with interest in plant breeders' rights, including: breeders, farmers, patent attorneys, growers, plant breeders' rights administrators from other countries and civil society organisations. Although South Africa has had Plant Breeders' Rights legislation since 1976, it has been observed that this piece of legislation is relatively unknown and often misunderstood by some stakeholders. There are views, among others, (a) that the plant breeders' rights system is only relevant and benefits breeders using modern breeding techniques which happen to be multinational companies such as Monsanto and farmers can never be recognised in such a system; (b) that the Plant Breeders' Rights Act is synonymous with genetically modified organisms; and (c) that indigenous ornamental plants are neglected as the system only promotes protection of foreign varieties. The most contentious issue is however around the impact of plant breeders' rights on the tradition of farmers to save, sell and exchange seed.

### 1.3.1 Aim

The overall aim of this study is to contribute towards using biodiversity in South Africa for the benefit of all of its people by examining the landscape of intellectual property protection, particularly plant breeders' rights in the agricultural sector, in order to make recommendations on some controversial issues to facilitate the development of policies by national government and policy makers.

### 1.3.2 Objectives

To achieve the aim, the following objectives were addressed:

a) To document the current South African legislation on plant breeder's rights with an analysis of some fundamental principles of the plant breeders' rights system.

b) To analyze international views and practices on the plant breeders' rights system in relation to seed crops, including the relationship with Farmers' Rights.
c) To conduct a survey on the experiences of various stakeholders on the application of the farmers' privilege provision in South Africa and on the understanding of legislation pertaining to plant breeders' rights, in particular the farmers' privilege concept, by the smallholder farmers from historically disadvantaged backgrounds.
d) To document the current legal framework on Genetically Modified Organisms (GMOs) in South Africa and to analyse intellectual property protection afforded to GMOs in South Africa and the extent of 'double protection' in terms of the Plant Breeders' Rights Act, 1976 and the Patents Act, 1978.
e) To analyse the South African floriculture industry with special emphasis on the participation of indigenous ornamental crops in the plant breeders' rights system.
f) To analyse intellectual property protection in relation to medicinal plants.
g) To make recommendations on future policy matters.

## 1.4 Scope and limitations of the study

This study is mainly concerned with the plant breeders' rights system in South Africa. This study does not aim to provide an exhaustive account and own opinions on moral arguments around intellectual property in agriculture and biosafety matters. In this study smallholder farmers include subsistence farmers.

## 1.5 Methodology

This study was based on original empirical research. The main methods of data collection involved: the analysis of information captured in the plant breeders' rights register maintained by the Registrar of Plant Breeders' Rights in South Africa; collection and assessment of published information and semi-structured interviews. Literature on international and national instruments pertaining to the subject is widely available in Libraries and the Internet. Information on National legislation and policies is available in

relevant government departments, e.g. Departments of Agriculture, Forestry and Fisheries; Environmental Affairs; Science and Technology; and Trade and Industry. Interviews were conducted with different stakeholders, e.g. smallholder farmers, to collect first-hand information. Questionnaires were used to collect information on certain aspects of the study where applicable.

## 1.6 Organisation of the study

The dissertation is organized into eight chapters. Chapter 2 outlines the current Plant Breeders' Rights legal framework in South Africa. Chapter 3 outlines the international perspective of farm-saved seed within the context of plant breeders' rights.

In Chapter 4, the aim was to determine the experiences of various stakeholders regarding the application of the farmers' privilege concept in South Africa and the understanding of this concept by smallholder farmers particularly from historically disadvantaged backgrounds.

Chapter 5 outlines the legal framework for Genetically Modified Organisms, and also provides an overview of intellectual property protection in genetically modified varieties. It includes an investigation of the trends in applications and grants of plant breeders' rights for genetically modified plant varieties in South Africa.

Chapter 6 gives an overview of the floriculture industry and investigates the trends in applications and grants of plant breeders' rights for plant varieties developed from plants indigenous to South Africa. In Chapter 7, the aim was to look into possible intellectual property protection systems as applied to medicinal plants, coupled with the discussions around Access and Benefit-Sharing.

Finally, a summary of results and recommendations are presented in Chapter 8.

# CHAPTER 2

## Plant Breeders' Rights in South Africa: An overview of the Legal Framework

### 2.1 Introduction

Plant Variety Protection (PVP) also known as Plant Breeder's Rights is a form of intellectual property afforded to breeders of newly bred plant varieties. The ultimate rationale for plant variety protection is the enhancement of food security through the provision of new improved varieties and improved availability of seeds through private sector channels (Cullet, 2003). A plant breeder's right is therefore an exclusive right, granted to the breeder of a new plant variety, to exploit his variety. The key objective of plant variety protection is to stimulate plant variety innovations (Thiele-Wittig and Claus, 2003).

The Commission on Intellectual Property (2002) raises the fact that until formal breeding programmes were introduced, varietal and cultural improvements depended on the success of selection and experimentation by farmers. Formal breeding programs have since utilized those varieties of higher productivity, or with desirable characteristics. The question is whether this contribution by farmers to conservation and innovation should either be protected or rewarded. According to Hiroko (2012) plant variety protection has become an important issue since the adoption of the TRIPS agreement on intellectual property rights in 1994. However it remains a novelty for all but a few African countries, and constitutes a significant departure from the customary practice based on the free sharing of knowledge.

### 2.2 The Plant Breeders' Rights (PBR) Act, 1976 (Act No.15 of 1976)

South Africa had a plant variety protection system well before the adoption of the TRIPS agreement. South Africa became a member of the International Union for the Protection of New Varieties of Plants (UPOV) in 1977 and is bound by the UPOV Act of 1978.

According to Barron & Couzens (2004), as a signatory to international conventions, South Africa is obliged to adhere to all of the obligations imposed in terms of its membership. It is to be noted, however, that a number of international agreements to which South Africa is a party, constitute 'soft' law. Direct consequences of South Africa's membership to international agreements are the development of policies, strategies, national action plans, and implementation plans. The Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976) gives effect to South Africa's obligations under the UPOV Convention. This Act provides for a system where plant breeders' rights are granted and registered and for the requirements which must be complied with for granting such right. Although South Africa is bound by the UPOV 1978 Act, the Plant Breeders' Rights Act was amended in 1996 and as such the current legislation is largely aligned to the UPOV 1991 Act.

### 2.2.1 Who can apply for a plant breeder's right

A plant breeder's right is granted to a breeder of a new plant variety. A breeder is defined in the Plant Breeder's Rights Act as**:**

*(a)* the person who bred, or discovered and developed, the variety;

*(b)* the employer of the person contemplated in paragraph *(a)*, if that person is an employee whose duties are such that the variety was bred, or discovered and developed, in the performance of those duties; or

*(c)* the successor in title of the person contemplated in paragraph *(a)* or the successor in title of the employer contemplated in paragraph *(b)*;

Interacting with stakeholders, mainly during meetings or workshops organized by civil society organizations, it was observed that some of the stakeholders interpret this definition to exclude private individuals and farmers. In their view, a 'breeder' means multi-national companies which use modern techniques to develop new varieties.

Contrary to this view, a breeder can include a farmer, private individual, multi-national companies, research institutions and universities, etc. In South Africa, all of these categories have applied for plant breeders' rights except for a farmer. It is suspected that this may be due to the lack of knowledge and understanding on how the plant breeders' rights systems work. In other countries, e.g. Kenya, a plant breeder's right for a *Strelitzia* variety has been awarded to a farmer-breeder (UPOV, 2005).

Another aspect is with regard to the requirement that the variety must be 'discovered and developed'. This means that discovery alone, e.g. a plant in the wild, would not qualify for a plant breeder's right. According to UPOV's explanatory notes on the definition of the breeder, adopted by UPOV Council in 2013, a 'discovery' might be the initial step in the process of breeding a new variety. However the term 'discovered and developed' means that a mere discovery or find would not entitle the person to obtain a plant breeder's right. Development of plant material into a variety is necessary for a breeder to be entitled to obtain a breeder's right.

### 2.2.2 Subject matter for protection

The Plant Breeders' Rights Act provides protection to plant varieties of prescribed genera and species. The South African Plant Breeders' Rights Act defines a variety as a 'plant grouping with a single botanical taxon of the lowest known classification, which grouping, irrespective of whether or not the conditions for the grant of a plant breeder's right are fully met, can be-

i. clearly defined by the expression of the characteristics resulting from a given genotype or combination of genotypes;

ii. distinguished from any other plant grouping by the expression of at least one of the said characteristics; and

iii. considered as a unit with regard to its suitability for being propagated unchanged'.

It has been observed, through interacting with stakeholders during workshops and meetings; and also through enquiries received by the office of the Registrar: Plant Breeders' Rights, that there is a misunderstanding among some stakeholders that only varieties that have been developed through genetic engineering are eligible for protection in terms of the Plant Breeders' Rights Act. Contrary to this belief, a variety may be developed through various means, including conventional breeding, selection from an existing variety or species, spontaneous mutation, induced mutation and be eligible for protection.

According to the Report of the Expert Panel on Breeding (2012), the panel's view of breeding is that, for the purposes of the Plant Breeders' Rights Act, eligible breeding methodologies include the same three fundamental steps:

*1. Amassing, or locating, plant material with sufficient variation (herein after referred to as the 'source population') to enable genetic variation to be identified. This variation could be: 'natural' variation (i.e. created without human interference such as spontaneous mutation); or could be 'man-made' variation (e.g. through genetic transformation, cross-pollination, induced mutations, etc).*

*2. Selection of a particular plant, or group of plants, having a set of 'desirable' characteristics from within the source population.*

*3. Propagation of the particular plant form (in preference to other plant forms in the source population) must occur, resulting in a change in the expression of one or more characteristics between the source population and the new variety. For a registrable new variety to be produced, this propagation would have to result in a variety that also met the criteria of distinctness, uniformity and stability, and of non-exploitation (i.e. meet the novelty requirements).*

In South Africa, protection is limited to those varieties of plants developed from plant genera and species that are prescribed in Table 1 of regulations to the PBR Act (Annexure 1). Although protection is limited to prescribed plant genera and species, the Minister is empowered to declare more plant genera and species for inclusion in the regulations. Any person who wishes to protect a plant variety of a taxon that is not prescribed must apply to the Registrar: Plant Breeders' Rights to have such a taxon included in the Regulations. It is apparent that it is important for countries to extend protection to all genera and species in order to receive full benefits of PVP (UPOV, 2005). The Plant Breeders' Rights Act, 1976 is currently under review. It is envisaged that South Africa will extend protection to all plant genera and species (occurring in South Africa and elsewhere) as this option has been included as one of the key amendments in the revision of the current PBR Act. It is worth mentioning that extending protection to the whole genus does not mean that all available varieties (cultivars) within that genus will be protected by plant breeders' rights and therefore subject to payment of royalties which is detrimental to smallholder farmers as is sometimes alleged. Only a certain percentage of varieties, within a genus, will be protected by plant breeders' rights and other varieties will still be freely available. Table 1 represents information obtained from the South African Varietal List. This is a list of varieties that are commercially available in South Africa. It is clearly shown that not all commercially available varieties have plant breeders' rights protection. For some varieties the plant breeders' rights period has expired, or a breeder has surrendered the plant breeder's right or some are varieties which did not conform with the novelty requirement for the granting of plant breeder's right, etc.

It has been argued that the plant breeders' rights system is tailor-made for genetically modified varieties. It is worth noting that in South Africa, currently only three Genetically Modified crops have been approved for commercial release under the Genetically Modified Act, 1997, namely: maize, soybean and cotton, each with a number of varieties granted plant breeders rights. Annexure 1 clearly the Plant Breeders' Rights Act caters for a wide range of crops, including ornamental plants, and that GM crops are in a minority.

**Table 1:** Number of protected varieties *versus* number of unprotected varieties in selected crops

| Crop | Total number of varieties listed in the National Varietal List | Total number of listed varieties with PBR | Total number of varieties without PBR |
|---|---|---|---|
| **Oats** | 22 | 10 | 12 |
| **Soybean** | 73 | 55 | 18 |
| **Wheat** | 98 | 74 | 24 |
| **Maize** | 599 | 326 | 273 |

Source: South African Varietal List, Dec 2013.

### 2.2.3 Requirements for protection

To be eligible for protection, plant varieties must be new, distinct, uniform and stable (DUS). A variety must also be afforded an acceptable variety denomination (unique name).

- To be new, the propagating or harvested material of a variety must not have been sold or otherwise been available, with the consent of the breeder, in South Africa for more than one year, and any other convention or agreement country for more than 6 years in the case of trees and vines, or in the case of any other plant, for more than 4 years, before the date of filing of the application for a plant breeder's right (novelty requirement),
- To be distinct, the variety must be clearly distinguishable from any other variety of the same kind of plant whose existence is a matter of common knowledge.
- To be considered uniform, the variety must be sufficiently uniform with regard to the characteristics of the variety in question, subject to variation that may be expected from the particular features of the propagation thereof.
- To be considered stable, the relevant characteristics of the variety remain unchanged after repeated propagation.

It has been argued that with the plant breeders' rights system, intellectual property protection is also granted for plants that grow in nature. It is confirmed that there have been cases where an applicant would apply for a plant variety growing from the wild. It is however important to note that a variety must be 'discovered **and** developed' to be eligible for protection in terms of the Plant Breeders' Rights Act, 1976. Plants growing in the wild are therefore not eligible for intellectual property protection, unless they have been developed and shown to conform with the requirements of Distinctness, Uniformity and Stability.

### 2.2.4 Distinctness, Uniformity and Stability (DUS) Testing

UPOV members use a range of approaches for DUS testing. In South Africa, the DUS test and trials are conducted by official examiners of DAFF. For most crops the test and trials are conducted on the premises of the department. For fruit crops, however, DUS test and trials are conducted at the property of the breeder, but these are also conducted by DAFF officials. In Brazil, for instance, DUS testing is conducted by the applicant or breeders themselves and they then submit the DUS report in conjunction with the application.

DUS test and trials are performed based on the UPOV Test Guidelines if available. The DUS Test generates a description of the variety, using its morphological characteristics, e.g. plant height, leaf shape, time of flowering, etc. UPOV TG1/3 (2002) gives a general introduction to the examination of Distinctness, Uniformity and Stability and the development of harmonized descriptions of new varieties of plants. In cases where no UPOV Test Guidelines are available for specific taxa, particularly for most of the indigenous species, National Test Guidelines are developed and used to assess DUS in candidate varieties. A Plant Breeders' Right is granted or refused based on these DUS test results. South Africa's legislation also allows the use of DUS test reports produced in other UPOV member countries and currently this is applies to *Chrysanthemum*, lucerne and potato.

### 2.2.5 Scope of a plant breeders' right

Under the Plant Breeders' Rights Act, the breeder of a new plant variety is granted an exclusive right to do or to licence the following acts in relation to the propagating material of the variety concerned:

a) production or reproduction (multiplication)

b) conditioning for the purposes of propagation

c) sale or any other form of marketing

d) exporting

e) importing

f) stocking for any of the purposes referred in (a) to (e) above.

A plant breeder's right is infringed by any person who performs or causes to perform any of the afore-mentioned acts without a licence obtained from the breeder. A well-reported case on infringement of a plant breeder's right in South Africa, is that of Keith Kirsten v Weltevreden Nursery. In this case a plant breeder's right was granted for a variety Canna Phasion in 1996. In 2001, Keith Kirsten sued the Weltevreden nursery for marketing this variety internationally under the name Canna Tropicanna. The Weltevreden Nursery argued that the variety concerned was neither 'new' nor 'distinct' as contemplated in the Act. The High Court ruled against Weltevreden nursery ordering that they pay a sum of R10 000 for damages in accordance to the Act. The Supreme Court of appeal however overturned the High Court's decision and ordered that the plant breeder's right for Canna Phasion be terminated, mainly because Keith Kirsten could not be considered as the breeder and the variety in question was neither new nor distinct [Weltevrede Nursery (Pty) Ltd v Keith Kirsten (Pty) Ltd and Another (515/2002) [2003] ZASCA 136; [2004] 1 All SA 181 (SCA) (28 November 2003)].

### 2.2.6 Exceptions to the Plant Breeder's Right

The Act provides that a person who procured any propagating material of a variety in a legitimate manner does not infringe the plant breeders' rights in respect of the variety for the following acts:

a) reselling that propagating material
b) acts done privately and for non-commercial purposes
c) acts done for bona fide research
d) acts done for the purposes of developing a new variety
e) a farmer who uses harvested material obtained from propagating material for purposes of propagation on land occupied by him or her.

Exceptions in (a) and (e) above are a bone of contention among various stakeholders. Re-selling plant propagation seems to be in contradiction with the provision that requires any person to 'undertake sale or any form of marketing' to do so by the way of licence granted by the holder of a plant breeder's right, which results in infringement of that plant breeder's right. The exception in (e) is discussed in detail under Chapters 3 and 4.

### 2.2.7 Periods of protection

The minimum period of protection is 25 years for trees and vines and 20 years for other crops. South Africa has a unique situation where breeders are afforded a "sole right period" of between five and eight years. During the sole right period the breeder has an option of issuing or not issuing licences for their protected varieties; compulsory licence may therefore not be issued during this period. The rationale behind the sole right period was to allow the breeder to have a period to use the variety exclusively, in order to recoup investment made in developing a new plant variety if he so wished.

### 2.2.8 The Registrar

The Registrar is an official designated by the Minister of Agriculture, Forestry and Fisheries (the Minister) who is an authority to whom the protection of varieties is entrusted. Decisions relating to the granting and refusal of plant breeders' rights are taken by the Registrar. The Registrar also has an obligation to maintain the South African plant breeders' rights register as well as to publish all prescribed matters in terms of the Act.

When an application is received, the Registrar checks if the application concerned complies with the provisions of the Act; that the application forms have been completely filled in, the relevant fees have been paid and that the variety in question is still within the novelty period. If everything is in order, the technical examination is arranged through one of the three national evaluation centers. All matters relating to application and grants of plant breeders' rights are published quarterly in the national Government Gazette and in the Plant Variety Journal posted on the department's website.

### 2.2.9 The Appeal Board

Any person who feels aggrieved by any decision or action taken by the Registrar may appeal to the Minister against the decision or action in question. The Minister shall refer the appeal for investigation and decision to an appeal board. The appeal board, appointed by the Minister, would consist of one person designated as chairperson on account of his knowledge of law and two persons who in the opinion of the Minister have expert knowledge of the subject of the appeal. The appeal board may confirm, set aside or vary the relevant decision of the Registrar.

## 2.3 General trends in applications and grants of plant breeders' rights

An average of 300 applications for plant breeders' rights are received annually. The applicants include both foreign and local nationals, from individuals, universities and research institutions to local and multinational companies. A total of 2 607 varieties had valid plant breeders' rights as of December 2013. The majority of these, 34%, were of ornamental crops, 34% were for agricultural crops, 23% were of fruit crops and 9% were of vegetable crops. About 60% of these valid plant breeders' rights belong to foreign nationals, and 40% to locals. The majority of the local plant breeders' rights belong to the Agricultural Research Council (ARC). Although the overall picture shows that the majority of plant breeders' rights belong to foreign officials, this is due to a high number in respect of ornamental crops, where about 85% of plant breeders' rights are owned by foreign nationals. In other categories such as the fruit crops and agricultural crops, local ownership is slightly higher than foreign ownership at around 57% and 55% respectively.

## 2.4 Amendments to the Plant Breeders' Rights (PBR) Act

The PBR Act was first amended in 1996. With these amendments, provisions from the UPOV 1991 Act, for an example definition of a variety, provisions on Essentially Derived Varieties, etc. were included and as such, although South Africa is bound by the UPOV 1978 Act, key provisions in the PBR Act are aligned to the UPOV 1991 Act.

The PBR Act is currently being reviewed and some of the relevant proposed amendments are discussed in this study.

## 2.5 Conclusions

Although legislation on plant breeders' rights has existed in South Africa for close to forty years, there are still some misunderstandings on the fundamental principles of the plant breeder's rights system. Also, there are sections of our agricultural communities who have

no knowledge of the existence of this legislation although it may have an impact on them. The administrators of this legislation need to develop a guidance document for the users of the system and also embark on a country-wide awareness programme on intellectual property protection of new plant varieties.

The next chapter discusses plant breeders' rights in relation to seed crops, in particular their effect on farmers' rights.

# CHAPTER 3

## Plant Breeders' Rights in Seed Crops

### 3.1 Introduction

In developing countries, agriculture remains the main source of livelihood for between 50 and 90% of the population. Of this percentage, smallholder farmers make up the majority, i.e. 70% to 90%. Most of these farmers depend on an informal seed supply system, i.e. they save, exchange, re-use and sell seeds informally in close connection with their neighbours and local people (Adhikari, 2004) and annual purchase of new seed is relatively rare. Van Wijk (1996) lists three options farmers have for acquiring seed:

a. to obtain quality seed each season from public institutes, seed companies or dealers;

b. to save part of their own harvest as seed; and

c. to trade part of their harvest for seed from grain dealers

Self-pollinating crops, such as wheat and soya bean, or vegetative crops such as potatoes and cassava offer the best opportunities for seed saving (Commission on Intellectual Property, 2002). The saved seed could either be used as a source of food in the form of grain for humans and livestock or as a source of starting material for next year's crop. In addition this seed was also a commodity because it could be traded for other goods or sold for cash (Blair, 1999). This is a practice which is still very widespread amongst poor farmers in developing countries, and is still common even in developed countries (Commission on Intellectual Property, 2002).

The first introduction of hybrid corn varieties in 1926 began to change the face of the seed industry from the small company and farmer seedsmen to hybrid seed producing companies that provided the farmers with superior hybrids in quantities. The early seedsmen had to protect their efforts to develop superior seeds as best they could

because there was no intellectual property protection prior to 1970. Since 1970, there has been a steady effort to improve the intellectual property protection for sexually-produced seeds to provide incentive for private breeding research, with the ultimate goal of better seed cultivars and varieties for the farmer (Blair, 1999).

### 3.2 Farmers' Rights

Article 9 of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (the Treaty) provides that each Contracting Party should, as appropriate and subject to its national legislation, take measures to protect and promote Farmers' Rights including:

a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
b) the right to equitably practice in sharing benefits arising from the utilization of plant genetic resources; and
c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

Article 9 also recognizes the rights of farmers to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate.

According to Blakeley (2011a), the concept of Farmers' Rights was developed as a "counterbalance to intellectual property rights". Farmers' rights are in tension with IPRs for plant breeders because many farmers and farming communities do not claim exclusive rights in the cultivated landraces (also known as traditional cultivars) and plant varieties they have cultivated over time. Moreover, the subject matter requirements for protection are designed to protect innovations in new and clearly distinguishable plant varieties, and often cannot accommodate contributions of individual farmers using more

informal methods to select for better or sought-after plant characteristics (Dutfield, 2008).

Landraces form a major component of of farmers' plant genetic resources included in genebank collections, and this material provides the backbone of agriculture and plant breeding today (Salaza et al., 2007). In South Africa, the Department of Agriculture, Forestry and Fisheries, is responsible for the conservation and sustainable utilization of Plant Genetic Resources for Food and Agriculture. The maintenance of the existing gene pool is managed by the National Plant Genetic Resources Centre (NPGRC) and is achieved through, among others, the collection, characterization and evaluation of these genetic resources. Currently, approximately 6 500 landraces and wild relative accessions with full passport data are conserved at the NPGRC. The majority of these accessions belong to cucurbits (18.5%), beans, cowpea, bambara (16.2%), maize (15%) and sorghum (5%). Kuyek (2002) argues that farmers' rights embody the rights of farmers and farming communities to conserve, develop, use, control, and benefit from not only local biodiversity but also rural peoples' knowledge systems and technologies. These rights, which cannot be protected by IPRs, form the basis of sustainable agriculture and recognize the importance of farmer innovation to global food and security and well being.

Over the last two decades commentators on the Plant Variety Protection (PVP) system have begun to question its relevance, raising the possibility that it might have become "the Neanderthal of intellectual property systems". At a more fundamental level it is observed that PVP focusing upon a phenotypic paradigm, based upon "characteristics" and "features", has become outmoded as plant breeding moves towards a genotypic approach (Blakeney, 2011a). According to Duttfield (2002) a concern has been raised that the UPOV system was drawn up mainly by European countries, and is designed to accommodate the specific characteristics of the capital intensive large-scale commercial agricultural systems that generally prevail on that continent. The requirement for uniformity (and stability) in UPOV type systems excludes local varieties developed by farmers that are heterogeneous genetically, and less stable. But these characteristics

are those that make them more adaptable and suited to agro-ecological environments in which the majority of poor farmers live. Also, there is a concern that the criterion of uniformity is that this requirement, and the certification of essentially similar varieties of crops, will add to uniformity of crops and loss of biodiversity (Commission on Intellectual Property, 2002).

Advocates of farmers' rights have developed different approaches to address this situation and to reward farmers for their contributions to plant genetic diversity. One of the approaches involves situating the traditional practices of farmers as exceptions to the exclusive rights of plant breeders under existing IPR laws. In other words, breeders are precluded from demanding payment from farmers who engage in certain farming practices such as saving seeds and planting seed saved from prior purchases, or informally exchanging seed (Dutfield, 2008). Usually exempted from plant variety rights is seed saved by a farmer from harvested material and treated for the purpose of sowing a crop on the farmer's own land (Blakeney, 2011a). This practice is commonly referred to as the farmers' privilege. The farmer's privilege provides the farmer with some exemptions to Intellectual Property Rights (IPRs), ranging from the right to save seed for his or her own use to the right to exchange or sell seed, depending on the national law (The World Bank, 2006).

It is estimated that African farmers depend on seeds cultivated within their communities for as much as 90% of their seed needs. According to an IPR expert Andrew Mushita, *'all resources belong to everyone and they are regulated by the community's cultural and local knowledge systems and practices. In this sense, farmers have exchanged seeds among themselves since time immemorial, passing from neighbour to neighbour, mother to daughter, mother-in-law to daughter-in-law, or even across villages and communities'* (Kuyek, 2002).

Farmer seed saving is one of the most contentious issues related to plant variety protection, is very sensitive and has political implications (Le Buanec, 2006). For a long time, both in Europe and the United States seed-saving has become one of the most hotly disputed aspects of IPR in agriculture (van Wijk, 1996). According to Cullet (2004)

the introduction of IPRs in agriculture raises specific concerns with regard to farmers' control over their resources and knowledge. In general, IPRs tend to facilitate control over seeds and related knowledge by agribusinesses at the expense of small and subsistence farmers. This is linked in part to the royalties that farmers must pay to acquire protected seeds together with the associated restrictions on saving, replanting and selling saved seeds. According to GRAIN (2003) the seed industry is a hot issue because the seed industry wants to control who produces seed and is working hard to secure legal systems that restrict seed saving by the farmers.

The issue of seed saving is a good example of how IPRs in plant breeding must be tailored to the conditions of national seed systems. The design of a suitable PVP regime will necessarily represent a dialogue and a series of compromises among various stakeholders, including the commercial seed industry, public agricultural research, and farmers. To be effective, the PVP system must elicit broad-based support, implying that the formulation of supporting legislation and regulations should be the product of open public debate (The World Bank, 2006).

### 3.3 The UPOV Convention and the Farmers' Privilege

There is no reference in the UPOV 1978 version to the right of farmers to re-sow seed harvested from protected varieties for their own use. The Convention establishes minimum standards such that the breeder's prior authorization is required for at least three acts, namely the production for purposes of commercial marketing; the offering for sale; and the marketing of the reproductive or vegetative propagating material, as such, of the variety. Thus, countries that are members of the 1978 Convention are free to either uphold farmers' privilege or eliminate it (Dutfield, 2008). The 1978 Act therefore implicitly allowed farmers to replant and exchange the seed (although this is not spelled out) (Commission on Intellectual Property, 2002). All UPOV member countries implemented the exemption for 'private and non-commercial use' under the UPOV Act of 1978 to include the re-sowing and in some cases the local exchange or sale of seed (Dutfield, 2008).

With the UPOV Convention of 1991, the provision on "farmer's privilege" is an optional benefit-sharing mechanism provided by the UPOV Convention, under which UPOV members may permit farmers, on their own farms, to use part of their harvest of a protected variety for the planting of a further crop. Article 15 of the UPOV Convention of 1991 provides for exceptions to the Breeder's Right as follows:

*Article 15*

*Exceptions to the Breeder's Right*

*(1) [Compulsory exceptions] The breeder's right shall not extend to*

*(i) acts done privately and for non-commercial purposes,*

*(ii) acts done for experimental purposes and*

*(iii) acts done for the purposes of breeding other varieties, and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to Article 14(4) in respect of such other varieties.*

*(2) [Optional exception] Notwithstanding Article 14, each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder's right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the protected variety or a variety covered by Article 14(5)(a)(i) or Arcticle 14(5)(a)(ii).*

Under this provision, members of UPOV are able to adopt solutions which are specifically adapted to their agricultural circumstances. However, this provision is subject to reasonable limits and requires that the legitimate interests of the breeder are safeguarded to ensure that there is a continued incentive for the development of new varieties of plants for the benefit of society. For example, certain members of UPOV apply the provision on farm-saved seed only to certain species or limit its application using criteria such as the size of the farmer's holding or the level of production (UPOV, 2003). This provision is a far cry from 'farmers' rights' as envisaged in the FAO International Undertaking of which farmers' rights mean 'rights arising from the past,

present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centers of origin/diversity (Narasimhan, 2008).

Although the UPOV 1991 Act allows farmers to reuse their own crop for seed purposes on their own holdings, it does not allow for informal sale or exchange (Commission on Intellectual Property, 2002). According to Thiele-Wittig & Clause (2003) the experience in the UPOV system has shown that plant variety protection increases the number of breeders, and consequently widens the spectrum of improved varieties available to farmers, with potential to increase genetic variability. A result of the fact that new varieties offer substantial advantages to farmers is that farmers may choose to stop growing their existing varieties or land races in favour of new varieties, whether or not such new varieties are protected by plant breeders' rights.

As stated above, the Treaty recognizes the rights of farmers to save, use, exchange and sell farm-saved seed/propagating material subject to national law and as appropriate. A question is often raised as to whether the UPOV system can co-exist with the Treaty. According to Jördens (2005), the provision on "farm saved seed" is an optional benefit-sharing mechanism provided by the UPOV Convention, under which members may permit farmers, on their own farms, to use part of their harvest of a protected variety for the planting of further crops within reasonable limits while safeguarding the legitimate interests of the breeder. He further concludes that the Treaty can be implemented in harmony with the UPOV Convention.

### 3.4 Alternatives to UPOV

The Genebank Campaign, along with other civil society organizations, believes that UPOV does not provide conditions favorable to developing countries. The interests of developing countries are not served by UPOV, which is completely insensitive to their needs. In understanding the UPOV system, it is crucial to understand that right from

1961, even when it was more flexible that it is today, UPOV granted only one right, the right to the Plant Breeder. There was never any concept of Farmers' Rights (Sahai, 2003). This view is also shared by civil society organizations from the SADC region as evident in a petition submitted to the SADC secretariat, condemning the SADC draft Protocol for the Protection of New Varieties of Plants (Plant Breeders' Rights). According to the groups, the Protocol is modeled after the 1991 UPOV Convention, an instrument that was developed by industrialized countries to address their own needs. UPOV 1991 grants extremely strong intellectual property right protection to plant breeders, and disallows farmers from continuing their customary practices of freely using, exchanging and selling farm-saved seed (AcBio, 2013)

The laws that have been hailed as progressive in recognizing Farmers' Rights to some extent, include India's Plant Variety Protection and Farmers' Rights Act of 2001 and the model law drafted by the Organization of African Unity (OAU), now African Union. A unique feature of the Indian Law is that it gives protection of rights to the breeders, to the farmers and to the researcher. This law also provides for the disclosure of origin. The Indian government has incorporated in its PVP legislation a clause that states:

"*a farmer shall be deemed to be entitled to save, use, sow, re-sow, exchange, share or sell his farm produce including seed of variety protected under this Act in the same manner as he was entitled to before the coming into force of this Act: Provided that the farmer shall not be entitled to sell branded seed of a variety protected under this Act".*

According to Sahai (2003) apart from a well defined breeders' right, it has strong and proactive farmers' rights. In fact the Indian legislation succeeds in balancing the rights of Breeders and Farmers and exploits the flexibility granted in TRIPS, in an intelligent manner. Another noticeable feature of the Indian Law is its disclosure requirement. This puts the breeder under an obligation to disclose the information regarding the use of any genetic material conserved by any tribal or rural families that the breeder used in developing the new variety. Failure to disclose such information will result in the rejection of the registration of the application (QUNO, 2014).

The OAU model legislation law provides for the protection of rights of local communities, farmers and breeders, and also for the regulation of access to biological resources. Section 26 of the OAU model law gives farmers a right to:

a) *the protection of their traditional knowledge relevant to plant and animal genetic resources;*

b) *obtain an equitable share of benefits arising from the use of plant and animal genetic resources;*

c) *participate in making decisions, including at the national level, on matters related to the conservation and sustainable use of genetic resources;*

d) *save, use, exchange and sell farm-saved/propagating material of farmers' varieties;*

e) *use a new breeders' variety protected under this law to develop farmers' varieties, including material obtained under genebanks or plant genetic resource centres; and*

f) *collectively save, use, multiply and process farm-saved seed of protected varieties.*

Farmers are however prohibited from selling farm-saved seed/propagating material of a breeders' protected variety in the seed industry (Ekpere, 2001).

De Jonge (2014) discusses other legal avenues to incorporate farming practices of smallholder farmers in a UPOV 1991 based PVP systems, including examples from the Phillipines, Malaysia, Zambia and Ethiopia.

### 3.5 Experiences in other countries

In Latin America, farmers' privilege has been included where PVP has been introduced but the large scale use of the exemption is controversial. In Argentina, as in Europe, on-farm seed-saving is only permitted for the purposes of replanting. The Argentinean PVP authority attached specific conditions from PVP in order to reduce commercial trade in saved seed (van Wijk, 1996). These conditions are as follows:

i) seed that is propagated must have been legally acquired;

ii) the seed must have been produced on the farmer's land;

iii) the farmer must replant the saved seed on his own land;

iv) the farmer must prove that the transport of saved seed to any other place is for preparation purposes only.

In Kenya, while there is no explicit exemption for farmer seed saving/exchange, this might be *de facto* permissible as these transactions are considered private and non-commercial (Rangneker, 2013). Although there is considerable farmer-to-farmer sale and exchange of seed, this activity is illegal for any major field crops (whether it is subject to PVP or not) because of Kenya's strict seed certification requirements (The World Bank, 2006).

In Europe, the EC Regulation 2100/94 on Community Plant Variety Rights, which was adopted in 1994, restricts farmers' privilege to certain crops, and breeders must be remunerated through the payment of royalties unless the users of farmers' privilege are smallholder farmers, in which case they are exempted (Dutfield, 2008).

In the US, this exception was expanded to allow limited sale of harvested crops for seed purposes to other farmers (Commission on Intellectual Property, 2002). Statutory provisions in the USA allow farmers to sell saved seeds, with the proviso that the variety name is not used in the sale, hence the term 'brown bagging' (Rangneker, 2013).

China's PVP legislation provides a broad farmer's privilege for saving and reusing one's own seed, which is seen as important in a country dominated by smallholder farmers. The degree to which farmers can sell or provide seed of protected varieties to others is not well defined, and there is a great deal of informal trade in certain varieties (The World Bank, 2006).

### 3.6 Restrictions on seed saving

A major reason that PVP does not elicit greater investment in commercial seed production for Open Pollinated Varieties (OPVs) is the problem of limiting farmers' seed saving and exchange (Tripps *et al.*, 2007). UPOV 1991 offers a solution to this problem by prohibiting seed saving of the protected seed (except for specifically designated crops) and eliminating the possibility of seed exchange. However, for most farming systems in most developing countries such restrictions would be politically explosive and impossible to enforce among farmers who are used to saving seed or obtaining it from their neighbors.

Breeders utilize other methods to restrict unauthorized multiplication and trade in their varieties by, amongst others: breeding of hybrids, patents, and purchase agreements.

a) Hybrids

One of the characteristics of hybrids is that they do not breed true to type, making them unattractive for seed saving (van Wijk, 1996). Crops such as commercial hybrid maize cannot be reused if hybrid yield and vigour are to be maintained. This characteristic of hybrids confers a natural form of protection by which seed companies can more readily capture a return on their investment (Commission on Intellectual Property, 2002). Seed saved from a hybrid crop does not yield nearly as high as the initial hybrid crop. Breeders of hybrid crops have an effective non-legal protection against replanting by farmers (Wright, 2006).

b) Patents

Patents are the strongest form of intellectual property protection in the sense that they normally allow the right holder to exert the greatest control over the use of patented material by limiting the rights of farmers to sell, or reuse seed they have grown, or other breeders to use the seed (or patented intermediate technologies) for further research and breeding purposes (Commission on Intellectual Property, 2002).

A number of governments in the industrialized world, including US, Japan, Australia, Sweden and UK permit plant breeders to obtain patent protection in new varieties provided that the eligibility requirements for a patent have been met (Parvin, 2009). However national laws governing the patentability of plants vary significantly among countries. Plant patents provide additional protection to inventors and innovators in addition to those UPOV in that plant patents do not provide for either a research exemption or farmers privilege (Ministero dello Sviluppo Economico & WIPO, 2015). Under the US utility patent law, for an example, neither a farmer's exemption nor a research exemption is available for material protected under this law (Kloppenburg, 2014). Then & Tippe (2014) provides case studies on recently granted patents on plants in Europe.

c) Purchase agreements

Rather than rely on PVP, a number of American seed companies make contract provisions which enable the company to use breach of contract claims in local courts to enforce ownership of seeds (van Wijk, 1996). Some contracts are aimed primarily at preventing seed saving and multiplication. The breeder can oblige a grower to use the plant variety in certain ways and can impose restrictions on the saving or multiplication of planting material (The World Bank, 2006).

According to Kuyek (2002) and Blair (1999) in the US and Canada, contractual agreements between seed companies and farmers are standard practice. Monsanto's Roundup Ready® Technology Agreement is the most widely known and enforced example. This agreement obligates the purchasing farmer to a one time use and gives

Monsanto the right to inspect farmer fields for the next three years –in other words the farmer cannot save the seeds to plant the next year's crop. According to the Agreement, the farmer:

i. Cannot save seed or any other part of the crop grown from the Monsanto seed for replanting

ii. Is prohibited from supplying to any other person

iii. Must pay 120 times the technology fee plus the legal fees if he or she is caught violating the agreement

iv. Must cooperate fully with Monsanto's inspections of his or her fields

According to Jacobson & Myhr (2012) large-scale commercial farmers in South Africa sign a technical agreement with Monsanto when buying Bt maize, agreeing to plant refugia and not to pass on seeds to a third party. Farmers not following the regulations stated in the technical agreement, could in theory be prosecuted,

d) Patented genetic use restriction technologies (GURTs)

Modern biotechnology has begun to offer even more effective means of controlling the use of Genetically Modified Organisms (GMOs) –Genetic Use Restriction Technologies (GURTs) (Kerle, 2007). GURTs are interventions which use specific genetic switch mechanisms to limit the use of genetic material for agricultural purposes. GURTS are made by inserting additional genetic material into the germplasm of plants. Before sale, genetically modified seeds are treated with special chemicals which render the seeds of the second generation infertile. As a result farmers cannot re-use seeds and breeders cannot utilize them in breeding programmes (Blakeney, 2011b). Fisher (2002) and Srinivasan & Thirtle (2002) discuss in depth the impact of terminator technologies in developing countries, also stating that with these technologies farmers cannot, by saving seed generated by those plants, produce additional crops in future years; they have to buy fresh seeds from the seed companies every year. Lombardo (2014) recalls the first session of the FAO Panel of Eminent Experts in Food and Agriculture where it

was unanimously stated that 'terminator seeds' are generally unethical, as it is deemed unacceptable to market seed whose offspring a farmer cannot use again because the seeds do not germinate. It is further stated that it is difficult to predict the development of GURTs in the near future because they seem still to be very far from commercialization. Several GURTs have been patented but none has been put into practice because of strong opposition.

## 3.7 Conclusions

The recognition of Farmers' Rights is one major issue that is often raised in debates around intellectual property protection of plant varieties especially the rights of farmers to save, exchange and sell seed. Different countries employ different ways to address this issue. The UPOV system is heavily criticized and there are cries, mainly from civil society organizations, for developing countries to explore *sui generis* (of its own kind) means as alternatives to the UPOV system with the Indian Law hailed as the most progressive *sui generis* system. Upon probing the possibility of an alternative system, suggestions on how such a system could be established and implemented in South Africa are wanting. For example, with regard to calls for the registration of farmer varieties, it is not clear what criteria would be used for such varieties to be eligible for registration and to whom would registration rights be granted. Also, one of the unique features of the Indian Law is the provision for equitable sharing of the benefits between breeders and the farming communities.

In South Africa, for instance, matters around equitable sharing of benefits are not addressed in legislation dealing with plant breeders' rights but in the Biodiversity Act. Some issues that could be addressed are: should legislation dealing with plant breeders' rights also address Farmers' Rights as envisaged in section 9 of the International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty)? Is the plant breeders' rights legislation an appropriate tool to implement farmers' rights as envisaged in the Treaty?

To minimize debates and uncertainties around the effects of plant breeders' rights on farmers' rights, governments, policy makers as well as civil society organizations must be wary of relying heavily on situations in other countries and rather do an in-depth analysis of situations in their own countries in order to be able to address issues around farmers' rights and intellectual property protection in consultation with farmers and breeders alike.

Consequently, the next chapter discusses the understanding of the farmers' privilege concept by small holder farmers in South Africa.

# CHAPTER 4

## The Farmers' Privilege Concept: A South African Perspective

### 4.1 Introduction

Smallholder agriculture is a core contributor to agricultural production in most African countries and the main driver for food security, poverty reduction and growth. But productivity remains desperately low with limited use of improved inputs (except where boosted by subsidies –compounded by volatility in climate and markets (FAC CAADP Policy Brief, 2011). In South Africa, smallholder farmers number approximately 225 000 as of 2010, belonging to about 150 000 households, and are predominantly black (Integrated Growth and Development Plan, 2012).

In South Africa, the farmers' privilege is provided for in section 23 of the Plant Breeders' Right Act, 1976. This section stipulates that

> *"a farmer who on land occupied by him or her uses harvested material obtained on such land from that propagating material for purposes of propagation: Provided that harvested material obtained from replanted propagating material shall not be used for purposes of propagation by any other person other than that farmer"*.

This section was inserted in the Plant Breeders Rights Amendment Act, 1996 and is modeled around Article 15 of the UPOV 1991 Act. This provision excludes exchange of seed of protected varieties. UPOV recommends that where it is decided that a farmer's privilege would be appropriate, there are various factors that might be considered in relation to reasonable limits and safeguarding of the legitimate interests of the breeder. These factors might include the size of the holding/crop area, the proportion or amount of harvested crop, etc. Currently, no such factors are considered in the South African Plant Breeders' Rights Act and it is not clarified how the legitimate interests of the breeder would be recognized.

In view of the above, it became apparent that the farmers' privilege in its current form under the Plant Breeders' Rights Act needs to be reviewed. The other factors that strengthened this view have been included in the Plant Breeders' Rights policy document published by the Department of Agriculture, Forestry and Fisheries in 2012. These factors are summarized as follows:

- *The section on farmers' privilege could be open to abuse, because "farmer" does not exclude commercial farming operations. Commercial farmers have used the farmer's privilege clause to the detriment of plant breeders, leading to the collapse of some breeding programs, e.g. groundnuts and placing the sustainability of others under threat, e.g. wheat.*
- *Breeders use one-sided contracts which prohibit the use of their material for farm saved seed. Clauses pertained in these sales agreements are sometimes in contradiction to the provisions of the Act.*
- *The Act should clarify that the farmers' privilege must only apply to seed crops and not apply to vegetatively reproduced ornamental and fruit varieties. Any application of farmers' privilege to vegetatively reproduced ornamental and fruit varieties leaves its breeders without effective protection.*

In the PBR policy, the DAFF has undertaken to develop norms and standards with regard to the application of the Farmers' Privilege in South Africa. The norms and standards would then inform the policy makers on what amendments would be needed to make the current farmers' privilege provision more equitable for both the breeders and the farmers. It was however evident that not enough information is available to develop such norms and standards. In this chapter, an investigation on the implementation of the farmers' privilege concept in South Africa was conducted.

## 4.2 Methodology

An invitation for the public to submit comments on their experiences with regard to the application of farmers' privilege in South Africa was published on DAFF's website. Inputs were received mainly from the formal sector (e.g. industry, commodity groups, patent attorneys). Upon observation that inputs received were mainly from the formal sector, we conducted workshops for historically disadvantaged smallholder farmers or their representatives. The sampling technique involved a one stage convenience sampling of smallholder farmers from the following provinces: Eastern Cape Province, Free State Province, Limpopo Province and the Western Cape Province. The participants for the workshops were mainly invited through the extension officers working for Provincial Departments of Agriculture except for the Western Cape where the participants were organized by Civil Society Organizations with interests of smallholder farmers.

During these workshops, I gave presentations on the plant breeders' rights system and farmers' privilege and conducted discussions on the practice of saving seed. The presentations and discussions were translated from English to the local languages, isiXhosa, Afrikaans, SePedi, Tshivenda and Sotho depending on the province. Questionnaires with basic questions on the Plant Breeders' Rights Act and the farmers' practices on saving seed were also distributed to all participants. Questions most relevant to this study are depicted in Annexure 2. The participants were assisted by the extension officers, with whom they had build relationships over time, and officials from the Department of Agriculture, Forestry and Fisheries, who explained the questions in the participants' languages, and helped the participants in completing the questionnaires. Respondents were encouraged to share their first-hand experiences on their farming practices. Simple statistical analysis involving the use of mean and percentages to analyse data and presented graphically.

## 4.3 Results

### a) Comments received from the formal sector

Comments, from the open public invitation on the DAFF website, were received from several stakeholders ranging from breeder organizations, research institutions and commercial farmers.

Some of the issues raised are highlighted below:

POSITIVES:

i) Farm saved seed has grown over the past decade because of the economic realities and cost related to seed production.

ii) The quality of farm saved seed in general has improved and contributes to the quality of production.

iii) Farmers should be able to use their own harvested material and farmers' privilege should not be taken away from them.

NEGATIVES:

i) The Plant Breeders' Rights Act, 1976 does not consider that the Farmers' Privilege was intended for certain crops and should be implemented "within reasonable limits".

ii) The drafting of the current Farmers' Privilege limits revenue generation and recoupment of research costs from commercial seed sales.

iii) It is difficult to determine what the definition of a "farm" is as many farming enterprises farm on many title deeds and even in different provinces under the same name.

iv) There has been a significant rise in the volume of retained grain that is planted as seed annually, and consequently the level of commercial seed sold in South Africa continues a downward trend.

## b) Comments received from historically disadvantaged smallholder farmers

### i) Discussions on saving seed

During the discussions with the participants, it was evident that farmers' opinions differed with regard to the practice of saving seed. Some farmers were in favour of seed saving while others were against the practice of saving seed. The following arguments were put forward:

*For saving seed*

- Saving, sharing and exchange of seeds are ancient practices within communities and this must be allowed in the PBR legislation.
- Selling of protected seed by smallholder farmers should be allowed (for surplus seed).

*Against saving seed*:

- Saving of seed should not be allowed as it compromises the quality of seed.

### ii) Results from Questionnaires:

a) The number of participants

A total number of 187 farmers/farmer representatives participated in this study, with 40% from the Free State province; 26% from Limpopo province, 23% from the Western Cape province and 11% from the Eastern Cape province.

b) Size of land under cultivation

The area under cultivation ranges from one to five hectares with the tenure ranging from communal, leased or self-owned land.

c) Familiarity with the PBR Act

The respondents differed in their familiarity with the PBR Act (Figure 1) As expected, only a low percentage varying from 10% in the Eastern Cape province to 29% in the Western Cape province was familiar with the Act.

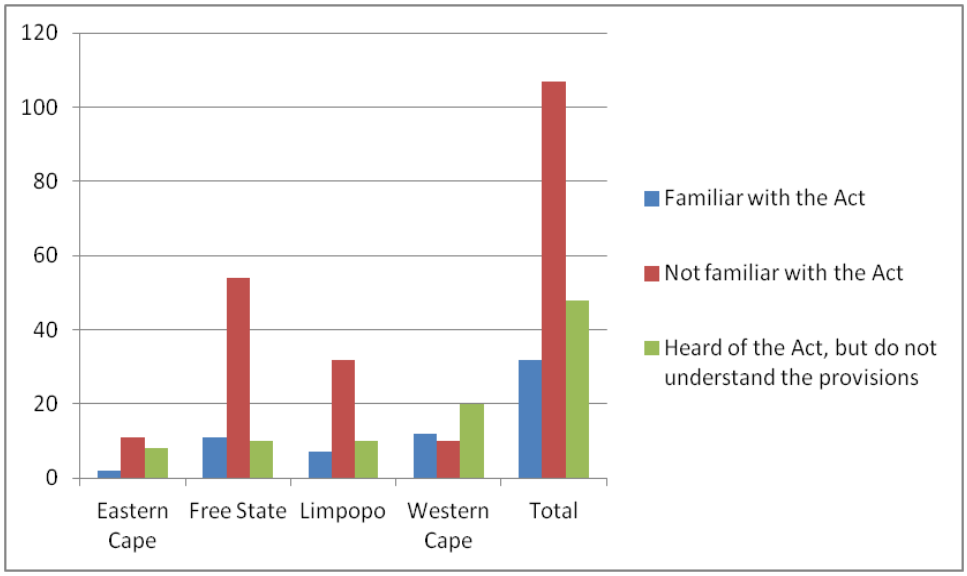


**Figure 1:** Familiarity among participants from different provinces with the Plant Breeders' Rights Act

d) Practice of saving seed

There were major differences in the percentage of respondents from different areas who indicate that they do save seed *vs* respondents who indicated that they do not save seed (Figure 2). The percentage of farmers who indicated that they do save seed ranged from 23% in the Free State province to 81% in Western Cape province.

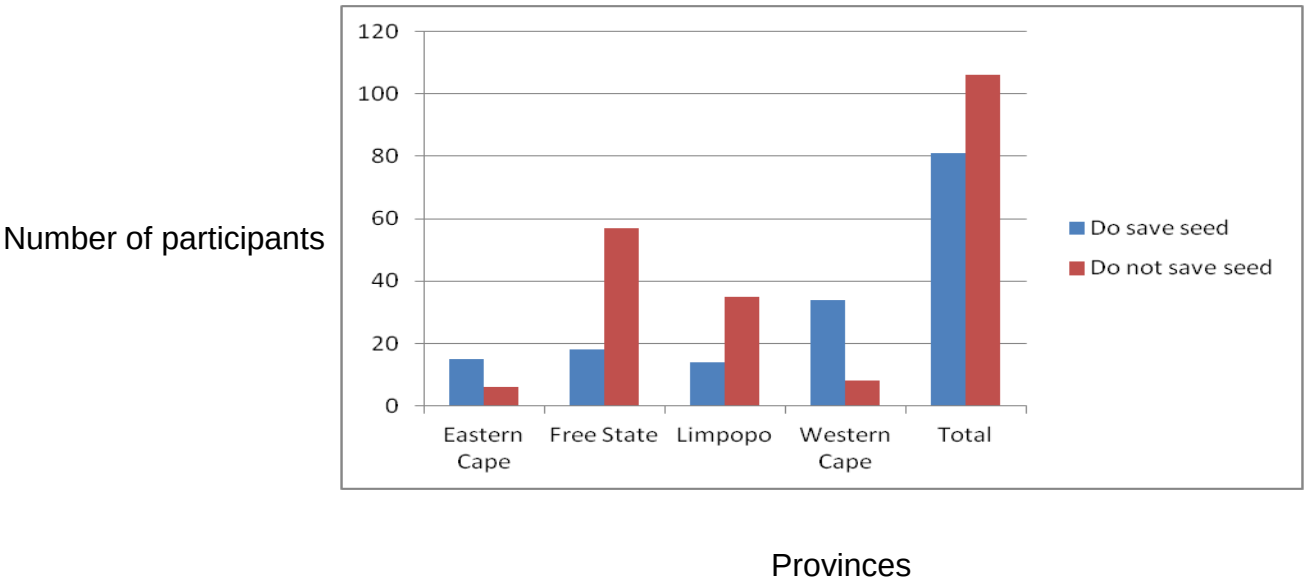


**Figure 2:** Practice of saving seed among participants from different provinces.

e) Types of crops of which seed are saved

Respondents listed the following crops from which they save seed: maize, sorghum, soy bean, wheat, potato, apricot, beans, beetroot, butternut, cabbage, carrot, chili, green pepper, onion, peas, plum, pumpkin, spinach, strawberry, tomato, watermelon. We noted that not only seed-propagated crops were listed; vegetatively-propagated crops were also listed by some respondents.

Of the total number of respondents, 57% indicated that they have never heard of the Plant Breeders' Rights Act before, 18% were familiar with the Act and 25% had heard of the Act but did not quite understand the provisions of the Act and how it impacted on them and their farming practices.

The majority of the respondents (57%) indicated that they do not save seed, citing two main reasons:

a) They were advised by the extension officers not to save seed but rather to buy seed annually to ensure good yield since they mostly used hybrid seed.

b) From their own experiences saved seed did not produce a good quality product. They prefer to buy seed annually and practice crop rotation.

During the discussions it was discovered that this group of respondents mainly used hybrid seed and hence the practice of saving seed did not lead to good yield and was not encouraged.

Nearly a half (43%) of the respondents indicated that they do save seed. Respondents from Limpopo indicated that they save seed both from hybrids and open pollinated varieties. They mostly use harvest from hybrid seed for animal feed in the following year. Respondents indicated that seed is mainly saved for own use but they do exchange and sometimes sell to neighbors when they have a surplus. The main crops of which they save seed are maize, sorghum, soy bean and wheat. It is interesting to note that respondents from the Western Cape also listed vegetable crops such as cabbage, butternut, carrot, spinach when asked to provide types of crops they save.

Some respondents from the Eastern Cape indicated that they mostly save seed from their traditional crops and not from the hybrids sold by the commercial companies. Jacobson & Myhr (2012) in their study on GM Crops and smallholders in the Eastern Cape also established that smallholder farmers preferred that project maize- i.e. maize from Monsanto should not be re-used as it was regarded as maize that you eat until it is finished. Another smallholder farmer argued that the reason for not recycling the seed was that they were too easily eaten by grain weevils in storage and therefore it was simply impossible to save them (Bt Maize, like many hybrid varieties, is more sensitive to grain weevils in storage and degrades more quickly in local storage conditions than local varieties).

## 4.4 Discussion

This survey shows that in all of the selected provinces there are smallholder farmers who still practice the tradition of saving seed and in some cases do exchange and sell this seed to their neighbors. These farmers are however in general neither familiar with the legislation on plant breeders' rights nor with the farmers' privilege concept. They however indicated that the seed they save is mainly from their traditional varieties and they did not know whether any of the varieties they used were protected by plant breeders' rights or not. This finding is in line with findings of Wynberg *et al.* (2012a), in their research in KwaZulu-Natal where it is reported that small-scale farmers preferred traditional crops over commercial varieties because of their perceived hardiness, good yields, drought resistance and high nutritional value. This survey has also shown that:

a) Awareness by smallholder farmers about Plant Breeders' Rights and the farmers' privilege concept is very low, between 10% and 29%.

b) Some of the smallholder farmers interviewed considered that a future Plant Breeders' Rights legislation in South Africa should create some freedom for smallholders to continue their traditional practice of saving and exchanging seed.

Further study may be useful to identify whether the exemption mentioned in (ii) above would be consistent with UPOV Act of 1991. The Protection of Plant Varieties Act in India allows a farmer to "save, use, sow, resow, exchange, share or sell his farm produce including seed of a variety protected under this Act. There are however concerns that this Act may not be compatible with the requirements of the UPOV 1991 Act.

The participants of the survey also indicated that they do their own selection in some crops. Kuyek (2002) states that small farmers constitute Africa's most capable innovators. The innovation of African farmers is particularly important when it comes to plant breeding. They carefully select those seeds that respond to various soil types and growing conditions and that carry particular traits such as stability, disease resistance,

drought tolerance, palatability, and storage quality. Many so-called 'traditional' or small-scale farmers are highly innovative. Farmer's varieties or 'landraces' are usually selected for a range of traits and are not genetically uniform, which helps ensure some crops will grow even in the face of unexpected, difficult or varying conditions (Dutfield, 2011).

According to Wynberg (2012a) traditional farmers in South Africa are active plant breeders, conserving traditional varieties, continuously selecting seed with characteristics such as hardiness, drought resistance, good storage qualities and taste in mind, and using seed preservation techniques which have been passed on orally for generations.

In this survey, some participants were convinced that some of the varieties they develop through selection are distinct, uniform and stable. They however were not aware of the Plant Breeders' Rights Act as they were under the impression that "*these pieces of legislation are meant for big companies which use modern breeding techniques*".

It is also likely that some of the varieties they develop do not conform to the distinctness, uniformity, and stability criteria. The issue of protection of farmer varieties is much debated. According to Helfer (2004) the four eligibility requirements of the UPOV – novelty, distinctiveness, uniformity and stability - have been criticized as unnecessarily rigid, undervaluing plant genetic diversity and precluding IPR claims by traditional farmers as opposed to commercial breeders.

Some commentators have proposed a more flexible "distinctness and identifiability" standard which replaces UPOV's narrow focus on the different characteristics by which a particular variety may be identified. States are not, however, required to adopt this standard for all purposes. They may, for example, apply different eligibility standards to different varieties, using UPOV-type criteria for varieties developed by classical breeding industries and more flexible criteria for more heterogenous varieties. It is also argued that if the right of farmers to protect their own local varieties is to be implemented by relaxing the standards of application (especially uniformity standards

for a variety) then there is a risk that relaxed standards can be misused to protect gene pools rather than individual varieties. Others argue that IPR on varieties conflicts with the moral values of farming communities, which have always relied on free exchange of materials, and that such protection should not be promoted for farmers' varieties. The protection itself serves a purpose only when the variety is commercialized on a sufficiently large scale to cover at least the cost of protection. At the very least, an IPR system should avoid granting protection for farmers' varieties without the consent of the community that developed them (The World Bank, 2006).

### 4.5 Recommendations from stakeholders:

Various stakeholders made valuable recommendations with regard to the application of the farmers' privilege application in South Africa as follows:

- Only subsistence farmers, which will be defined as those farmers that farm in total less than 5 hectares, be exempt from the provisions of the Act. Farmers farming on more than 5 hectares who wish to retain seed must declare to the holder of the plant breeder's right of the variety to be planted, the number of hectares that has been planted for that variety. An agreed royalty fee will be charged by the holder and this will be payable by the farmer.
- The PBR Act needs to define 'farmer' to include scale of production.
- The PBR Act should define a commercial farmer and farmers' privilege should not be applicable to commercial farmers as defined.
- Farmers' Privilege should only apply to certain crops (for species where it has been traditionally used, i.e. food and feed crops) subject to the obligation that farmers provide information concerning the use to the breeder and to the payment of an equitable remuneration.

- The PBR Act should define "harvested material" to include all products of harvest, but define the scope of varieties applicable or exclude vegetative propagation material of fruit varieties where it pertains to Farmers' Privilege.
- Farmers' Privilege clause should remain as it is in the Plant Breeders' Rights Act, 1976 for the sake of food security/availability. Infringements of the Plant Breeders' Rights Act (e.g. brown bagging) should rather be pursued more actively rather than omitting farmers' privilege.
- The Department should work towards giving farmers the legal space to freely save, use, exchange and sell farm-saved seed.
- Small farmers should be given a right to choose to save or not to save seed.
- The Department of Agriculture, Forestry and Fisheries should spearhead a process to develop a coherent and supportive national policy for farmers' rights and agricultural biodiversity that involves smallholder farmers and includes the voices of the poor and marginalized.
- South Africa should sign and accede to the International Treaty on Plant Genetic Resources for Food and Agriculture.

## 4.6 Legislative Review

Based on the recommendations from the stakeholders, it became evident that the farmers' privilege provision in its current form needs to be reviewed taking into account, among others, the following factors:

*1. Eligibility and/or payment of royalties:* The "farmer" and conditions for the payment of royalties will have to be defined in the regulations of the Act based on size of the farm/ scale of production, number of plots, etc.

*2. Kinds of crops:* The kinds of crops should be prescribed in the regulations of the Act based on the information gathered from the communities and the industries concerned, with the approval of the Minister responsible for Agriculture.

*3. Identification of the variety:* Labeling requirements will have to be stipulated in the regulations.

*4. Infringements:* Acts of infringement, including innocent infringements in relation to the farmers' privilege will have to be prescribed.

Based on this study an amendment to the current farmers' privilege provision has been proposed as follows:

> *A plant breeder's right in respect of a variety obtained in a legitimate manner does not extend to—*
>
> *1) A farmer who uses farm-saved seed in the prescribed manner.*
>
> *(2) The Minister must prescribe—*
>
> *(a) the category or categories of farmers and plants in respect of which subsection (1)(d) applies;*
>
> *(b) the uses to which such farm-saved seed may be put;*
>
> *(c) the conditions for payment of royalties, where applicable; and*
>
> *(d) the labelling requirements, where applicable.*

This proposal was presented and discussed with various stakeholders and has been favorably received. This amendment will allow key stakeholders, with approval from the Minister of Agriculture to decide on, among others: which type of crops will be subjected to the farmers' privilege provision and from which hectarage this provision should apply per crop; the categories of farmers that will benefit; identify circumstances under which royalties must be paid, etc. This proposal has since been included in the draft Plant Breeders' Rights Bill, as it is seen as a possible solution to create a balance between the rights of the breeders and those of the farmers.

## 4.7 Conclusions

According to Wynberg *et al.* (2012a) in South Africa, little supportive legislation exists to broaden the system to include farmers and communities that have traditionally bred and developed crops and that have, in some instances, provided knowledge and resources to commercial breeders. It would be difficult for South African policy makers to engage fruitfully in debates around the farmers' privilege if they are not well acquainted with the dynamics around farm saved seed in the country. This study has clearly shown the importance of engaging various stakeholders, especially smallholder farmers in discussions pertaining to legislation that have an impact on them. This study has also highlighted the extent of seed saving practices in some communities although there is a need for further studies in this regard, particularly in the use of PBR protected varieties. The importance of on-going dialogue between policy makers and Civil Society Organizations representing interests of smallholder farmers became evident.

Nel & Davies (1999) studied the challenges facing farming and rural development in the Eastern Cape province in the Eastern Cape. Some of the challenges facing black farmers in the Eastern Cape included, among others, the small size of holdings, general lack of support and shortage of resources and low levels of agricultural education and inexperience. Kirsten & van Zyl (1998) once argued that in analyzing South African agrarian history, one finds overwhelming evidence of how various policies and government actions have reduced small-scale farming to a state where it contributes very little to the economy as a whole and to the welfare and livelihoods of rural dwellers. This study will therefore assist policy makers in developing policies and legislation that will make this sector more viable and by so doing benefit the country.

Developing countries will have to comply with the TRIPS agreement and have some system for the protection of new plant varieties. Despite the heavy criticism of the UPOV system of plant breeders' rights, African countries are developing their PBR systems aligned to the UPOV 1991 Convention. This is seen by the number of African countries that have acceded to the UPOV 1991 Convention, most recently Tanzania and OAPI member states. Some African countries are considering developing or have already

started developing a Plant Breeders' Rights System for their respective countries. This study is likely to assist countries who are developing their laws especially with the various debates and options with regard to the farmers' privilege.

The next chapter discusses the plant breeders' rights protection of genetically modified seed crops, also looking into the legislative framework on Genetically Modified Organisms.

# CHAPTER 5

## Plant Breeders' Rights and Genetically Modified Organisms

### 5.1 Introduction

It is estimated that the global food demand will double by the year 2050. The need to produce more food in a sustainable agricultural system makes way for innovation in traditional agricultural practices (Mehta-Bhatt, 2001). During the last three decades, modern biotechnology and enabling technologies in the life sciences have emerged leading to improved products and services in various sectors with tremendous impact on the global economy. These include new vaccines and diagnostic tools from gene cloning in health care and pharmaceutical sector; *in vitro* culture, synthetic enzymes, genetically modified crops and microbes in the food and agriculture sector (UNIDO, 2013). Farmers have been trying to minimize the impact of crop pests for thousands of years. Insects, nematodes, bacteria, fungi and viruses can cause massive destruction of important crops, and this destruction can have great socioeconomic effects. To develop pest-resistant or tolerant cultivars, plant breeders have taken advantage of natural genetic variation or induced mutations (Committee on Genetically Modified Pest-Protected Plants, 2000).

GMOs are biological entities created or altered to serve a certain purpose. Wheeler (2004) in Kerle (2007) defines a GMO as an organism whose genome has been altered by techniques of genetic engineering so that its DNA contains one or more genes not normally found there. The South African Genetically Modified Organisms Act, 1997 (Act No. 15 of 1997) as amended in 2006 defines a genetically modified organism as an organism the genes or genetic material of which has been modified in a way that does not occur naturally through mating or natural recombination or both.

Genetic engineering to create what are called ‘transgenic crops’ or ‘genetically modified organisms (GMOs) has emerged as a central new practice in international agricultural research (deGrassi & Rosset, 2003). The development of crops resistant to pathogens is one of the most important applications of crop genetic engineering –particularly for developing countries (Quemada, 2001). Some of the traits of interest for genetic modification that have been successfully introduced into agricultural crops include insect resistance, disease resistance, herbicide tolerance and stress tolerance.

The first genetically modified organism deregulated and commercialized was the Flavr Savr tomato in 1994 in the USA, which did not prove to be commercially viable (Meyer, 2011). Since then, a small number of crops have been engineered to provide herbicide resistance and insect resistance. These crops have become widespread and commercially successful (Ervin *et al.*, 2010). US genetically modified agriculture actually started with *Bacillus thuringiensis* (Bt) cotton planting in 1995, but it was only the introduction of Roundup Ready soybeans in 1996, being exported worldwide as a basic ingredient for the feed and food industry, that initiated the worldwide public debate on the use of GM crops (Meyer, 2011). In 1997/1998, South Africa became the first country in Africa to have a GM crop produced on a commercial level, with the release of insect resistant (Bt) cotton. The first planting of Bt white maize in 2001/02 established South Africa as the first GM subsistence-crop producer in the world (Gouse, 2012).

According to James (2014), in 2014 a record of 181.5 million hectares of biotech crops were planted by 18 million farmers in 28 countries. Of the 28 countries, 20 were developing countries and eight industrial countries. The US continued to be the lead country with 73.1 million hectares with over 90% adoption for the principal crops of maize (93% adoption) soybean (94%) and cotton (96 %). In South in 2014 the area under GM crop production was estimated to be 2. 7 million hectares. The total maize area in South Africa for 2014 was estimated at 2.5 million hectare, with 58% white and 42% yellow. Of the total GM crop produced, 86% was GM maize, 92% GM soybean, and all the cotton planted was genetically modified. The economic gains for biotech

crops for South Africa for the period 1998 to 2013 were US $1 153 million and US $313 million for 2013 alone.

## 5.2 Debates around GMOs

Unlike conventional breeding, genetic engineering has been and continues to be received with mixed reactions amongst nations, regions, civil society groups and the academic community (Nyirenda & Ng'ambi, 2004). Almeida *et al.* (2015) also remarks that despite the numbers and high adoption rates, the cultivation of GM crops is far from being widely accepted. In some countries, attempts to introduce and establish GM food crops have led to disputes between different groups. As far back as 2009, Tripps (2009) noted that decisions about the use of this technology are highly politicized and polarized between the proponents who claim the science is safe and can offer solutions to productivity declines, land scarcity and harsh climatic conditions; and opponents, who question the moral and ethical responsibility being exercised by companies developing transgenic seed and point to the lack of understanding of the environmental and health impacts of gene manipulation (Tripps, 2009).

Proponents present the technology as a key to the solution to many problems that have plagued humanity for centuries, including food insecurity, and further contend that it offers opportunities for new breakthroughs in medicine and industry (Nyirenda & Ng'ambi, 2004). Genetically engineered seeds potentially have the ability to combat malnutrition and poverty by creating specialty crops with high productivity, better nutritional value, and enhanced resistance to disease (Stein, 2005). The creation of crops designed for specific environments such as arid lands and having enhanced nutritional value that will produce higher yields or reduce the amount of pesticides, fungicides and herbicides required to control insects and plant pests seems achievable. In this way, biotechnology can contribute to increased food security and help fight hunger and poverty (Kerle, 2007). Furthermore, proponents note that GM crops might prove to be an important tool in recognizing the increase of crop yield, especially of staple crops. This might be particularly relevant for small-scale, resource-poor farmers

in developing countries (Nuffield Council of Bioethics, 2004). Others argue that biotechnology will boost food security for the world's growing population by raising food production. It will benefit the environment by reducing the need for more farmland, irrigation and pesticides (www.biodiv.org/biosafety).

Opposing views label the technology as intolerable tampering with the state of nature, threatening to set loose a whole spectrum of irreversible dangers to the human race (Nyirenda & Ng'ambi, 2004). For many people this rapidly advancing science raises a tangle of ethical, environmental, social and health issues. Because modern biotechnology is still so new, they say much is unknown about how its products may evolve, and how they may interact with other species (www.biodiv.org/biosafety). The major bone of contention lies within the sector of agriculture where genetic engineering efforts seem to be concentrated, with the resultant production of genetically modified crops and food. The dangers linked with genetically modified products, especially crops, are many. Fears are raised of contamination of the local land races by the foreign genes in genetically modified relatives. Safety of genetically modified foods for human consumption remains contentious (Nyirenda & Ng'ambi, 2004). Some commentators take the view that possible risks of GM crops for human health have not yet been sufficiently examined. In a common, but controversial, interpretation of what is known as the precautionary principle, critics argue that GM crops should not be used anywhere unless there is a guarantee that no risk will arise (Nuffield Council of Bioethics, 2004). According to van Rijssen *et al.* (2015), the debate on the *precautionary principle* illustrates the diverse opinions on safety requirements of GM crop plants. Some consider GM crops irreversibly harmful, while others view them as representing only a continuum of existing knowledge and agricultural practices. There are also fears of increased resistance to pesticides, adaptation of insects, unknown environmental impacts and detrimental effects on the plant's gene pool (Stein, 2004). In South Africa, there have been calls for a ban on all further cultivation of GM crops, and use of their associated pesticides (African Centre for Biosafety, 2013).

According to Almeida et al. (2015) putting the debate on GMOs as a matter of being "in favour" or "against" is a simplistic way of trying to understand or explain the differences of opinion and positions taken on this issue. This polarization tends to be present in decision-making environments and in the media, but is not replicated in a broader social context, although it ends up being reproduced in some quantitative studies that seek objective answers on how society views GM products.

## 5.3 International Agreements

### 5.3.1 The World Trade Organization (WTO)

The WTO administers the most comprehensive multilateral trade agreements. The primary purpose of the WTO is to facilitate international trade. It aims to achieve this by establishing trade rules, serving as a forum for trade negotiations and assisting in the settlement of disputes. There are two principal agreements that relate to GM crops *viz*., the Technical Barriers to Trade Agreement (TBT), which concern the negotiation of free trade and the Sanitary and Phytosanitary Agreement (SPS), which concerns the protection of public health and welfare standards in member states (Nuffield Council of Bioethics, 2004).

### 5.3.2 The Codex Alimentarius

The Codex Alimentarius was established by the Codex Alimentarius Commission, a subsidiary body of the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO). The Commission is the principal international body on food standards and represents more than 95% of the global population. The primary aim of the *Codex* is 'to guide and promote the elaboration and establishment of definitions and requirements for food to assist in their harmonization and in doing so to facilitate international trade' (Nuffield Council of Bioethics, 2004). The Commission has established an *ad hoc Intergovernmental Task Force on Foods Derived from*

*Biotechnologies* that is responsible for developing standards and guidelines for genetically modified foods. The Commission is also considering the issue of labeling biotech foods to allow the consumer to make an informed choice (www.biodiv.org/biosafety).

### 5.3.4 The International Plant Protection Convention (IPPC)

The IPPC protects plant health by assessing and managing the risks of plant pests. The IPPC is in the process of setting standards to address the plant risks associated with GMOs and invasive species. Any GMO that could be considered a plant pest falls within the scope of this treaty. The IPPC allows governments to take action to prevent the introduction and spread of such pests. It also establishes procedures for analyzing pest risks, including impacts on natural vegetation (www.biodiv.org/biosafety).

### 5.3.5 The Cartagena Protocol on Biosafety

The Cartagena Protocol on Biosafety was adopted by the parties of the CBD. The protocol contains procedural rather than substantive measures, relating to the provision of information and the carrying out of tests to assess the safety of the Living Modified Organisms such as GM crops. The main procedures introduced by the Protocol include procedures on: advanced informed agreement procedure, risk assessment, capacity building and involvement of the public, Biosafety Clearing House and LMOs intended for direct use as food and feed (Nuffield Council of Bioethics, 2004). The Protocol for the first time sets out a comprehensive regulatory system for ensuring the safe transfer, handling and use of GMOs subject to transboundary movement. The Protocol seeks to meet the needs of consumers, industry and the environment for many decades to come (www.biodiv.org/biosafety).

### 5.3.6 Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety

The Nagoya – Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety was adopted on 15 October 2010 in Nagoya, Japan. The Supplementary Protocol aims to contribute to the conservation and sustainable use of biological diversity by providing international rules and procedures on liability and redress for damage resulting from living modified organisms (LMOs). The adoption of the Supplementary Protocol fulfils the commitment set forth in Article 27 of the Cartagena Protocol to elaborate international rules and procedures on liability and redress for damage to biodiversity resulting from transboundary movements of LMOs. As an extension of the Cartagena Protocol, the Supplementary Protocol builds on existing international environmental law principles (www.biodiv.org/biosafety).

## 5.4 National legislation

### 5.4.1 The Genetically Modified Organisms Act, 1997 (Act 15 of 1997) (GMO Act).

The aim of the South African GMO Act is to provide for measures to promote the responsible development, production, use and application of genetically modified organisms in South Africa; while limiting possible adverse impact on the environment, human and animal health. Before the introduction of the GMO Act, living modified organisms (LMOs) were handled by the South African Committee on Genetic Experimentation (SAGENE). This was a governmental statutory body that handled requests for contained use, field trials, or general releases of LMOs. Currently, the GMO Act is administered by the Department of Agriculture, Forestry & Fisheries.

The GMO Act makes provision for the appointment of a Registrar, two regulatory bodies i.e. the Advisory Committee, Executive Council and inspectors. All GMO applications are subjected to scientific evaluation. The Registrar is responsible for administering the Act, which includes duties such as examining of applications submitted in terms of the

Act and issuing of permits. The Registrar also maintains a register of all facilities registered in terms of the Act and appoints inspectors who conduct investigations as prescribed in the Act.

The Advisory Committee (AC), comprising scientific experts together with subcommittee members, is responsible for the evaluation of risk assessment data of all applications as it relates to food, feed and environmental impact, following which a recommendation is submitted to the Executive Council (EC). The EC is the ultimate decision-making body and it consists of members from different government departments (i.e. Agriculture and Forestry; Arts and Culture;, Science and Technology; Environmental Affairs; Health; Labour; Water Affairs; and Trade and Industry).

All applications for field trials, commodity clearance and general release are published for the information and inputs of the general public. Since South Africa is a member of the Codex Alimentarius Commission, it follows the Codex internationally recognized standards, codes of practice, guidelines and other recommendations for the evaluation of the safety of food and feed derived from GMOs. This includes a safety assessment of the food considering aspects such as the possible allergenicity, toxicity, possible effects of food processing, nutritional modifications and other considerations. Such an evaluation of food and feed safety is necessary when applying for a Commodity Clearance or General Release permit in South Africa. Under the GMO Act, South Africa has approved the commercialization of genetically modified maize, cotton and soybean. Table 2 shows events that have been approved for commercial release in South Africa by December 2012.

**Table 2** Commercial release approvals in South Africa by December 2012.

| Event | Crop | Trait | Company | Year approved |
|---|---|---|---|---|
| **TC1507** | Maize | Insect resistance<br>Herbicide tolerant | Pioneer | 2012 |
| **BT11xGA21** | Maize | Insect resistance<br>Herbicide tolerant | Syngenta | 2010 |
| **GA21** | Maize | Herbicide tolerant | Syngenta | 2010 |
| **MON89034xNK603** | Maize | Insect resistance<br>Herbicide tolerant | Monsanto | 2010 |
| **MON89034** | Maize | Insect resistance | Monsanto | 2010 |
| **Bollgard IIxRR flex (MON15985x MON88913)** | Cotton | Insect resistant<br>Herbicide tolerant | Monsanto | 2007 |
| **MON88913 (RR flex )** | Cotton | Herbicide tolerant | Monsanto | 2007 |
| **MON810xNK603** | Maize | Herbicide tolerant<br>Insect resistant | Monsanto | 2007 |
| **Bolgard RR** | Cotton | Insect resistant<br>Herbicide tolerant | Monsanto | 2005 |
| **Bollgard II, line 15985** | Cotton | Insect resistant | Monsanto | 2003 |
| **Bt11** | Maize | Insect resistant | Syngenta | 2003 |
| **NK603** | Maize | Herbicide tolerant | Monsanto | 2002 |
| **GTS40-3-2** | Soybean | Herbicide tolerant | Monsanto | 2001 |
| **RR lines 1445 & 1698** | Cotton | Herbicide tolerant | Monsanto | 2000 |
| **Line 531 / Bollgard** | Cotton | Insect resistant | Monsanto | 1997 |
| **MON810 / Yieldgard** | Maize | Insect resistant | Monsanto | 1997 |

Source: www.daff.gov.za

### 5.4.2 The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004): the NEMBA

Section 10(1)(b) of the NEMBA establishes the South African National Biodiversity Institute. One of the functions of the institute is to 'monitor and report regularly to the Minister on the impacts of any genetically modified organism that has been released into the environment, including the impact on non-targeted organisms and ecological processes, indigenous biological resources and the biological diversity of species used for agriculture'.

Section 78 of the NEMBA provides for non-issuance of the permit for trial release or general release in terms of the GMO Act if the Minister has reason to believe that the release of the genetically modified organism may pose a threat to any indigenous species or the environment unless an environmental assessment has been conducted.

### 5.4.3 Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 52 of 1972)

The Foodstuffs, Cosmetics and Disinfectants Act, 1972 is administered by the Department of Health. The object of this Act is to control the sale, manufacture and importation of foodstuffs, cosmetics and disinfectants; and to provide for incidental matters. This Act provides for the labeling of GM foods in South Africa. Regulations relating to the labelling of foodstuffs obtained through certain techniques of genetic modification were published in the Government Gazette in 2004.

### 5.4.4 Consumer Protection Act, 2008 (Act No. 68 of 2008)

The object of this Act is to promote a fair, accessible and sustainable marketplace for consumer products and services and for that purpose to establish national norms and standards relating to consumer protection. This Act imposes further labelling requirements. Section 24(6) provides that any person who produces, supplies, imports or packages any prescribed goods must display on, or in association, with the package

or those goods, a notice in the prescribed manner and form that discloses the presence of any genetically modified ingredients or components of those in accordance with applicable regulations. Draft amendment regulations on product labeling and trade descriptions: genetically modified organisms were published in the Government Gazette in 2012. The Consumer Protection Act, 2008 is administered by the Department of Trade and Industry.

## 5.5 Intellectual property protection and GMOs

The processes of genetic engineering as well as the genes themselves and the end product, such as plant variety, are generally regarded as “new constructs” of human intervention and therefore intellectual property. Seed companies can use various mechanisms to protect such property, including plant variety protection, material transfer agreements and more frequently, patents (Kuyek, 2002). Intellectual Property Rights on GMOs and on technologies enabling the identification of useful genes and their transfer were considered by private industry to be important, not only in capturing return on investment and research, but also in gaining access to agricultural markets (Hardon, 2004). Genetic modification has provided the breeder with new tools to create novel varieties and stronger rights in the form of patents have been granted to protect them. Theoretically, as far as GMOs are concerned, the following processes and products might be encompassed by principally patentable subject matter: the transgenic organism itself, a cell containing the altered DNA, the isolated and purified gene or gene sequence that is later inserted into the alien DNA, the respective processes, and the respective products (Correra 2000 in Kerle, 2007).

Patent protection for plants or seeds is frequently obtained by securing a broad patent which claims rights over the gene or gene carrier, and may cover a number of varieties or even crops incorporating the gene. In effect this may have the same outcome as patenting the whole plant. The holder of a patented variety may be able to prevent others from using it for breeding purposes (Nuffield Council of Bioethics, 2004). Patents on plants can substantially restrict or hamper access to biological resources needed in

plant breeding as well as hinder the process of innovation in breeding and impede the farmer's activity and freedom of choice (Then & Tippe, 2014). According to Hardon (2004) policymakers in the many developing countries where Farmer Seed Systems are the main source of seeds need to fully understand the consequence of such exclusive patent regimes when they are applied to GM crop varieties.

### 5.5.1 Dual Protection

The first regimes aimed to protect the results of traditional plant breeding, but with the rise of modern biotechnology, these systems became insufficient and, in many legal systems, a variety of IPRs are now available as the result of modern biotechnology research (Kerle, 2007). The extension of intellectual property to products of genetic engineering, particularly genetically modified crop seeds, has thrown the system into fresh controversy especially in developing countries (Nyirenda & Ng'ambi, 2004). There is a concern that the existence of overlapping rights with different scopes of protection can have an adverse impact on food security and sustainable agriculture in developing and least developed countries. For instance, GM varieties can be protected using both patents and plant breeders' rights, i.e. a patent for the GM event and a plant breeder's right for a variety itself, in which that event has been used. In such a case, the limited exceptions to patent protection may hinder the farmers' right to use the protected material, even if they are entitled to a saved seed exemption under the plant variety protection law (Hiroko, 2012). The International Seed Trade Federation (FIS) has stated that despite the benefits of the UPOV system for protection of plant varieties, it will be useful for companies to take advantage of patent protection also for plants (Spillane, 2002).

The UPOV Convention, as adopted in 1961, imposed a ban on the dual protection of the same invention by both the plant breeder rights system and the patent system, but this was removed in the revised 1991 UPOV Convention. This change made it possible for the contracting states to issue patents that covered plant varieties, particularly transgenic plants, according to national patent law provided that this law did not contain

exclusions to the patentability of life forms (Fleck & Baldock, 2003). Article 27.3 of the TRIPS agreement invites member countries to protect plant varieties with patents or a combination of patents and an effective *sui generis* system. Dual protection is possible in countries like the United States and Australia.

In South Africa new plant varieties are eligible for protection in terms of the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976). Genetically modified varieties can also be protected in terms of the Plant Breeders' Rights Act. Conditions for protection are the same as those for conventional varieties; that is such GM varieties must be found to be new, distinct, uniform and stable. There however seems to be no universal standard on the establishment of tests and trials for the evaluation of GM varieties for plant breeders' rights protection. In South Africa these tests and trials are set-up in a manner that GM varieties are always planted separately from conventional varieties, and according to different traits. This approach is different from other countries, e.g. Canada, where if a GM variety is the first of its kind it is planted with all varieties including conventional varieties. With more GM events (single and stacked events) being developed, it would be useful for countries to work towards a similar approach in handling GM varieties, for example through the UPOV Technical Working Party for Agricultural Crops, especially since applicants do sometimes lodge applications for a particular variety in different countries.

The Patent Act, 1978 (Act No. 57 of 1978) excludes from patentability "any varieties of animals or plant or any essentially biological process for the production of animals or plants, not being a microbiological process or the product of such a process" (s. 25(4)(b)). There are many legal complexities about the wording of TRIPS, such as the exact meaning of a plant variety, a "microorganism" or an essentially biological process. The issue raised by TRIPS is what constitutes an invention in relation to genetic material (Commission on Intellectual Property Rights, 2002). According to Merry (2009) it is possible that dual protection by way of a patent and a plant breeder's right may well be possible where the Patents Act does not specifically exclude plant varieties from protection. This exclusion has however not as yet been litigated upon in South Africa,

therefore when interpreting this section recourse must be based on foreign law, *viz*. European Patent Convention, Novartis Transgenic Plant v EPO Enlarged Board of Appeal, Lubrizol Hybrid Plants v . EPO Enlarged Board of Appeal. After examining such foreign law Merry (2009) concludes that dual intellectual property protection for genetically modified plants is possible under the Plant Breeders' Rights Act and the Patents Act in South Africa. This is because the exclusion in terms of the Patents Act does not extend to a variety developed through a microbiological process, such as plants modified through genetic engineering.

According to Hiroko (2012) the Ethiopian patent law's plant exclusion does not include microorganisms and plant varieties produced through non-biological or microbiological processes. Thus genetically modified plants produced through a microbiological process may be subject to dual protection under the patent and plant variety legislation. This suggests the possibility of both rights in the same derivative biological material, a situation inconsistent with the exclusion under the patent legislation. As the law stands now in Ethiopia both patents and plant breeders' rights can be concurrently created over the same subject matter even if plant variety protection as such is excluded from the patent law regime. However this possible overlap is left ungoverned. A similar situation exists in South Africa because neither the Plant Breeders' Rights Act nor the Patents Act addresses the issue of dual protection explicitly. .

### 5.5.2 Protection by Plant Breeders' Rights

During this study, through interaction with various stakeholders in workshops and meetings as well as from the queries received by the Registrar's office, it was established that more often arguments on intellectual property protection, particularly plant breeders' rights in GM varieties are based on vast generalizations rather correct information held by national competent authorities. This includes issues around:

- the type of crops protected by plant breeders' rights, where some stakeholders are of the view that many of the crops protected by plant breeders' rights were

genetically modified, some citing crops such as tomatoes, bananas and pumpkins,

- the number of protected varieties that are genetically modified *versus* those of conventional varieties, where some stakeholders are of the view that in crops such as maize almost all varieties granted plant breeders' rights protection are GM varieties

- the ownership of plant breeders' rights for GM varieties, where some stakeholders are of the view that all protected GM varieties are owned by either Monsanto or Pioneer.

This study investigates the trends of plant breeders' rights granted for GM varieties *versus* conventional varieties in the different crops as well as the ownership of the plant breeders' rights granted.

Data on the varieties protected by plant breeders' rights was obtained from the plant breeders' rights register maintained at the Department of Agriculture, Forestry and Fisheries by the Registrar of Plant Breeders' Rights, a National Authority on plant breeders' rights in South Africa. Information obtained from the plant breeders' rights register includes the plant botanical and common name, plant variety name (denomination), applicant name, country of origin, application date of PBR and grant date of PBR.

Upon investigation, it was established that in terms of the Plant Breeders' Rights Act, only three crops have GM varieties protected under the Plant Breeders' Rights Act, namely maize, cotton and soy bean. By December 2013 there were 411 varieties of maize, 66 varieties of soy bean and 10 varieties of cotton protected by plant breeders' rights. Figure 3 shows the distribution of these plant breeders' rights between GM varieties and varieties developed by conventional breeding methods. Tables 3 to 6 illustrate the numbers of plant breeders' rights granted, comparing those granted for GM varieties to those granted for their conventional counterparts, the holders of the granted plant breeders' rights as well as their countries of origin.

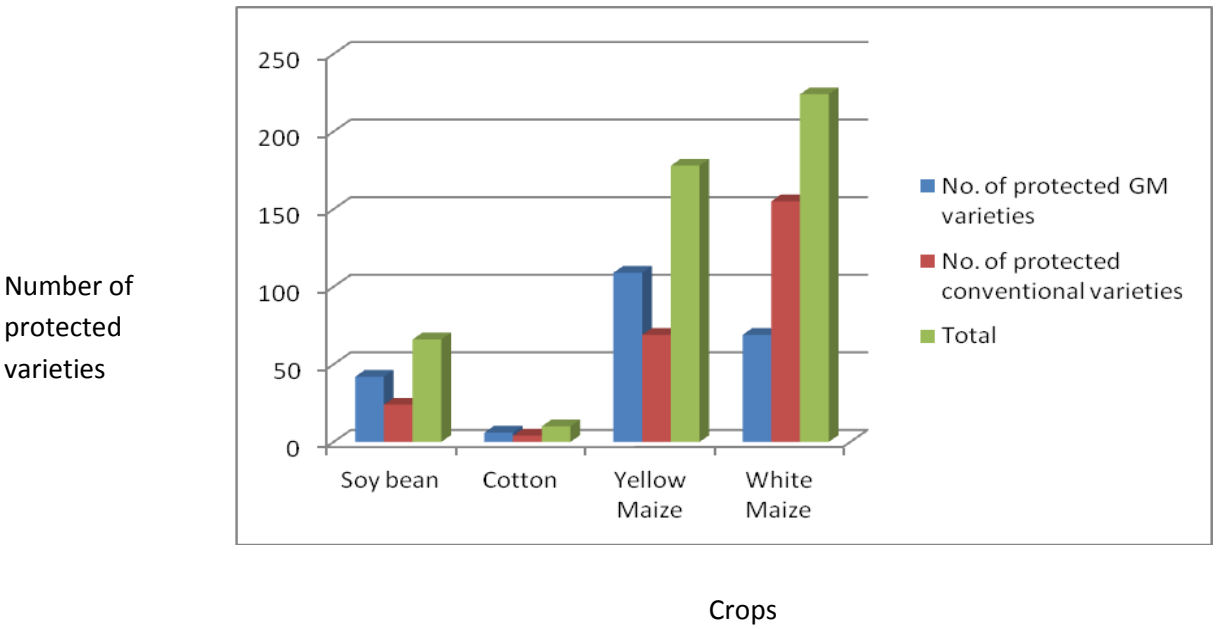


**Figure 3**: The distribution of protected GM varieties versus conventional varieties in soya bean, cotton, yellow maize and white maize by December 2013.

**Table 3** Distribution of protected varieties in GM and conventional *Glycine max* (soy bean) respectively

| Holder of a PBR | Home country | No. of protected GM varieties | No. of protected conventional varieties |
|---|---|---|---|
| **Agborn** | United States of America | - | 1 |
| **Agricultural Research Council** | South Africa | - | 7 |
| **Associados Don Mario SA** | Argentina | 7 | - |
| **Dept of Agric** | South Africa | - | 1 |
| **FN Simillas** | Argentina | 1 | - |
| **Link Seed** | South Africa | 14 | 4 |
| **Monsanto** | United States of America | 3 | 2 |
| **Pannar Seed** | South Africa | 5 | 4 |
| **Pioneer HiBred** | United States of America | 7 | - |
| **Relmo** | Argentina | 2 | 1 |
| **Seed Co** | Zimbabwe | - | 2 |
| **Sensako** | South Africa | - | 2 |
| **Terral Seeds** | United States of America | 3 | - |
| **Total protected** | | **42** | **24** |

**Table 4:** Distribution of protected varieties in GM and conventional *Gossypium hirsutum* (cotton) respectively

| Holder of a PBR | Home country | No. of protected GM varieties | No. of protected conventional varieties |
|---|---|---|---|
| **Agricultural Research Council** | South Africa | - | 2 |
| **D & PL Tech** | United States of America | 2 | 2 |
| **Monsanto** | United States of America | 4 | - |
| **Total** | | **6** | **4** |

**Table 5:** Distribution of protected varieties in GM and conventional white *Zea mays* (maize) respectively

| Holder of a PBR | Home country | No. of protected GM varieties | No. of protected conventional varieties |
|---|---|---|---|
| **BASF** | Germany | - | 1 |
| **Capstone** | South Africa | - | 2 |
| **Garst Seed** | United States of America | - | 1 |
| **Klein Karoo SM** | South Africa | 7 | 19 |
| **Lefroy Seed** | Australia | - | 1 |
| **Limagrain** | France | - | 1 |
| **Monsanto** | United States of America | 14 | 10 |
| **Nelson Genetics** | South Africa | - | 2 |
| **Pannar Seed** | South Africa | 2 | 14 |
| **Pioneer HiBred** | United States of America | 46 | 104 |
| **Total** | | **79** | **154** |

**Table 6** Distribution of protected varieties in GM and conventional yellow *Zea mays* (maize) respectively

| Holder of a PBR | Home country | No. of protected GM varieties | No. of protected conventional varieties |
|---|---|---|---|
| **BASF** | Germany | - | 1 |
| **Capstone** | South Africa | - | 1 |
| **Corn States** | France | 1 | - |
| **Garst Seed** | United States of America | - | 1 |
| **Klein Karoo SM** | South Africa | 9 | 4 |
| **Lefroy Seed** | Australia | - | 1 |
| **Limagrain** | France | - | 1 |
| **Monsanto** | United States of America | 15 | 3 |
| **Pannar Seed** | South Africa | 6 | 3 |
| **Pioneer HiBred** | United States of America | 78 | 54 |
| **Total** | | **109** | **69** |

## 5.6 Discussion and conclusions

The purpose of this chapter was to give an overview of the legal framework around genetically modified organisms. The main issues I investigated was the regulatory framework in South Africa; the dual protection of GM plant varieties, i.e. in terms of a patent and a plant breeder's right and the trends of plant breeders' rights protection of GM varieties as compared to their conventional counterparts.

It is evident that a comprehensive approach is followed in dealing with GMOs. This involves various government departments, most notably, the Department of Agriculture, Forestry and Fisheries responsible for the administration of the GMO Act and issuance of relevant permits; the Department of Environmental Affairs (including the South

African National Biodiversity Institute) responsible for the assessesment the environmental risks associated with the use of genetically modified crops, and also conducts long-term monitoring and reporting on genetically modified organisms released into the environment; the Departments of Health responsible for the assessment of food safety pertaining to genetically modified crops under the established risk assessment processes; the department of trade and industry responsible for the assessment of impact of GMO activities on trade relations, market access, investments and industry development and the Department of Health responsible to promotes public awareness and participation with regard to the regulation of GMOs.

It is worth noting that only three genetically modified crops have been approved for commercial release in South Africa, namely maize, soybean and cotton. This is contrary to some public views that all crops, including tomatoes, banana and pumpkins are genetically modified. This shows that there are members of the public who do not understand the concept of a genetically modified organism. Government, policy makers, researchers, civil society organizations need to come up with awareness programmes to educate the general public on genetically modified organisms in order for them to be able to engage in discussions pertaining to GM matters and to make informed choices should a need arise.

With regard to plant breeder's rights protection, in 2013, of the total number of GM varieties protected under the Plant Breeders' Rights Act, 1976: 60% are GM for cotton, 63% for soy bean, 34% for white maize and 61% for yellow maize.

Although there are events approved in terms of the GMO Act in South Africa, none of these events seem to be currently protected in terms of the Patents Act. This would mean that for GM varieties containing these approved events there is currently no dual protection in terms of both the Plant Breeders' Rights Act and the Patents Act..

According to Anderson (2014) while ministers, scientists and policy makers talk of Biosafety frameworks, and the cost and benefits of GMOs, all seem insensitive to the

issue which is of most concern to African farmers: the issue of patented GM crops and how it will affect farmers' rights to save seed. Although currently there seem to be no patented 'varieties' in South Africa, new events are being developed and released in terms of the GMO Act and it is highly likely that patents will be taken out on these events and subsequently plant breeders' rights on the varieties in which these events are used. The South African Department of Agriculture, responsible for the administration of the Plant Breeders' Rights Act and Department of Trade and Industry responsible for the Patents Act need to initiate discussions around dual protection as far as plant varieties are concerned. South Africa needs to take a country position on how dual protection should be handled to achieve equitable protection of intellectual property in plant varieties.

Ornamental plants represent the highest number of varieties protected by plant breeders' rights. The next chapter discusses the participation of indigenous ornamental plants in the plant breeders' rights system.

# CHAPTER 6

## Plant Breeders' Rights and Indigenous Ornamental Crops

### 6.1 Introduction

Floriculture can be defined as "a discipline of horticulture concerned with the cultivation of flowering and ornamental plants for gardens and for floristry, comprising the floral industry" (Getu, 2009). Floriculture is an important multibillion dollar industry dealing with thousands of species and varieties of ornamental plants in both cultivation and the wild. Therefore the future ornamental plants can become very important to mankind just like many other well known crop plants such as the oil palm which was introduced into Malaysia as an ornamental palm in the early 20$^{th}$ century (Chin & Tay, 2007). Flower and ornamental plant production have become a component of food security and better livelihood in developing countries. Within the trade liberalization process, developing countries can seize opportunities to develop their ornamental plant industry in order to create employment and generate income leading to improved livelihoods for the less endowed. Promoting the development of the floriculture sector in developing countries is also a means to contribute to another universal commitment related to safeguarding the biodiversity (Baudoin *et al.*, 2007).

The commercial production of ornamental plants is growing worldwide. Its monetary value has significantly increased over the last two decades (Rout *et al.*, 2006). The most ornamentals are produced in Europe and countries with the largest share cut are Netherlands (35%), Italy (18%) and Germany (11%). Production in Africa has increased over the last decade, with Kenya in the frontline followed by Tanzania, South Africa and Uganda. Besides an estimate of an annual US $0.2 billion production, there are hardly any figures available about ornamental production on this continent (van Uffelen & de Groot, 2005). The South African floriculture industry has become competitive in the international market since the country's trade liberalization in 1994 (Matthee *et al.*, 2006).

Flower production ranks as one of the most efficient contributors to development and growth in the South African economy. This finding is based on the impact of this sector on aspects, such as value added to the economy, employment creation and income and wealth distribution within the local economy (Van Rooyen & Van Rooyen, 1998). In South Africa, the industry employs about 17 500 people and it is argued that the South African floriculture industry has the opportunity to grow into a significant player on the international stage (Kaiser Associates, 2000).

The products of floriculture (ornamental plants and cut flowers) are appreciated for the attractiveness of their flowers, fruits and foliage (Mol *et al.*, 1995). Mankind has always been fascinated by flowers. The desirability of flowers emanating from their beauty has, over the centuries led to domestication, cultivation, selection and breeding of desired traits, in the process metamorphosing floriculture into a global multi-billion dollar industry (Moyo *et al.*, 2011). New ornamental plant varieties are continuously being created by breeders in response to consumer demand for new products (Casanova, *et al.*, 2005). Using traditional breeding methods (i.e. continuous crossing and selection), breeders have been able to 'create' new varieties that have desirable traits such as colour, shape, plant architecture, vase life and resistance against pests and diseases (Mol *et al.*, 1995).

There are numerous ornamental plants which may have great potential, but people are not aware of their existence or true value. Besides their value as ornamental plants with beautiful flowers, they can also be of great value as medicinal plants, herbs, vegetables or for other industrial uses (Chin & Tay, 2007). The ornamental, vegetable and fruit varieties are the result of elaborate and time-consuming innovative process – the bounties of specialized labor and intellectual activity – ergo the objects of protection under the specific Intellectual Property regime (Mansuino, 2014).

### 6.1.2 South African indigenous plants

Several developing countries in the world have an interesting ornamental plant diversity that could gain added value in the future, either through direct development of commercial floriculture or through breeding of newer crops (Baudoin *et al.* 2007). South Africa is considered to be a 'hotspot' for biodiversity with 20 456 recorded indigenous vascular plant taxa; some 13 265 taxa representing 65% of our flora are internationally recognized (Raimondo, *et al.*, 2009). Despite the enormous richness in plant species, relatively few of these plants are economically utilized. In South Africa, indigenous ornamental flower species represent an untapped resource of inestimable proportion (FAO, 1999). The under-development of indigenous floral varieties and ornamental plants indicates the country has failed to benefit fully from its biodiversity, which has been partly attributed to political isolation in the past and the effects of sanctions, the absence of incentives and lack of domestic interest in the development of these resources (George & van Staden, 2000).

The indigenous flora of South Africa is world famous for its botanical diversity and is being exploited as cut flowers and ornamental pot plants/garden plants. International interest in South African indigenous floriculture increased since the middle of the eighteenth century, when Linnaeus started naming and describing the rich abundance of new plant examples, albeit in dried form, received initially from the Western Cape (Reinten *et al.*, 2011). The plant genetic resources of the Cape Floral Kingdom provide the basis of many international ornamental flowering plants. Unfortunately little is done in South Africa to utilize these floral resources for the economic benefit of the country (Coetzee *et al.*, 2000). South Africa's tremendous floral wealth has continued to attract the attention of botanists, horticulturists and plant enthusiasts, resulting in many species with ornamental potential being taken away from South Africa. These plants have been bred into numerous cultivars and are now widely cultivated in many places such as Europe, USA, China, Australia and New Zealand (Moyo *et al.*, 2011).

The wild flower industry has a humble origin; members of the disadvantaged communities of the Western Cape picked flowers in the surrounding mountains and sold

them in the streets of Cape Town – a tradition still in existence (Coetzee and Littejohn, 1995). Over the last 250 years, horticulturists and botanists have transported many South African floral plants to other regions of the world, where they developed them into garden and floral plants. Plants such as *Gladiolus*, *Freesia*, *Pelargonium*, *Strelitzia* and *Nerine* all originated in South Africa. These plants were developed into successful industries, e.g. approximately US $100 million worth of freesia flowers are sold annually on the Dutch Auctions, with no benefit to the country of origin (Coetzee *et al.*, 1999). Several South African plant species are well known internationally as the source of genetic material for cut flowers that have been hybridized, registered with plant breeders' rights and distributed world-wide (Reinten *et al.* 2011).

The initial success of this industry was based mainly on the unique novelty value of the products. Proteas and other fynbos species infiltrated the "niche market" of exotic floral products. Over the years an opportunity arose for countries such as Australia, New Zealand and Zimbabwe to initiate the cultivation of indigenous flora of South Africa and annex a part of the international protea flower market (Coetzee & Middelmann, 1997). According to the Kaiser study (2000), South Africa's indigenous products, particularly Proteaceae, are "rapidly losing their indigenousness" as South Africa's competitors in Europe, the Middle East, the US and the Pacific Rim begin to cultivate large quantities of these products. Market saturation by traditional materials has provoked an increasing interest in novelties, both in the form of cultivars and new introductions from the wild, and more and more countries are looking to their native flora as a source of such introductions (Heywood, 2003).

The South African floriculture industry has become competitive in the international market since the country's trade liberalization in 1994. The value of floriculture exports increased from R77 million in 1995 to R269 million in 2002 (Matthee *et al.,* 2006). In terms of products and markets, there is exceptionally strong demand for the South African floriculture across the world. The major markets for South Africa's floricultural products are Europe (65%), the USA (9%) and Asia (5.2%) (Van Rooyen, 2005 cited in Matthee *et al.*, 2006). Baudoin *et al.* (2007) states that the *Protea* is South Africa's

flagship cutflower export. The local market is valued at R240 million and export revenue amounts to about R280 million.

According to Reinten and Coetzee (2002) the large and rich biodiversity of the indigenous plants of South Africa offers a valuable source for investigating new crops. Research funding for indigenous crops is a limiting factor in scientific evaluations and trials to commercialize new crops, but worthwhile results have been achieved with regard to basic taxonomic documentation and general botany. Research has been conducted by the Agricultural Research Council (ARC) in South Africa in the field of floriculture using Fynbos. The ARC is a publicly funded institution mandated to conduct research, development and technology transfer to among others contribute to a better quality of life. Many indigenous species have been used in their research, including *Protea*, *Leucadendron*, *Leucospermum*, *Serruria*, *Aulax*, *Mimetes*, *Paranomus*, *Ornithogalum*, *Lachenalia*, *Amaryllis belladonna*, *Nerine*, *Cyrtanthus*, *Gladiolus*, *Lapeirousia* and *Crinum* (Reinten and Coetzee, 2002). Currently the number of cultivars developed from indigenous flora and protected by plant breeders' rights in South Africa are: *Aloe* (14), *Agapanthus* (12), *Protea* (13), *Leucadendron* (12), *Ornithogalum* (9), *Lachenalia* (6), *Dietes* (2) and *Gerbera* (2).

Considerable breeding efforts are required to improve ornamental species. This is due in part to the fact that the breeding objectives concerned have to satisfy the breeder or originator of the new variety, as well as the growers, retailers and consumers (Engels, 2007). In a media report, Prinsloo (2012) urges government to fund research and development of indigenous species. The CEO of the South African Flower Export Council is quoted as saying that the growth of the floriculture industry depends on the niche products. Important policy choices need to be made to stimulate local innovation, to enable local innovators to advance ahead of their competitors, and to build understanding among research institutions as to the nature of IPRs and options available. Policy mechanisms also need to be introduced to develop and improve the leverage of South African pharmaceutical, horticultural and other biodiversity-based enterprises in these globally competitive industries (Wynberg, 2004).

## 6.2 Materials and Methods

The results presented here build on information collected from various sources. The main methods of data collection involved gathering and evaluation of information from the plant breeders' rights register maintained at the Department of Agriculture, Forestry and Fisheries by the Registrar of Plant Breeders' Rights, a National Authority on plant breeders' rights in South Africa. Information obtained from the plant breeders' rights register includes the plant botanical and common name, plant variety name (denomination), applicant name, country of origin, application date of PBR and grant date of PBR. Additional information was obtained from other sources, including literature and personal communication with key stakeholders within the sector.

## 6.3 Results

### 6.3.1 Number of plant breeders' rights applications

Ornamental genetic resources are the biggest category of plant species for which plant breeders' rights are used to protect a variety (Engels, 2007). This trend is also true for South Africa. More than 3 000 plant breeders' rights applications were received in South Africa between 2000 and 2010. It bears noting that most applications received, about 37%, are for ornamental plants. Table 7 shows the trend in number of applications for ornamental plants versus the number of applications received for other crops since 2000. Of all the ornamental plants applications received over this period, about 20% are of varieties developed from plants indigenous to South Africa.

**Table 7** Participation of ornamental plants towards the total number of applications between 2000 and 2010.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ornamental crops** | 117 | 81 | 124 | 156 | 152 | 115 | 99 | 84 | 64 | 106 | 103 | **1201** |
| **Agricultural crops** | 49 | 70 | 70 | 85 | 69 | 76 | 93 | 143 | 136 | 117 | 104 | **1012** |
| **Fruit crops** | 45 | 35 | 40 | 50 | 71 | 57 | 53 | 105 | 96 | 76 | 138 | **766** |
| **Vegetable crops** | 16 | 37 | 28 | 42 | 19 | 9 | 18 | 44 | 24 | 30 | 21 | **288** |
| **Total** | 227 | 223 | 262 | 333 | 311 | 257 | 263 | 376 | 320 | 329 | 366 | **3267** |

### 6.3.2 Number of valid plant breeders' rights

A total of 2 318 plant breeders' rights titles were in force at the end of December 2010. Ornamental plants have the highest number of valid plant breeders' rights (39%). This trend is in line with studies by Srinivisan (2005) which shows that the most striking feature of PVP grants in UPOV member countries is the large proportion of grants accruing to ornamentals. He argues that it is something of a paradox that PVP almost universally evokes the largest response from the ornamental species as the debate on plant variety protection often focuses on its impact on food security for small and resource poor farmers.

Table 8 shows the top ten ornamental crops with valid plant breeders' rights by December 2010. One would note that most valid plant breeders' rights are for roses. This could be because the rose is considered the most important cut flower as well as pot plant and has great variation in flower and plant characteristics, and is adaptive to varied agro-ecological conditions (Rout *et al.*, 2006). Indigenous taxa, e.g. *Agapanthus*, have relatively few protected varieties. However, the number of titles granted to foreign

nationals against domestic nationals may have to be assessed on a crop-by-crop basis as some crops have only domestic applications, e.g. *Aloe* or only foreign applications, e.g. *Chrysanthemum*.

**Table 8** Share of top ten taxa in plant breeders' rights for ornamental plants by December 2010

| Taxon | Number of valid plant breeders' rights |
|---|---|
| **1. *Rosa*** | 368 |
| **2. *Chrysanthemum*** | 64 |
| **3. *Impatiens*** | 30 |
| **4. *Pelargonium*** | 22 |
| **5. *Lilium*** | 21 |
| **6. *Argyranthemum*** | 18 |
| **7. *Osteospermum*** | 18 |
| **8. *Alstroemeria*** | 15 |
| **9. *Petunia*** | 15 |
| **10. *Agapanthus*** | 10 |

Concentration of the plant breeders' rights for ornamental plants is greater at the international level than at a national level. About 84% of these belong to foreign breeders, 12% to privately owned local entities and 4% to local public research institutions. Table 9 shows the distribution of plant breeders' rights holders for ornamental plants. It bears noting that, as expected, most plant breeders' rights holders are from EU countries.

**Table 9:** Share of top ten holders of plant breeders' rights for ornamental plants by December 2010

| Company | Country | Number of valid plant breeders' rights on taxa non-indigenous to South Africa | Number of valid plant breeders' rights on taxa indigenous to South Africa |
|---|---|---|---|
| **1. Kordes Sohne** | Germany | 113 | - |
| **2. Ball Horticultural Company** | United States of America | 49 | 10 |
| **3. Agricultural Research Council** | South Africa | - | 38 |
| **4. Dekker Breeding** | Netherlands | 36 | - |
| **5. Delblard Pepiniers** | France | 27 | - |
| **6. Meilland International** | France | 27 | - |
| **7. Poulsen Roser APS** | Denmark | 22 | - |
| **8. Deliflor Royalties** | Netherlands | 21 | - |
| **9. Ludwig's Roses** | South Africa | 21 | - |
| **10. Vletter & De Haan** | Netherlands | 19 | - |

### 6.3.4 Challenges faced by the floriculture industry

South Africa has many advantages for floriculture, such as infrastructure, climate and inputs. However, the industry is characterized by high labour costs, expensive material, lack of market information, a poor knowledge base and secrecy within the industry (Van Rooyen & Van Rooyen, 1998). South Africa struggles to compete with its African counterparts, e.g. Kenya and Zimbabwe in terms of cost factors, as these African countries have advantages in, for example, export volumes and cheap labour (Matthee *et al.*, 2006). Matthee *et al.* (2006) further lists the shortcomings of the South African flower exporters identified by the South African Flower Export Members which included:

little participation in international floriculture programs, and failing to differentiate or add value to their products.

The monetary value of sales based on flowers of southern African origin does not currently provide a large enough source of income to justify major new research projects in South Africa. Furthermore, the South African indigenous flower trade is not yet fully regulated as an industry enterprise and is historically focused on the local market. International trends in increased transport cost, concern about carbon footprints, higher labor costs in South Africa compared to other large-scale producing countries and the economic crises since 2009 impacted negatively on the South African flower trade (Reinten *et al.*, 2011). Malanseuns Pleasure Plants (pers. comm.) mentioned that labour laws in the country are too restrictive for South Africa to compete. According to Prinsloo (2012) inflationary pressures, tariffs, a volatile rand and restrictive, slow-moving, regulatory issues were putting additional stress on South Africa's high-volume, low-margin flower industry.

According to New Nursery (pers. comm.), many growers in South Africa still either do not understand or do not want to respect the PBR legislation. Infringement of IPRs is also a great concern in the ornamental sector. A grower needs only a limited number of plants to produce hundreds and thousands of identical plants which can be used for the production of other plants and cut flowers. The reason is that for vegetatively reproduced plants no technical or natural barriers exist for reproduction. IP-piracy causes not only loss in the revenues but generates additional, unproductive costs. The right holder has to carry out investigations to gain the information necessary to pursue an infringement; he needs legal advice and has to pay for court actions (CIOPORA, 2007). Malanseuns Pleasure Plants (pers. comm.) also suffered from illegal growing of plants in 2010, but this was sorted out between the two parties without the involvement of the courts or the Plant Breeders' Rights Office. New Plant Nursery (pers. comm.) mentioned that in their view, policing of PBR transgressions is difficult and expensive. It was also mentioned that the evaluators employed to do evaluations often do not know

the market well enough to know all the varieties present to be able to make comparisons.

Government also does not do enough in promoting gardening as a free time activity for the emerging middle class of previously disadvantaged communities and not enough is done to promote the use of indigenous plants as an alternative to potentially invasive exotic species (New Plant Nursery, pers. comm.).

## 6.4 Conclusions

In this section the economic importance of the South African floricultural industry was highlighted. It is recognized that the South African floriculture industry has the opportunity to grow into a significant player in the world floricultural markets. It is however argued that this may be deterred by, among others, the fact that South Africa's indigenous products are being copied and improved by its competitors at an alarming rate due to the fact that there is currently no protection strategy in place (Kaiser Associates, 2000). Reinten *et al.* (2011) however argue that successful commercialization of South African plants does not rely on their unique aesthetic features and attractiveness, but in order to compete on international markets, they need to be true to type, available in large quantities for a relatively long marketing period and have an acceptable vase life.

In this study, the circumstances surrounding the Plant Breeders' Rights Act show there was no systematic trend in the number of plant breeder's rights received over this period as they tend to increase or decrease over the years. The number of applications tends to pick up in one year and drop in the next year. There was however a significant increase in the number of applications in 2010, due in particular to a sharp increase in the number of applications received for fruit crops.

A high number of plant breeders' rights applications have been received for ornamental crops compared to other crop types in the past decade. It is however worth noting that

in some years, e.g. 2007 and 2008, the total number of applications for ornamental crops was lower than those for agricultural crops and fruit crops. Sanderson & Adams (2008) list possible explanations for a decrease in number of applications, such as changing environmental conditions, or plant breeders using other mechanisms to protect their varieties.

It is shown that despite the biodiversity richness of South Africa, very few indigenous taxa are eligible for protection in terms of the Plant Breeders' Rights Act and even fewer local cultivars are protected. Coetzee *et al.* (2000) argue that due to the serious threat from competing countries, only unique cultivars can give South Africa the competitive edge. Such cultivars can be protected internationally by registration of intellectual property rights like plant breeders' rights, thereby providing protection to local breeders. It would be important to structure government initiatives to assist the private sector to expand this industry. Effective linkages between technology, research and development and producers could clearly provide a major boost to the South African flower industry (Van Rooyen & Van Rooyen, 1998).

The local turnover in floriculture is unfortunately insufficient to allow for large and ambitious new breeding programs and research initiatives, so that public funding is required to stimulate growth in this potentially important industry (Reinten *et al.*, 2011). To ensure that South Africa's role in the international floriculture industry expands and that South Africa judiciously exploits her natural plant resources, a holistic approach is needed between research, development and technology transfer (Coetzee *et al.*, 2000). There is little empirical evidence concerning the impact of plant breeders' rights on the South African floricultural industry. More studies are needed to identify and clarify real or perceived constraints imposed by the national regulatory system (e.g. intellectual property, biodiversity, labour) that might jeopardize the viability of floriculture efforts especially based on exploitation of indigenous plants. Information on the national production of ornamental plants and the effectiveness of Government's support programmes (nationally and provincially) is also not well documented. Hopefully, the outcomes from such studies might recommend practical actions and provide guidance

to the government, the research community and the industry in order to promote further development of the South African floriculture industry.

Some of the ornamental plants are also important medicinal plants in South Africa. The next chapter discusses various intellectual property protection systems afforded to medicinal plants, in view of the legislation governing biodiversity and Access and Benefit-Sharing.

# CHAPTER 7

# PLANT BREEDERS' RIGHTS AND MEDICINAL PLANTS

## 7.1 Introduction

The collection and trade of plants for use as food, drugs, or insecticides dates back to the earliest hunter-gatherer communities. The knowledge and use of local plants was important in the development of medical practices (Merson, 2000). Medicinal plants, since time immemorial, have been used in virtually all cultures as a source of medicine (Hoareau & DaSilva, 1999). Medicinal plants contribute significantly to the rural livelihoods. Apart from traditional healers practicing traditional medicine, more people than ever are involved in collecting, trading and utilizing medicinal plants (Amujoyegbe *et al.*, 2012). Medicinal plants are still widely used in the health-care system of South Africa, particularly by the African population. The use and trade of plants in medicine is not confined to traditional healers, but has entered both the informal and formal entrepreneurial sectors in the South African economy, resulting in an increase in the number of herbal gatherers and traders (Wiersum, *et al.*, 2006). Due to the remarkable plant and cultural diversity in South Africa, a large number of plant species are used for medicinal purposes (Hutchings *et al.*, 1996). It has been estimated that approximately 3000 plant species are used as medicines (van Wyk *et al.*, 1997). There are up to 100 million traditional remedy consumers in southern Africa and as many as 500 000 traditional healers. Up to 700 000 tonnes of plant material are consumed annually (Wiersum *et al.*, 2006). The average South African consumer of traditional medicine uses 750 g of medicinal plants a year (Mander, *et al.*, 2005).

It is well known that plants are an abundant source of medicinal drugs. Between 25 and 50% of current prescription pharmaceuticals come from plants or natural products, either directly or through modifications of biochemical templates harvested from the plants. Aspirin, digitalis, cortisone, taxol, ephedrine, curare and novacaine were all initially plant-derived (Zakrzewski, 2002). In Germany, the value of prescriptions written

for the anti-depressant St. John's Wort is twice that for Prozac, a top selling depressant (Singh, 2006). Currently, there are only a few South African medicinal plants that have contributed to herbal medicines used internationally. These include, for example, aloe (*Aloe ferox*), buchu (*Agathosma betulina*), devil's claw (*Harpagophytum procumbens*), cancer bush (*Sutherlandia frutescens*) and *Hoodia* (van Wyk, 2002).

As Africa is comparatively far behind in the development and control of its medicinal plant industry, researchers are investigating several aspects required for the development of the medicinal plant trade in the region; in particular, the pharmacology and toxicology of African medicinal plants (Fennel *et al.*, 2004). There are, however, many complex issues surrounding the use of indigenous plants in traditional medicine in South Africa, including that of bioprospecting and intellectual property (George & van Staden, 2000).

### 7.1.1 Cultivation of Medicinal Plants

Medicinal plants are considered a healthy source for the people who are able to harvest them from the wild to meet their primary health care needs. The result of the increased demand in both local and international markets as well as bioprospecting activities searching for new sources of new drugs is a source of concern (Amujojegbe *et al.*, 2012). The high and increasing demand of plants for medicinal purposes has resulted in dwindling numbers and sometimes extinction of certain species at an unprecedented rate due to over-harvesting (Moyo *et al.*, 2011). Karki (2002) cited in Amujojegbe *et al.* (2012) estimated that 95% of medicinal and aromatic plants are harvested and collected in the wild. Harvesting from the wild, the main source of raw material, is causing loss of genetic diversity and habitat destruction (Canter *et al.*, 2005). According to van Staden (1999), the increasing demand for medicinal plants has meant that sustainable harvesting of wild plants is not feasible. In fact, the only real solution is to develop medicinal plants as crops through small scale farming. With the increased realization that some wild species are being over-exploited, a number of agencies such as the World Health Organization (WHO), International Union for

Conservation of Nature (IUCN) and World Wildlife Fund for Nature (WWF) are recommending that wild species be brought into cultivation systems (Schippmann *et al.*, 2002).

Netshiluvhi & Eloff (2015) suggest that because environmental factors does not affect biological activity for some species, cultivation might guarantee a long-term solution to excessive global demands. Amujoyegbe *et al.* (2012) also argue that cultivation offers the opportunity to optimize yield, achieve a uniform, high quality product and control in every stage of the production process. It may also allow us to modify concentrations of biologically important compounds through the manipulation of growing environments, through selective breeding methods and through the application of modern biotechnology methods.

In India, medicinal plants procured from cultivated private fields account for 10 percent of the total medicinal plants in active trade (Singh, 2006). By bringing herbs into cultivation, traditional and plant breeding techniques can be applied at the genetic level to improve yield and uniformity, and to modify potency and toxicity (Canter *et al.*, 2005). The commercial viability of bringing medicinal plants into domestic cultivation and the potential for increased use of modern biotechnologies are likely to be strongly influenced by the popular perception of both herbs and biotechnology. One of the main attractions of herbs as medicines is their 'natural' status and the associated, but erroneous, view that they must be safe and intrinsically good for us. In stark contrast is the popular view of crops bred with the assistance of molecular biology and modern farming methods as highly 'unnatural' (Canter *et al.*, 2005). According to Schippman *et al.* (2002) medicinal plant properties in plants are mainly due to secondary metabolites which the plants need in their natural environments under particular conditions of stress and competition and which perhaps would not be expressed under monoculture conditions. Active ingredient levels can be much lower in fast growing cultivated stocks, where wild populations can be older due to slow growth rates and can have higher levels of active ingredients. Netshiluvhi & Eloff's 2015 study on effect of water stress on antimicrobial activity of selected medicinal plant species however does not support the

general perception that cultivation will reduce the biological activity of medicinal properties. This study concluded that cultivation of important medicinal plants will not only conserve plants in nature but also increase the quality of the product and the efficacy and the safety to the user.

Domestic cultivation is a viable alternative and offers the opportunity to overcome problems inherent in the production of herbal medicines. These include species misidentification, genetic and phenotypic variability, variability and instability of extracts, toxic components and contaminants (Canter *et al.*, 2005). The process of domestication is often interpreted as referring to the modification of a plant's morphological characteristics and genetic make-up as well as the artificialization of the biophysical environment in which the plant is growing (Wiersum *et al.,* 2006). Cultivation of medicinal plants, especially high value medicinal plants, is creating new dimensions in the field of agriculture. Plant breeders of medicinal plants play key roles in improvement of medicinal plants because they care for stable produce and uniform plant growth and maturity (Amujoyegbe *et al.*, 2012).

### 7.1.2 Bioprospecting and Biopiracy

Research into natural plant products is an established area of science and is believed by many scientists to hold great potential for the discovery of new drug leads (Pefile, 2005). Over the past 20 years, there has been a resurgence of worldwide scientific research in the field of ethnopharmacology. With the Western world acknowledging the continued use of traditional medicine by the majority of developing countries, and the need for novel drug development, much of the pharmaceutical research in recent years has focused on an ethnobotanical approach to drug discovery (Light *et al.*, 2005). Medicinal plants are an integral part of research developments in the pharmaceutical industry. Such research focuses on the isolation and direct use of active medicinal constituents, or on the development of semisynthetic drugs, or still again on the active screening of natural products to yield synthetic pharmacologically active compounds (Hoareau & DaSilva, 1999).

Bioprospecting is the 'exploration, extraction and screening of biological diversity and indigenous knowledge for commercially valuable genetic and biochemical resources' (Zakrzewski, 2002). Global Exchange (2001) defines bioprospecting as 'the search for biological resources and accompanying indigenous knowledge – primarily for the purpose of commercial exploitation. According to Wekesa (2006) biopiracy is the process through which the rights of indigenous cultures to genetic resources and knowledge are ignored in preference to the Western model of IPRs. A large number of patents, for example, have been granted on genetic resources and knowledge obtained from Africa and other developing countries. An example is the US patent number 5, 401, 5041 granted for wound healing properties of turmeric acid. The innovation has been used in India for centuries prior to the registration of the patent. The Council of Scientific and Industrial Research (CSIR) from India successfully applied for its revocation (Wekesa, 2006).

With an increase in bioprospecting, however, another political, economic and human rights issue has risen: the notion of biopiracy, of which several definitions have been provided. For decades, plant collectors from industrialized countries have ventured southward in search of valuable genetic material for plant breeding, but no money changed hands in the process, nor was recognition given to the indigenous communities who selected, maintained and improved traditional varieties. This type of practice has become known as biopiracy, which refers to 'the theft of intellectual property, such as genetic resources or traditional plant medicines, from poor communities by multinational companies' (Zakrzewski, 2002).

Information on the use of plants in traditional medicine is enshrined in traditional knowledge (Wekesa, 2006). The need to protect traditional knowledge is increasingly being realized as traditional knowledge and associated practices are recognized as having an essential role to play in environmental management and sustainable development (Daya & Vink, 2006). Global Exchange (2001) defines biopiracy as 'the illegal appropriation of life – microorganisms, plants, and animals (including humans) - and the traditional cultural knowledge that accompanies it'. Barnett (2006) cited in

Roberson (2008) defines 'biopiracy' as the term coined to describe the practice of private companies patenting traditional remedies from the wild and selling them at a vast profit, often allowing little or none of that profit to go back to the country or indigenous and local communities of origin. Bioprospecting of new drugs from medicinal plants and the exploitation of unprotected traditional knowledge in starting-up potentially new bio-industries are the focus of new monitoring measures (Hoareau & DaSilva, 1999). Protection of traditional knowledge, access to genetic resources and sharing of related benefits are issues of great importance for developing countries because of their enormous cultural, social and potential economic value. These issues are cross-cutting and have emerged in a number of policy areas including food and agriculture, the environment, human rights, health, cultural policy, trade and economic development (Fuavao, 2003). Historically, a lack of bioprospecting legislation and associated regulations has permitted almost unconstrained access to South African bioresources, with materials being harvested, sometimes in destructively excessive quantities, and being exported to research and development nodes abroad, for innovative value addition, and off-shore financial benefits. The consequence has been that the country as a whole, including traditional knowledge-owning communities and biological resources providers, have not benefited equitably from local bioresource commercialization (Crouch *et al.*, 2008).

## 7.2 Access and Benefit-Sharing

There are several instruments (nationally and internationally) that address Access and Benefit-Sharing as follows:

### 7.2.1 Convention on Biological Diversity (CBD)

Article 8(j) of the CBD states that 'Each contracting Party shall, as far as possible and as appropriate: Subject to 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'.

### 7.2.2 The Nagoya Protocol on Access and Benefit-sharing

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity is a supplementary agreement to the Convention on Biological Diversity. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Nagoya Protocol on ABS was adopted on 29 October 2010 in Nagoya, Japan and entered into force on 12 October 2014. South Africa ratified the Nagoya Protocol in January 2013.

Article 5(2) of the Nagoya Protocol states that 'Each Party shall take legislative, administrative or policy measures, as appropriate, with the aim of ensuring that benefits arising from the utilization of genetic resources that are held by indigenous and local communities, in accordance with domestic legislation regarding the established rights of these indigenous and local communities over these genetic resources, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms'; and Article 6(1) states that 'In the exercise of sovereign rights over natural resources, and subject to domestic access and benefit-sharing legislation or regulatory requirements, access to genetic resources for their utilization shall be subject to the prior informed consent of the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention, unless otherwise determined by that Party' (https://www.cbd.int/abs/).

Since its adoption, the CBD has strived to implement its three major goals: the conservation of biological biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources. Although Medicinal and Aromatic Plants (MAPs) have not been explicitly on the agenda of the various CBD meetings, all three goals of the Convention are fully applicable to MAP resources.

### 7.2.3 The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)

South Africa has a high level of endemism and biological diversity. This makes South Africa a favourable destination for bioprospectors in the garb of companies seeking potential new crops and novel biochemical molecules with medicinal, agricultural, horticultural, environmental or other economic potential (George and Van Staden, 2000). Recently introduced bioprospecting legislation in South Africa has sought to redress disparities in the sharing of benefits from bioprospecting (Crouch *et al*., 2008).

NEMBA aims to, among others, ensure the sustainable use of indigenous biological resources and the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. Section 2(a)(iii) states that the objectives of this Act are 'within the framework of the National Environmental Management Act, to provide for the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources'. NEMBA defines bioprospecting, in relation to indigenous biological resource as any research on, or development or application of, indigenous biological resources for commercial or industrial exploitation, and includes-

*(a)* the systematic search, collection or gathering of such resources or making extractions from such resources for purposes of such research, development or application;

*(b)* the utilisation for purposes of such research or development of any information regarding any traditional uses of indigenous biological resources by indigenous communities; or

*(c)* research on, or the application, development or modification of, any such traditional uses, for commercial or industrial exploitation;

The purpose of Chapter 6 of the NEMBA is to:

a) regulate bioprospecting involving indigenous biological resources;

b) regulate the export from the Republic of indigenous biological resources for the purpose of bioprospecting and any other kind of research; and

c) to provide for a fair and equitable sharing by stakeholders in benefits arising from bioprospecting involving indigenous biological resources.

The definition of indigenous biological resources in this chapter includes

- any indigenous biological resource …whether gathered from the wild or accessed from any other source, including any animals, plants or other organisms of an indigenous species cultivated, bred or kept in activity or cultivated or altered in any way by means of biotechnology

- any cultivar, variety, strain, derivative, hybrid or fertile version of any indigenous species of animals, plants or other organisms

Section 81(1) of the NEMBA states that “No person may without a permit issued in terms of Chapter 7:

a) engage in bioprospecting involving any indigenous biological resources; or

b) export from the Republic any indigenous biological resources for the purpose of bioprospecting or any kind of research.

NEMBA Regulations on Bio-prospecting, Access and Benefit-Sharing were gazetted on 8 February 2008. Crouch *et al.* (2008) critiques the NEMBA and ensuant regulations governing access to biological resources for bioprospecting purposes, and benefit

sharing. This work gives emphasis to some of the definitions in the Act and regulations, concluding that the well-intentioned but impractical legislation and regulations could impose severe restraints on bioprospecting activity (and benefits derived therefrom) in years to come, besides collapsing our existing bioresource-based industries within the country.

Amendments to the Regulations on Bioprospecting, Access and Benefit-Sharing were gazetted on 19 May 2015. Some of the changes include: amending the definitions of 'applicant' and 'benefit-sharing agreement', 'material transfer agreement', 'traditional use and knowledge'; inclusion of the definition of 'biotrade'. It remains to be seen whether these will adequately address concerns on ABS regulations thus far. To date, eight permits have been issued as depicted in the Table 10 below:

**Table 10** Permits issued in terms of NEMBA

| Indigenous Biological Resource | Permit Type | Applicant | Use | Beneficiaries | Beneficiation |
|---|---|---|---|---|---|
| ***Galenia africana*** | Bioprospecting | Rapitrade 670 (Pty) Ltd, | Further extraction and purification of flavonoids for the development of commercial products in the agro-food chemical and pharmaceutical markets. | 1) Khoi Heritage Foundation – Indigenous knowledge holders<br>2) Komaggas Buffelsrivier Inheemse Vennootskap – Access providers | Monetary & Non-monetary |
| ***Sceletium tortuosum*** | Integrated export and bioprospecting | HGH Pharmaceuticals (Pty) Ltd | Successfully cultivated a selection of naturally occurring chemo-types as a new commercial crop on a large scale and developed a standardised extract, known as Zembrin which is manufactured to EU-GMP. | South African National San Council (San), Paulshoek and Nourivier or Nama communities | Monetary & Non-monetary |
| ***Chlorocebus aethiops*** | Integrated export and bioprospecting | The Regents University of California jointly with the University of Free State | To assist in the international collaborative effort to establish *Chlorocebus* as the leading non-human primate model system for genomics-driven research. | University of Free State: lecturer and post graduate students, the broader national and international research community in HIV/AIDS related research, provincial conservation agencies and departments in KwaZulu-Natal, Limpopo, North West, Northern Cape and Eastern Cape | Non-monetary |

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|---|---|---|---|---|---|
| ***Indigenous Biological Resource*** | *Permit Type* | *Applicant* | *Use* | *Beneficiaries* | *Beneficiation* |
| ***Aloe ferox*** | Integrated export and bioprospecting | Dennis Noel de Villiers | To sell *Aloe ferox* sap, extracts and crystals on national and international markets for bioprospecting | Land owner of farm Matjieskraal in Kommadagga Alicedale, Eastern Cape | Monetary & Non-monetary |
| ***Aloe ferox* and *Pelargonium sidoides*** | Integrated export and bioprospecting | Gower Enterprise | To sell raw materials in various formats on national and international markets for bioprospecting | 1) Imingcangathelo Community Development Trust,<br>2) Nonkqubela Multi-Purpose Community Project<br>3) Tshatshu Traditional Council and<br>4) The Anta Traditional Authority | Monetary & Non-monetary |
| ***Aloe ferox, helichrysum odoratissimu, Pelargonium reniforme and Palergonium sidiodes*** | Integrated export and bioprospecting | Essential Amathole (PTY) LTD | To produce a range of organic oils and medicinal plant extracts for local and international markets.. | Amathole Community Trust | Monetary, Non-monetary& In-kind |
| **40 indigenous biological resources.** | Bioprospecting | Edakeni Muthi Futhi Trust | The cultivation, processing and marketing of traditional medicinal plants for local and international markets. | Edakeni Community, Senzokuhle Food Production Cooperative Ltd and Enzangakho Consultancy cc | Monetary & Non-monetary |
| ***Sclerechiton illicifolius*** | Integrated export and bioprospecting | Council for Scientific and Industrial Research (CSIR) | The relative sweetness determined to be 1200 - 1400 times sweeter than that of sucrose when tested as 5% and 10% solution. | Seleka and Shongwane communities under Lephalale Municipality, Limpopo Province | Monetary and Non-Monetary |

Source: Department of Environmental affairs website: www.dea.gov.za

### 7.2.4 Protection, Promotion, Development and Management of Indigenous Knowledge Systems Bill (IKS Bill)

The Bill, emanating from the Department of Science and Technology, aims to provide for the protection, promotion, development and management of indigenous knowledge systems; to provide for the establishment and functions of the National Indigenous Knowledge Systems Office; to provide for the management of rights of indigenous knowledge holders; to provide for the establishment and functions of the Advisory Panel on indigenous knowledge systems; to provide for access and conditions of access to knowledge of indigenous communities; to provide for the registration, accreditation and certification of indigenous knowledge holders and practitioners; to provide for the facilitation and coordination of indigenous knowledge systems-based innovation; and to provide for matters incidental thereto.

Benefit sharing as defined in the Bill includes the fair and equitable sharing of benefits that accrue from access to indigenous knowledge, which includes participation in scientific research, fair and equitable sharing of research and development results and commercial and other benefits derived from indigenous knowledge, access to and transfer of technology, priority access to results and benefits accruing from the access to any indigenous knowledge or indigenous knowledge systems.

The IKS Bill was published on 20 March 2015 to solicit comments from the public, including other government departments. The Bill has clauses that may have a linkage with the Plant Breeders' Rights Act.

## 7.3 Intellectual Property Protection in Medicinal Plants

### 7.3.1 Subject Matter of Protection

#### a) Patent Act, 1978 (Act No. 57 of 1978)

According to the South African Patent Act, 1978 (Act No. 57 of 1978), as amended, 'a patent may be granted for any new invention which involves an inventive step and which is capable of being used or applied in trade, industry or agriculture' (s. 25(1)). In the protection of IP rights of medicinal plants, patents can cover the following areas: 1) an identified active principle/s from a plant, 2) a method/process for the isolation of the principle and 3) new use/s of particular extracts (George & van Staden, 2000). Daya & Fink (2006) argue that the plant cannot be patented in South Africa but the active compounds, ingredients and processes of extracting compounds of the plant may still be patented. Both South African legislation and the TRIPS agreement appear to subscribe to the view that the isolation, identification and developing of active compounds from natural resources constitutes a microbiological process, which brings it to the ambit of a patentable subject matter. In terms of requirements of listed and in terms of the interpretation of the terms contained in the Act, it appears that knowledge of active compounds or substances may qualify for patent protection in South Africa (Daya & Fink, 2006).

Some patents have received attention in the media, particularly those on an appetite suppressant from *Hoodia*, and a hypnotic from *Sceletium*. Other South African plants of commercial interest for which various patents have been filed include *Agathosma betulina, Aspalathus linearis, Brackenridgea zanguebarica, Combretum caffrum, Combretum kraussii, Harpagophytum procumbens, Hypoxis hemerocallidea and Prunus africana* (van Wyk, 2002, source: United States Patent and Trademark Office, http://www.uspto.gov).

**b) Plant Breeders' Rights, 1976 (Act No. 15 of 1976)**

A plant breeder's right is granted to a plant variety that is new, distinct, uniform and stable. Literature discussed above indicates that plant breeders are interested in breeding medicinal plant varieties that are uniform and stable. In light of the above, if a variety developed from a medicinal plant is found to conform to the conditions of protection then such a variety is eligible for protection in terms of the Plant Breeders' Rights Act. The Plant Breeders' Rights Act, 1976 already provides for protection of some of the kind of plants well-known for their medicinal properties, including *Aloe*, *Artemisia*, *Pelargonium*, to name but a few. The Plant Breeders' Rights Bill (2015) proposes that protection be extended to all kinds of plants which, if made into law, means that all kinds of plants will be covered.

### 7.3.2 Access and benefit-sharing

**a) Patents**

The most important impact of IPR, specifically patents, on biodiversity is that the rights of countries over their genetic resources lead to direct or indirect misappropriation of biological and genetic resources, particularly, the traditional knowledge, which has also been called 'biopiracy' (Dewan, 2011).

One of the most famous cases on benefit-sharing is the San-Hoodia case involving the patent taken out on the appetite suppressant properties of *Hoodia*, a plant that has been used for many years by the San people as a substitute for food and water during hunting expeditions. Several studies have been conducted on the Hoodia case of benefit sharing (Wynberg & Chennels, 2009; Wynberg, 2004a).

Another example involving a South African plant, that attracted media attention, is that of US Patents granted to Dr Willmar Schwabe Gmbh & Co.KG, Germany. The invention relates to production methods for obtaining dry extracts from *Pelargonium sidoides*

and/or *Pelargonium reniforme*, extracts which may be obtained according to said method, and pharmaceutical products comprising such extracts. Schwabe Pharmaceuticals manufactures a syrup called Umckaloabo from the roots of these plants to treat respiratory tract infections such as bronchitis and common coughs and colds.

*Pelargonium sidoides* is widely distributed in South Africa, occurring in the Eastern Cape, Free State and Gauteng Provinces. The plant also occurs in Lesotho. According to Maree & Viljoen (2007), *Pelargonium sidoides* and *Pelargonium reniforme* are highly valued in South Africa. For hundreds of years various ethnic groups have used root extracts of *P. sidoides* as a remedy to treat coughs, upper respiratory tract irritations and gastrointernal conditions.

Communities in Alice, Eastern Cape have been using roots of the plant for generations to treat respiratory tract infections, including tubercolosis. The community, with the help of the Africa Centre for Biosafety (now Africa Centre for Biodiversity) challenged this patent as they argued that Schwabe Pharmaceuticals illegally used their traditional knowledge and genetic resources without any compensation to the community. In January 2010, the Opposition Division of the European Patent Office (EPO) revoked the patent in its entirety. It was revoked because it was found not to satisfy the requirement of inventiveness (www.acbio.org.za). This was a victory indeed for South Africa and the community in Alice, Eastern Cape. However one may argue that literature has shown that the plant is widespread and the traditional knowledge associated with it runs across various ethnic groups. Crouch *et al.* (2008) raised the fact that, in relation to Benefit-Sharing Agreements, 'indigenous community' is not defined in NEMBA, but defined in the Regulations (2008) as 'any community of people living or having rights or interests in a distinct geographical area within the Republic of South Africa with a leadership structure and-

i. whose traditional uses and indigenous biological resources to which an application for a permit relates, have initiated or will contribute to or form part of the proposed bioprospecting; or

ii. whose knowledge of or discoveries about the indigenous biological resources to which an application for a permit relates are to be used for the proposed bioprospecting.

The Regulations also do not define the required 'leadership structure' of the indigenous community, to allow for the unambiguous identification of appropriate TK-holding indigenous communities eligible to enter into Benefit-Sharing Agreements (Crouch *et al.,* 2008). The NEMBA: Amendments to the Regulations on Bioprospecting, Access and Benefit-Sharing gazette in May 2015 does not seem to clarify this issue. Regulation 39(2) provides for the Director-General to enter into the Benefit-Sharing Agreement with the applicant in cases where stakeholders for the provision of or access to the indigenous biological resources cannot be identified.

The Patents Amendments Act, 2005 (Act No. 20 of 2005) complements the NEMBA with the requirement for applicants of patents to lodge a statement disclosing whether or not the invention for which protection is claimed is based on or derived from an indigenous biological resource, genetic resource, or traditional knowledge or use.

### b) Plant Breeders' Rights

There are not many cases involving plant breeders' rights granted for varieties developed from medicinal plants in as far as Access and Benefit-Sharing is concerned. However, the recent granting of a plant breeder's right to Monsanto, by USA (PVPA Certificate 200400327) and the European Union (CPVO Certificate 20050779), for a purple carrot variety, referred to as 'Turkey Black Carrot' which has sparked media attention is of relevance. Monsanto, through their subsidiary Seminis, purchased seed from farmers in Turkey, and conducted selections to develop a variety with desired shape and colour. This case brings to the fore the issue of Access and Benefit-Sharing and Disclosure of Origin in relation to plant variety protection/plant breeders' rights.

UPOV (2003) issued a Reply to the Notification of June 26, 2003, from the Executive Secretary of the Convention on Biological Diversity (CBD) notification on Access to Genetic Resources and Benefit-Sharing. The following are excerpts from this Reply:

a) Access to Genetic Resources: *It is of the opinion that access to genetic resources is a key requirement for sustainable and substantial progress in plant breeding. The concept of 'breeder's exemption' in the UPOV Convention, whereby acts done for the purposes of breeding other varieties are not subject to any restriction, reflects the view of UPOV that the worldwide community of breeders need access to all forms of breeding material to sustain greatest progress in plant breeding and, thereby, to maximize the use of genetic resources for the benefit of the society'.*

b) Disclosure of Origin: *The breeder is usually required, in a technical questionnaire that accompanies his application of protection, to provide information concerning the breeding history and genetic origin of the variety. UPOV encourages the information on the origin of the plant material, used in the breeding of the variety, to be provided where this facilitates the examination mentioned above, but could not accept this as an additional condition for protection since UPOV Convention provides that protection should be granted to plant varieties fulfilling the conditions of novelty, distinctness, uniformity, stability and a suitable denomination and does not allow any further or different conditions for protection.*

c) Prior Informed Consent: *UPOV notes that this is consistent with Article 15 of the CBD, which provides that the determination of the access to genetic resources rests with the national governments and is subject to national legislation. Furthermore, UPOV considers that the competent authority for the grant of the breeder's rights is not in a position to verify whether the access to genetic material has taken place in accordance with the applicable law in this field.*

This approach by UPOV has received criticism from various authors, notably Correa *et al.* (2015) published by the Association for Plant Breeding for the Benefit of Society (APREBES) which is a network of civil society organizations from developing and

industrialized countries. According to Correa *et al.* (2015) UPOV's restrictive position on this subject undermines the implementation of the CBD and the Nagoya Protocol as well as the efforts made by developing countries to curb misappropriation of genetic resources.

In South Africa, the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976), unlike the Patents Amendment Act, does not require applicants to 'disclose whether or not the invention for which protection is claimed is based on or derived from an indigenous biological resource, genetic resource, or traditional knowledge or use'. The applicant is however required, in the application for a plant breeder's right and the accompanying technical questionnaire to declare the origin of the genetic material and the breeding history of the variety concerned.

The Plant Breeders' Rights Bill, 2015 provides for the applicant to submit relevant documentation, e.g. a permit, 'in the event that a variety may not be used without prior approval in terms of other legislation. This is an attempt to ensure that the legislation governing plant breeders' rights is aligned to other relevant pieces of legislation applicable to issues of Access and Benefit-Sharing such as the NEMBA. NEMBA, however explicitly excludes indigenous biological resources listed in terms of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) as well as the artificial propagation, multiplication or cultivation of flora species for the local and international cut flower and existing ornamental plant markets. Agricultural crops and ornamental crops make up the majority of valid plant breeders' rights in South Africa. For example at the end of 2014, 35% of valid plant breeders' rights were for Agricultural Crops, 33% for Ornamental Crops, 23% for Fruit Crops and 9% for Vegetable Crops. It remains to be seen if the clause inserted in the Bill will adequately address the issues around Access and Benefit-Sharing, despite these exceptions in NEMBA, and the fact that South Africa has not yet acceded to the ITPGRFA.

## 7.4 Conclusions

South Africa's richness in biodiversity and use of traditional medicine makes this country a hub of bioprospecting for new crops and biochemical molecules for potential use in the pharmaceutical industries. Researchers/bioprospectors have to be mindful of legislation governing issues around intellectual property protection as well as Access and Benefit-Sharing. The study addressed the conditions for protection in terms of the Patents Act as well as the Plant Breeders' Rights Act, concluding that in South Africa, both forms of protection are possible, depending on what aspect of the plant is protected. The provisions of NEMBA and associated Regulations were analysed in relation to the intellectual property laws, and this study has shown that there may be gaps in respect to linking Access and Benefit-Sharing with the Plant Breeders' Rights system, in view of the exceptions afforded by NEMBA in relation to plants listed in ITPGRFA and cut flowers and ornamental plants. The Department of Environmental Affairs and the Department of Agriculture, Forestry and Fisheries might have to enter into discussions in relation to this matter to determine if it is an issue of concern that could be addressed by amending the relevant legislation(s) if needed.

# CHAPTER 8

# GENERAL CONCLUSIONS

The South African National Development Plan (NDP) aims to eliminate poverty and reduce inequality by 2030. According to the NDP, South Africa can realize these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. South Africa's agriculture, forestry and fisheries sector has not grown as much as the other sectors over the past few decades, but remains a critical sector for employment and food security among the country's rural poor in particular and is thus a sector in which development opportunities should be vigorously pursued and not overlooked (Integrated Growth and Development Plan, 2012). Development of new improved plant varieties contributes to increasing agricultural productivity and therefore in job creation and poverty alleviation. Plant breeders' rights play a vital role as an incentive for plant breeders to invest in research and development of new plant varieties.

The overall aim of this study is to contribute towards using biodiversity in South Africa for the benefit of all of its people by examining the impact of intellectual property protection, particularly plant breeders' rights, and to propose recommendations to the key issues for national government and policy developers from a practical point of view. To achieve this aim, a number of objectives were formulated with key results presented under different headings below:

### 8.1 To document the current South African legislation on plant breeder's rights with an analysis of some fundamental principles of the plant breeders' rights system.

Although the Plant Breeder' Rights Act was promulgated in 1976 and South Africa became a member of UPOV in 1977, not much is documented on the plant breeders' rights system in South Africa, especially from the administrator's perspective. There is still a lack of understanding of key principles of the plant breeders' rights system and a lack of knowledge about this legislation by some role players in the Agricultural sector. The Department of Agriculture, Forestry and Fisheries has to develop activities and programmmes to create awareness around the plant breeders' rights system in South Africa.

### 8.2 To analyze impact of plant breeders' rights on seed crops, particularly in relation to Farmers' Rights.

The most contentious issue in the realm of plant breeders' rights is around Farmers' Rights. Farmers' Rights in this regard are either interpreted in a broad sense as contemplated in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) or in a narrow sense in as far as the rights of farmers to save, exchange and sell seed. The UPOV 91 system is viewed as not suitable for developing countries, but is designed for European countries as it prohibits farmers from continuing with their traditional farming systems. Developing countries are encouraged to develop alternative *sui generis* systems with the Indian system hailed as exemplary.

It is my view that we should be cautious in trying to advocate for systems that seem to be working in other countries. South Africa has its own unique situation, e.g. different government departments dealing with different aspects around intellectual property protection and farmers' rights, e.g. Department of Agriculture, Forestry & Fisheries dealing with intellectual property protection only in as far as plant breeders' rights;

Department of Trade & Industry being custodians of intellectual property laws in South Africa and administrators of, among others, the Patents Act; Department of Environmental Affairs dealing with Access and Benefit Sharing matters; Department of Science and Technology dealing with Indigenous Knowledge Systems and NIPMO dealing with intellectual property protection emanating from publicly funded research institutions. South Africa is only one of a few countries having such a diverse groups of farmers including historically disadvantaged farmers and mega farming complexes. These factors necessitate that government, policy developers and civil society organizations work together and assess South Africa's socio-economic and political situations in order to come up with policies that reflect South Africa's realities for the protection of both the farmers and the breeders. Also, South Africa needs to engage on debates around acceding to the Treaty as this would pave a way for the development of such policies.

### 8.3 To conduct a survey on the experiences of various stakeholders on the application of the farmers' privilege provision in South Africa and on the understanding of legislation pertaining to plant breeders' rights, in particular the farmers privilege concept, by the smallholder farmers from historically disadvantaged backgrounds.

The farmers' privilege provision was included in the Plant Breeders' Rights Act only in 1996. This provision brought unhappiness both to the breeders and civil society organizations. In the breeders' view this provision created a loophole for abuse by commercial farmers. The civil society organizations' view is that this provision discriminates against smallholder farmers as it prohibits them from continuing with their tradition of saving, exchanging and selling seed. None of the stakeholders apparently dispute that subsistence farmers should be allowed to continue with this tradition.

The majority of smallholder farmers from historically disadvantaged backgrounds are neither familiar with the Plant Breeders' Rights Act nor with issues around the farmers' privilege concept. One would wonder if both the governments and civil society organizations are doing enough to educate the very farmers' interests they are claiming to be protecting and whose interests are being served regarding policies and legislation that may impact on their livelihoods.

It is interesting to note that some of the smallholder farmers do not want to save seed as they consider this practice to contribute to them obtaining lower yields. Some farmers confirmed that they do their own selections but have never heard of the plant breeders' rights legislation. They therefore would not know whether their selections would qualify for plant breeders' rights or not. In countries like Kenya, smallholder farmers are encouraged to apply for plant breeders' rights protection. Perhaps government and civil society organizations work together in sharing with the farmers both the perceived positives and perceived negatives about the plant breeders' rights system and other Seed Laws including the varietal listing system and seed certification. This would allow farmers to make informed decisions based on their own experiences and future aspirations. Policy makers should not develop policies in isolation but must involve all stakeholders, not only in the formal sector, in developing such policies.

Based on the engagements with stakeholders, a proposal was made that the farmers' privilege provision be amended to allow for the Minister to prescribe among others: the crops that will be subjected to this provision; the category or categories of farmers that will benefit; the uses of farm-saved seed; and the circumstances under which royalties will be paid to the breeder. This is an attempt to recognize the legitimate interests of the breeder as well as with the interests of the farmers. These amendments were discussed and welcomed by various stakeholders and have since been included in the draft Plant Breeders' Rights Bill which is anticipated to be tabled in Parliament in the near future.

### 8.4 To document the current legal framework on Genetically Modified Organisms (GMOs) in South Africa.

The legal framework pertaining to GMOs is spread across different government departments, namely, the Department of Agriculture, Forestry and Fisheries for the administration of the GMO Act; the Department of Environmental Affairs for monitoring; the Department of Health and the Department of Trade and Industry for labeling requirements. Each of these departments, together with six other departments, is represented in the Executive Council appointed in terms of the GMO Act, which is the decision-making body for all applications of GM activities in South Africa.

South Africa has approved only three GM crops for commercialization, viz. maize, soy bean and cotton. Engagements with stakeholders have shown that some members of the public are of the view that everything that is not organically grown is GM. Again this shows more needs to be done to inform and educate the public, from farmers to the consumer, about policies and legislation that impact on them. There is a lot of debate around GM matters including impact on health, impact on the environment, calls around labeling of GM products and calls for banning of GMOs. The public need to be educated on fundamental principles to be able to engage effectively in such debates.

### 8.5 To analyse intellectual property protection afforded to GMOs in South Africa and the extent of 'double protection' in terms of the Plant Breeders' Rights Act, 1976 and the Patents Act, 1978.

Dual protection is one of the most debated issues around intellectual property protection of GM varieties where breeders could protect the event using Patent Law and

the plant variety itself using Plant Breeders' Rights Law. Plant breeders' rights laws can allow for farmers to save seed but not the patent law. This may mean that in some instances, although a farmer can save seed in terms plant breeder's right, he is prohibited to do so in terms of the patent.

Currently there seem to be no plant varieties subjected to dual protection in terms of the Plant Breeders' Rights Act, 1978 and the Patents Act, 1978 in South Africa. However, new products are being developed and I expect that this situation will exist soon. Although, it has been argued that dual protection is possible in South Africa, the Plant Breeders' Rights Act, the Patents Act and the draft National Policy on Intellectual Property are silent on dual protection. Policy makers should initiate discussions around this matter and a policy stand taken on how dual protection should be handled in future taking into consideration the provisions of relevant legislation, the interests of the innovators as well as the interests of the farmers in order to achieve equitable protection of intellectual property in plant varieties.

## 8.6 To analyse the South African floriculture industry and with special emphasis on the participation of indigenous ornamental crops in the plant breeders' rights system.

South Africa is blessed with rich biodiversity. It is reported that South African indigenous flower species represent an untapped source of very high value and that South Africa has the potential to grow into a significant player in the world floricultural markets. The success of the floricultural industry hinges on novelty of the products. Given the popularity of the South African flora internationally and the potential of the floriculture industry to create employment for thousands of people, government and policy developers must develop policies that support the development and release of new varieties using indigenous ornamental plants.

Although ornamental plants attract the highest number of plant breeders' rights applications, the major challenge with regard to the plant breeders' rights system is that of infringements, as it is relatively easy to reproduce vegetatively propagated plants –Policing of PBR infringements and potential court cases are expensive. Other challenges faced by the industry include high labour costs and lack of market information. Continued financial support should be given by the Department of Agriculture, Forestry and Fisheries together with Provincial Departments of Agriculture, for research and development pertaining to the development of indigenous ornamental crops. The issue on infringements pertaining to ornamental crops is highly likely to be curtailed should the new Bill be passed in parliament as it will be addressed by the amendments on the farmers' privilege as well as offences and penalties provisions. The national Department of Agriculture, Forestry and Fisheries together with the other relevant departments, e.g. the Department of Labor and the Department of Trade and Industry need to engage more with the floricultural industry stakeholders to discuss the challenges facing the industry and come up with policies that would be conducive for the further development of the industry in order for South Africa to benefit from its unique biodiversity.

## 8.7 To analyse intellectual property protection afforded to medicinal plants in relation to Access and Benefit-Sharing as contemplated in NEMBA.

Plant breeders are interested in developing varieties of medicinal plants that will be uniform and stable. Researchers and bioprospectors continue to search for novel plants and biochemical compounds for possible use in the pharmaceutical industry. It is vital that these stakeholders are aware of the provisions of the different intellectual property legislations, in the form of the IPR Act, the Patent Act and the Plant Breeders' Rights Act as well as legislation on biodiversity and Access and Benefit-Sharing. Policy developers, on the other hand must ensure that the different pieces of legislation are

aligned and drafted in a manner that creates an enabling environment for the benefit of South Africa and all of its people.

## 8.8 Interpretation and implications for future research

This study appears to be at present the only study to document the South African plant breeders' rights system from the administrator's perspective. Intellectual property protection is a wide and far-reaching topic and as such this study was limited by a number of factors. It was not possible to study all aspects related to intellectual property protection including economic benefits and ethics thereof. Some aspects are based on small study groups to make generalizations, so this study must be interpreted as a pilot study. However, the research reported here offers new insights about the understanding and the application of the plant breeders' rights legislation in South Africa. For future research it would be interesting to analyze the impact of the proposed amendments should the new draft Plant Breeders' Rights Bill be passed by Parliament to assess whether it suits the needs of breeders, different categories of farmers and the general public.

An in-depth study into, for example, the current practices of smallholder farmers in relation to farm-saved seed, development of own varieties, and their own views on the protection of farmer varieties needs to be undertaken. South Africa needs to make an assessment of pros and cons of acceding to the Treaty as this will pave ways for the development of policies towards the recognition of Farmers' Rights in the broad sense.

It is vital to investigate all kinds of protection afforded to GM varieties, including patents, plant breeders' rights, and technology agreements to understand the extent of such protections in South Africa and the impact thereof on different role players.

Future studies may also give insight on, among others: the benefits and challenges with regard to the plant variety protection system in the floricultural industry; the effects of

the plant breeders' rights system on public and private research and development, and investment in plant breeding; the extent, difficulties and benefits of international plant variety protection for domestically bred cultivars and the impact of the plant breeders' rights system on the general economy of the country. This study will not only make a contribution towards attaining an equitable plant breeders' rights system in South Africa, but will make a contribution in assisting those countries that are planning to develop a plant breeders' rights system taking into cognisance those issues that may need in-depth consultations within their countries in order to develop a system that would be beneficial for such countries.

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Annexure 1: Table 1 of regulations to the Plant Breeders' Rights Act, 1976 (Act No. 15 of 1976

**TABLE 1 – TABEL 1**

**KINDS OF PLANTS AND PERIODS OF RIGHTS**
**SOORTE PLANTE EN TERMYNE VAN REGTE**
[Reg. 11; 11(a)]

| 1 | | 2 | 3 | 4 |
|---|---|---|---|---|
| Kind of plant/Soort plant | | | | |
| Botanical name<br>Botaniese naam | Common name<br>Gewone naam | Category<br>Kategorie | Period of plant breeder's right (years)<br>Termyn van Planttelersreg (jare) | Period of sole right (years)<br>Termyn van alleenreg (jare) |
| ***Abelmoschus*** Medik. (All/Alle spp.) | Gumbo, Lady's fingers | B | 25 | 8 |
| ***Abelia*** R.Br. (All/Alle spp.) | Abelia | A | 20 | 5 |
| ***Abutilon*** Mill. (All/Alle spp.) | Flowering maple, Chinese lantern/Blomwattel, Chinese lantern | B | 25 | 8 |
| ***Acacia podalyriifolia*** A. Cunn. *Ex* G. Don | Queensland silver wattle, Pearl acacia/Lierwattel, Vaalmimosa | B | 25 | 8 |
| ***Acorus*** L. (All/Alle spp.) | Sweet flag | A | 20 | 5 |
| ***Acmadenia*** Bartl. & H.L. Wendl (all spp./alle spp.) | Acmadenia | B | 25 | 8 |
| ***Actinidia*** Lindley (All/Alle spp.) | Kiwifruit/Kiwivrug | B | 25 | 8 |
| ***Adenanthos*** Labill. (All/Alle spp.) | Adenanthos | A | 20 | 5 |
| ***Agapanthus*** L'Hérit. (All/Alle spp.) | Agapanthus, Blue lily/Agapant, Bloukandelaar, Bloulelie | A | 20 | 5 |
| ***Agastache*** L. (All /Alle spp.) | Agastache, Hyssop | B | 25 | 8 |
| ***Agathosma*** Willd.[Barosma Willd.] (All/Alle spp) | Agathosma, Buchu/Agathosma, Boegoe | A | 20 | 5 |
| ***Agave* L.** (All spp. except *A. sisalana* Perrine) | Agave | A | 20 | 5 |
| ***Ageratina*** Spach (All/Alle spp.) | Ageratina | A | 20 | 5 |
| ***Aglaonema*** Schott (All/Alle spp.) | Aglaonema | A | 20 | 5 |
| ***X Agrotriticum*** Ciferri *et* Giacom. (*Agropyron x Triticum*) | Agrotriticum | A | 20 | 5 |
| ***Ajuga*** L. (All/Alle spp.) | Bugleweed/Senegroen | A | 20 | 5 |
| ***Allium* L.** (All spp.) | Onion genus | A | 20 | 5 |
| ***Aloe*** L. (All/Alle spp.) | Aloe/Aalwyn | A | 20 | 5 |
| ***Alternanthera*** Forssk. (except for ***A. philoxeroides*** (Mart.) Griseb. | Joyweeds<br>Joseph's Coat | A | 20 | 5 |
| ***Alstroemeria*** L. (All/Alle spp.) | Peruvian lily, Inca lily/Perulelie, Inkalelie | A | 20 | 5 |
| ***Alyogyne huegelli*** (Endl.)Fryxell | Blue hibiscus | B | 25 | 8 |
| ***Amaranthus* L.** (All spp.) | Amaranth | A | 20 | 5 |
| ***Ananas comosus*** (L.) Merrill | Pineapple/Pynappel | B | 25 | 8 |
| ***Anemone*** L. (All spp.) | Anemone, Windflower, Lily-of-the-field | A | 20 | 5 |
| ***Angelonia*** Humb. & Bonpl.(All/Alle spp.) | Angelonia | A | 20 | 5 |

| 1 | | 2 | 3 | 4 |
|---|---|---|---|---|
| Kind of plant/Soort plant | | | | |
| Botanical name<br>Botaniese naam | Common name<br>Gewone naam | Category<br>Kategorie | Period of plant breeder's right (years)<br>Termyn van Planttelersreg (jare) | Period of sole right (years)<br>Termyn van alleenreg (jare) |
| ***Anisodontea*** K. Presl. (All/Alle spp.) | George mallow, Hairy mallow/Georgemalva, Harige malva | A | 20 | 5 |
| ***Anthephora pubescens*** Nees | Bottle brush grass/Borseltjiegras | A | 20 | 5 |
| ***Anthurium*** Schott (All/Alle spp.) | Anthurium | A | 20 | 5 |
| ***Antirrhinum*** L. (All/Alle spp.) | Snapdragon/Leeubekkie | A | 20 | 5 |
| ***Arachis*** L. (All/Alle spp.) | Groundnut/Grondboon | A | 20 | 5 |
| ***Arctotis*** L. (All/Alle spp.) | Arctotis/Gousblom | A | 20 | 5 |
| ***Argyranthemum*** Webb *ex* Sch. Bip. (All/Alle spp) | Daisy bush, White marguerite/Madeliefiebos | A | 20 | 5 |
| ***Artemisia*** L. (All/Alle spp.) | Artemisia | A | 20 | 5 |
| ***Aspalathus*** L. (All/Alle spp.) | Aspalathus | A | 20 | 5 |
| ***Asparagus densiflorus*** (Kunth) Jessop | Asparagus fern/varing | A | 20 | 5 |
| ***Asparagus officinalis*** L. | Asparagus/Aspersie | A | 20 | 5 |
| ***Aster*** L. (All/Alle spp.) | Michaelmas daisy, Frost flower/Michaelmas Madeliefie | A | 20 | 5 |
| ***Aulax*** Berg (All/Alle spp.) | Aulax | B | 25 | 8 |
| ***Avena*** L. (All/Alle spp.) | Oats/Hawer | A | 20 | 5 |
| | | | | |
| ***Barleria*** L. (All/Alle spp.) | Barleria | A | 20 | 5 |
| ***Bauhinia*** L. [excluding ***B. purpurea*** L. and ***B. variegata*** L.] | Bauhinia; Orchid tree | B | 25 | 8 |
| ***Begonia*** (All/Alle spp.) | Begonia | A | 20 | 5 |
| ***Bergenia*** Moench. (All/Alle spp.) | Elephant's ear, Siberian saxifrage/Siberiese steenbreek | A | 20 | 5 |
| ***Beschorneria*** Kunth. (All/Alle spp.) | Beschorneria | A | 20 | 5 |
| ***Beta vulgaris*** L. | Beetroot, Fodder Beet, Swiss Chard/Beet, Voerbeet, Snybeet | A | 20 | 5 |
| ***Bougainvillea*** Comm. *ex* Juss. (All/Alle spp.) | Bougainvillea | A | 20 | 5 |
| ***Bouvardia*** Salisb. (All/Alle spp.) | Bouvardia | A | 20 | 5 |
| ***Brachiaria*** (Trin.) Griseb. (All/Alle spp.) | Brachiaria, signal grass | A | 20 | 5 |
| ***Brachiaria brizantha*** (Hochst. *ex* A. Rich.) Stapf [See/sien ***Urochloa brizantha*** (Hochst. Ex A. Rich.) R.D. Webster] | Beard grass, Palisade grass | | | |
| ***Brachyscome*** Cass. (All/Alle spp.) | Swan river daisy/Australiese madeliefie | A | 20 | 5 |
| ***Bracteantha*** Anderb. & Haegi (See/sien ***Xerochrysum***) | Bracteantha | | | |
| ***Brassica juncea*** (L.) Czern | Indian Mustard/Indiese Mosterd | A | 20 | 5 |
| ***Brassica napus*** L. | Forage rape, Swede/Weikool, Sweedse raap | A | 20 | 5 |

| 1 | | 2 | 3 | 4 |
|---|---|---|---|---|
| Kind of plant/Soort plant | | | | |
| Botanical name<br>Botaniese naam | Common name<br>Gewone naam | Category<br>Kategorie | Period of plant breeder's right (years)<br>Termyn van Planttelersreg (jare) | Period of sole right (years)<br>Termyn van alleenreg (jare) |
| ***Brassica oleracea*** L. | Fodder Kale, Kohlrabi, Curly Kale, Cauliflower, Broccoli, Cabbage, Savoy Cabbage, Brussels Sprouts/Beeskool, Knolkool, Boerkool, Blomkool, Brokkoli, Kopkool, Savoikool, Brusselse Spruitjies | A | 20 | 5 |
| ***Brassica rapa*** L. [including/insluitend ***B. campestris*** & spp. previously known as/ voorheen bekend as ***B. chinensis*** and/en ***B. pekinensis***] | Turnip/Raap | A | 20 | 5 |
| ***Bromus catharticus*** Vahl (= *B willdenowii*) | Rescue grass/Reddingsgras | A | 20 | 5 |
| ***Brunfelsia latifolia*** (Pohl) Benth. | Brunfelsia | A | 20 | 5 |
| ***Brunia*** Lam. (All/Alle spp.) | Brunia/Stompie | B | 25 | 8 |
| ***Buddleja*** L. (All/Alle spp.) | Sagewood/Salie | A | 20 | 5 |
| ***Bulbine*** Wolf. (All/Alle spp.) | Bulbine | A | 20 | 5 |
| | | | | |
| ***Cajanus*** L. (All spp.) | Cajanus | A | 20 | 5 |
| ***Calibrachoa*** Llave & Lex (All/Alle spp.) | Miniature Petunia/Miniatuur Petunia | A | 20 | 5 |
| ***Callistemon*** R. Br. (All/Alle spp.) | Bottle brush/Bottelborsel, Perdestert | B | 25 | 8 |
| ***Camellia*** L. (All/Alle spp.) | Camellia, Japonica/Kamellia, Japonika | B | 25 | 8 |
| ***Camellia sinensis*** (L.) O. Kuntze (= ***Thea sinensis*** L.) | Tea/Tee | B | 25 | 8 |
| ***Campanula*** L. (all spp./alle spp.) | Bellflower | A | 20 | 5 |
| ***Canna*** L. (All/Alle spp.) | Canna/Kanna | A | 20 | 5 |
| ***Capsicum*** L. (All/Alle spp.) | Pepper, Paprika/Rissie, Paprika | A | 20 | 5 |
| ***Carex brunnea*** Thunb. | Greater brown sedge | A | 20 | 5 |
| ***Carex oshimensis*** Nakai | Oshima sedge, Japanese sedge | A | 20 | 5 |
| ***Carica papaya*** L. | Pawpaw/Papaja | B | 25 | 8 |
| ***Carya illinoinensis*** (Wangenh.) K. Koch | Pecannut/Pekanneut | B | 25 | 8 |
| ***Ceanothus dentatus*** Torr. & A. Gray | Red Root/Rooiwortel | A | 20 | 5 |
| ***Cenchrus ciliaris*** L. | Blue buffalo grass/Bloubuffelgras | A | 20 | 5 |
| ***Chamelaucium*** Desf. (All/Alle spp.) | Wax flower, Wax plant/Wasblom | B | 25 | 8 |
| ***Cheiranthus*** L. (All/Alle spp.) | Wall flower/Muurblom | A | 20 | 5 |
| ***Chironia*** L. (All/Alle spp.) | Christmas berry, Wild gentian/Bitterbos, Perdebossie | A | 20 | 5 |
| ***Chloris gayana*** Kunth | Rhodes grass/Rhodesgras | A | 20 | 5 |

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| ***Chlorophytum*** Ker-Gawl. (All/Alle spp.) | St Bernard';s Lily/St Bernardlelie | A | 20 | 5 |
| ***Choisya x dewitteana*** Geerinck. | Mexican Orange | B | 25 | 8 |
| ***Chondropetalum*** Rottb. (All spp.) | Chondropetalum | A | 20 | 5 |
| ***Chrysanthemum*** L. (All/Alle spp.) [including ***Dendranthema*** (DC.) Desm.] | Chrysanthemum/Krisant, Aster | A | 20 | 5 |
| ***Cichorium intybus*** L. | Chicory/Sigorei | A | 20 | 5 |
| ***Citharexylum*** Mill. (All/Alle spp.) | Fiddlewood/Vioolhout | B | 25 | 8 |
| ***Citrullus lanatus*** (Thunb.) Matsum. *et* Nakai | Watermelon/Waatlemoen, Makataan | A | 20 | 5 |
| ***Citrus*** L. (All/Alle spp.) | Sweet orange, Lemon, Grapefruit, Loose skin citrus types, Other citrus (Bitter Seville, Lime)/Soetlemoen, Suurlemoen, Pomelo, Losskil sitrussoorte, ander sitrus (Bitter Seville, Lemmetjie) | B | 25 | 8 |
| ***Clematis*** L. (All/Alle spp.) | Clematis, Leather flower/Leerblom | A | 20 | 5 |
| ***Cleome*** L. (All spp.) | Cleome | A | 20 | 5 |
| ***Clivia*** Lindl. (All/Alle spp.) | Bush lily/Boslelie | A | 20 | 5 |
| ***Cnidoscolus*** Pohl (All/Alle spp.) | Cnidoscolus, Tread-softly, Spurge nettle | A | 20 | 5 |
| ***Coffea arabica*** L. | Coffee/Koffie | B | 25 | 8 |
| ***Coleonema*** Bartl. & H.L. Wendl (all spp.) | Coleonema | A | 20 | 5 |
| ***Coleostephus*** Cass. (All/Alle spp.) | Coleostephus | A | 20 | 5 |
| ***Colocasia*** Schott. (All spp.) | Elephant ear | A | 20 | 5 |
| ***Coprosma*** J. R. Forster *et* G. Forster (All/Alle spp.) | Mirror plant/ Spieëlplant | A | 20 | 5 |
| ***Corchorus*** L. (All spp.) | Mallow | A | 20 | 5 |
| ***Coriandrum*** L. (All spp.) | Coriandrum | A | 20 | 5 |
| ***Coreopsis lanceolata*** L. (HYBRIDS ONLY) | Lanceleaf coreopsis | B | 25 | 8 |
| ***Coreopsis pubescens*** Elliott | Star tickseed | B | 25 | 8 |
| ***Coreopsis rosea*** Nutt | Pink tickseed | B | 25 | 8 |
| ***Cordyline*** Comm. *ex* Juss. (All/Alle spp) | Dragon tree/Drakeboom | A | 20 | 5 |
| ***Corylus*** L. (All/Alle spp.) | Hazelnut/Haselneut | B | 25 | 8 |
| ***Cotyledon*** L. (All spp./alle spp.) | Cotyledon | B | 25 | 8 |
| ***Cosmos atrosanguineus*** *x hybrid* | Chocolate cosmos | A | 20 | 5 |
| ***Cucumis*** L. (All/Alle spp.) | Sweet melon, Cucumber/Spanspek/Komkommer | A | 20 | 5 |
| ***Crambe abyssinica*** Hochst. Ex R.E. Fr. | Abyssinian-kale,Crambe | A | 20 | 5 |
| ***Crassula*** L. (all spp./alle spp.) | Crassula | B | 25 | 8 |

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| ***Crinum*** L. (All/Alle spp.) | Cape Lily | A | 20 | 5 |
| ***Crocosmia*** Planchon (All/Alle spp.) | Coppertip/Falling stars | A | 20 | 5 |
| ***Cucurbita*** L. (All/Alle spp.) | Pumpkin, Squash/Pampoen, Skorsie | A | 20 | 5 |
| ***Curcuma*** L. (All spp.) | Hidden cone gingers | A | 20 | 5 |
| ***Cupressus*** L. (All/Alle spp.) | Cypress/Sipres | B | 25 | 8 |
| ***x Cupressocyaparis*** Dallim. | | B | 25 | 8 |
| ***Cuphea hyssopifolia*** *HBK* | False heather/Valsheide | A | 20 | 5 |
| ***Cyathea*** Sm. (All/Alle spp.) | Tree fern/Boomvaring | B | 25 | 8 |
| ***Cyclopia*** Vent. (All/Alle spp.) | Honeybush Tea/Heuningbostee | A | 20 | 5 |
| ***Cydonia*** Mill. (All/Alle spp.) | Quince/Kweper | B | 25 | 8 |
| ***Cynodon*** L. (All/Alle spp.) | Bermuda grass, Couch grass/Bermudagras, Kweekgras | A | 20 | 5 |
| ***Cyperus*** L. (All/Alle spp.) | Sedge. | A | 20 | 5 |
| ***Cyrtanthus*** L. (All/Alle spp.) | Fire lily/Vuurlelie. | A | 20 | 5 |
| | | | | |
| ***Dactylis glomerata*** L. | Cocksfoot/Kropaargras | A | 20 | 5 |
| ***Dahlia*** Cav. (All/Alle spp.) | Dahlia | A | 20 | 5 |
| ***Daphne x transatlantica*** C.D. Brickell & A.R.White | Daphne | B | 25 | 8 |
| ***Daucus carota*** L. | Carrot/Geelwortel | A | 20 | 5 |
| ***Delosperma*** N.E.Br. (All/Alle spp.) | Delosperma | A | 20 | 5 |
| ***Dendranthema*** (DC.) Desm. [See/sien ***Chrysanthemum*** L.] | | | | |
| ***Desmodium*** Desv. (All/Alle spp.) | Tick Trefoil/Desmodium | A | 20 | 5 |
| ***Dianella*** Lam. (All/Alle spp.) | Dianella, Flax Lily/Dianella, Vlaslelie | A | 20 | 5 |
| ***Dianthus*** L. (All/Alle spp.) | Carnation/Angelier , Dianthus, Pink | A | 20 | 5 |
| ***Dianthus x alwodii*** *Hort.* | Dianthus | A | 20 | 5 |
| ***Diascia*** Link *et* Otto (All/Alle spp.) | Twinspur/Pensie | A | 20 | 5 |
| ***Dieffenbachia*** Schott (All/Alle spp.) | Dieffenbachia, Dumb cane/Stomriet, Verdoofblaar | A | 20 | 5 |
| ***Dierama*** C.Koch. (All/Alle spp.) | Wandflower | A | 20 | 5 |
| ***Dietes*** Salisb. ex Klatt (All/Alle spp.) | Fortnight Lily; African Iris | A | 20 | 5 |
| ***X Digiplexis (Digitalis x Isoplexis)*** | Illumination flame | A | 20 | 5 |

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| ***Digitaria eriantha*** Steud. (=***D. Smutsii*** Stent.) | Smuts finger grass/Snutsvingergras | A | 20 | 5 |
| ***Dimorphotheca*** Vaill. ex Moench (All/Alle spp.) | Bito, Daisy/Bietou, Madeliefie, Magrietjie | A | 20 | 5 |
| ***Dipladenia*** A. DC. [See/Sien ***Mandevilla*** Lindl.] | | | | |
| ***Drimiopsis*** Lindl.[See/sien ***Ledebouria*** Roth.] | | | | |
| ***Draceana*** L. (All/Alle spp.) | Draceana | A | 20 | 5 |
| ***Duranta*** L. (All/Alle spp.) | Forget-me-not tree/Vergeet-my-nie-boom | A | 20 | 5 |
| | | | | |
| ***Echinocloa*** P. Beauv. (All spp.) | Echinocloa | A | 20 | 5 |
| ***Elegia*** L. (All/Alle spp.) | Cape Thatching Reed | B | 25 | 8 |
| ***Eragrostis curvula*** (Schrad.) Nees | Weeping lovegrass/Oulandsgras | A | 20 | 5 |
| ***Eragrostis tef*** (Zucc.) Trotter | Teff/Tefgras | A | 20 | 5 |
| ***Erica*** L. (All/Alle spp.) | Heath/Heide | B | 25 | 8 |
| ***Eriobotrya*** Lindl. (All/Alle spp.) | Loquat | B | 25 | 8 |
| ***Eriocephalus*** L. *(All/Alle spp.)* | Eriocephalus, Kapok bush/Eriosephalus, Kapokbos | A | 20 | 5 |
| ***Eryngium*** L. (All/Alle spp.) | Eryngo, Sea holly/ Bloudissel, Kruisdissel | A | 20 | 5 |
| ***Escallonia*** Mutis *ex* L.f. (All spp.) | Escallonia | A | 20 | 5 |
| ***Eucalyptus*** L'Hér. (All/Alle spp.) | Eucalypt, Gumtree/Bloekom | B | 25 | 8 |
| ***Eucomis*** L'Hér. (All/Alle spp.) | Pineapple lily | A | 20 | 5 |
| ***Euonymus*** L. (All/Alle spp.) | Spindle tree/Speekbeenboom | A | 20 | 5 |
| ***Eupatorium*** L. (All/Alle spp.) | Eupatorium | A | 20 | 5 |
| ***Euphorbia hypericifolia*** L. | Spurge | B | 25 | 8 |
| ***Euphorbia X martini*** | Red spurge | A | 20 | 5 |
| ***Euphorbia pulcherrima*** Willd. *ex* Klotzsch | Poinsettia/Poinsettia, Karlienblom | A | 20 | 5 |
| ***Euryops*** Cass. (All/Alle spp.) | Resin bush, Daisy bush/Harpuisbos | A | 20 | 5 |
| | | | | |
| ***Felicia*** Cass. (All/Alle spp.) | Felicia | A | 20 | 5 |
| ***Ferraria*** Burm. ex Mill. (All/Alle spp.) | Ferraria | A | 20 | 5 |
| ***Festuca arundinacea*** Schreber | Tall fescue/Langswenkgras | A | 20 | 5 |
| ***X Festulolium*** Aschers. *et* Graebn. (*Festuca x Lolium)* | Festulolium, Hybrid fescue/Baster swenkgras | A | 20 | 5 |
| ***Ficus*** L. | Fig tree, Rubber plant/Vyeboom, Rubberboom | B | 25 | 8 |
| ***Foeniculum*** Mill. (All spp.) | Fennel | A | 20 | 5 |

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| ***Fortunella*** Swingle | Kumquat/Kumkwat | B | 25 | 8 |
| ***Fragaria x ananassa*** Duchesne | Strawberry/Aarbei | A | 20 | 5 |
| ***Freesia*** Klatt (All/Alle spp.) | Freesia/Freesia, Kammetjie | A | 20 | 5 |
| ***Fuchsia*** L. (All/Alle spp.) | Fuchsia, Ladies' eardrops/Fuchsia, Foksia | A | 20 | 5 |
| | | | | |
| ***Gaillardia x grandiflora*** hort. ex Van Houtte | Blanket Flower | A | 20 | 5 |
| ***Gardenia*** Ellis (All/Alle spp.) | Gardenia/Katjiepiering | B | 25 | 8 |
| ***Gaura*** L. (All/Alle spp.) | Gaura | A | 20 | 5 |
| ***Gasteria*** Duval (All/Alle sp) | Tongue plant | A | 20 | 5 |
| ***Gazania*** Gaertn. (All/Alle spp.) | Gazania/Gousblom, Botterblom | A | 20 | 5 |
| ***Gelsemium sempervirens*** (L.) Ait. | Carolina jasmine/Vals jasmyn | A | 20 | 5 |
| ***Gerbera*** L. (All/Alle spp.) | Barberton daisy, Gerbera/Barbertonse madeliefe | A | 20 | 5 |
| ***Gladiolus*** L. (All/Alle spp.) | Gladiolus/Swaardlelie | A | 20 | 5 |
| ***Glandularia*** J.F. Gmel. (All/Alle spp.) | Glandularia | A | 20 | 5 |
| ***Gloriosa*** L. (All spp.) | Flame lily | A | 20 | 5 |
| ***Glycine max*** (L.) Merrill | Soya bean/Sojaboon | A | 20 | 5 |
| ***Goniolimon*** Boiss. (All/Alle spp.) | Goniolimon | A | 20 | 5 |
| ***Gossypium hirsutum*** L. | Cotton/Katoen. | A | 20 | 5 |
| ***Grevillea*** R. Br. (All/Alle spp.) | Grevillea | B | 25 | 8 |
| ***Gypsophila*** L. (All/Alle spp.) | Gypsophila, Baby's breath/Gipskruid | A | 20 | 5 |
| | | | | |
| ***Haemanthus*** L. (All/Alle spp.) | Haemanthus | A | 20 | 5 |
| ***Hardenbergia*** Benth (All/Alle spp.) | Australian lilac/Australiese lilac | A | 20 | 5 |
| ***Hebe*** Comm. *ex* Juss. (All/Alle spp.) | Shrubby veronica/Bosveronica | A | 20 | 5 |
| ***Hedera*** L. (All/Alle spp.) | Ivy/Hedera, Klimop | A | 20 | 5 |
| ***Helianthus annuus*** L. | Sunflower/Sonneblom | A | 20 | 5 |
| ***Helianthus tuberosus*** L. | Jerusalem artichoke, Girasole/Jerusalemartisjok, Knolartisjok | A | 20 | 5 |
| ***Heliopsis helianthoides*** (L.) Sweet | False sunflower | A | 20 | 5 |
| ***Hemerocallis*** L. (All/Alle spp.) | Day lily/Daglelie | A | 20 | 5 |
| ***Hermannia*** L. (All/Alle spp.) | Doll's roses | B | 25 | 8 |
| ***Heteranthemis*** Schott (All/Alle spp.) | Heteranthemis | A | 20 | 5 |
| ***Heuchera*** L. (All/Alle spp.) | Coral bells | A | 20 | 5 |

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| ***Hibiscus*** L. (All/Alle spp.) | Hibiscus, Rosemallow, Kenaf/Hibiskus, Vuurblom | B | 25 | 8 |
| ***Hippeastrum*** Herb. (All/Alle spp.) | Amaryllis/Narsinglelie | A | 20 | 5 |
| ***Hordeum*** L. (All/Alle spp.) | Barley/Gars | A | 20 | 5 |
| ***Hosta*** Tratt. (All/Alle spp.) | Plaintain lily/Funkia | A | 20 | 5 |
| ***Humulus lupulus*** L. | Hops/Hop | A | 20 | 5 |
| ***Hydrangea*** L. (All/Alle spp.) | Hydrangea/Krismisroos, Hortensia | A | 20 | 5 |
| ***Hylocereus*** (A. Berger) Britton & Rose (All/Alle spp.) | Dragon fruit | B | 25 | 8 |
| ***Hypericum*** L. (All/Alle spp.) | Saint John's wort/Sint-Janskruid | A | 20 | 5 |
| ***Hypoestes*** Soland. *ex* R.Br. | Ribbon bush/Lintbos | A | 20 | 5 |
| ***Hypoxis*** L. (All/Alle spp.) | Yellow star; Star lilly; African potato | A | 20 | 5 |
| | | | | |
| ***Iberis*** L. (All/Alle spp.) | Candy tuft/Skeefblom | A | 20 | 5 |
| ***Ilex crenata i****Thunb* | Japanese holly, Box leaved holly | B | 25 | |
| ***Ilex dimorphophylla*** Koidz | Holly | B | 25 | 8 |
| ***Impatiens*** L. (All/Alle spp.) | Snapweed/Springsaad, Springkruid | A | 20 | 5 |
| ***Ipomoea batatas*** (L.) Lam. | Sweet potato/Patat | A | 20 | 5 |
| ***Iris*** L. (All/Alle spp.) | Iris | A | 20 | 5 |
| ***Isoglossa*** Oerst. (All/Alle spp.) | Isoglossa | A | 20 | 5 |
| ***Isopogon*** RBr ex Knight (All/Alle spp.) | | B | 25 | 8 |
| | | | | |
| ***Jamesbrittenia*** O. Kuntze (All/Alle spp.) | Jamesbrittenia | A | 20 | 5 |
| ***Juglans*** *L.* (All/Alle spp.) | Walnut/Okkerneut | B | 25 | 8 |
| ***Juniperus*** L. (All/Alle spp.) | Juniper, Cedar/Seder | B | 25 | 8 |
| | | | | |
| ***Kalanchoe*** Adans. (All/Alle spp.) | Kalanchoe, Chandelier plant/Kandelaarplant | A | 20 | 5 |
| ***Kniphofia*** Moench (All/Alle spp.) | Poker plant | A | 20 | 5 |
| ***Koeleria*** Pers. (All/Alle spp.) | Hair grass/Haargras | A | 20 | 5 |
| ***Kunzea*** Reichb. (All/Alle spp.) | Burgan, White tea tree | A | 20 | 5 |
| | | | | |
| ***Lachenalia*** Jacq. F. ex J. Murr. (Alle/All spp.) | Lachenalia, Cowslip/Viooltjie, Kalossie | A | 20 | 5 |
| ***Lactuca sativa*** L. | Lettuce/Slaai | A | 20 | 5 |

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| ***Lagerstroemia indica*** L. | Crape myrtle/Crepe myrtle | B | 25 | 8 |
| ***Lamium maculatum*** L. | Spotted deadnettle/Bontnetel | A | 20 | 5 |
| ***Lampranthus*** N.E.Br. | Midday plants | B | 25 | 8 |
| ***Lantana montevidensis*** (Sprengel) Briq. | Weeping lantana/Treurlantana | A | 20 | 5 |
| ***Lathyrus tingitanus*** L. | Tangier scarlet pea, T. sweet pea, Gypsy sweet pea/Pronkertjie | A | 20 | 5 |
| ***Lavandula*** L. (All/Alle spp.) | Lavender/Laventel | A | 20 | 5 |
| ***Ledebouria*** Roth. (All/Alle spp.) [including ***Drimiopsis*** Lindl. & Paxton and ***Resnova*** Van der Merwe] | Ledebouria | A | 20 | 5 |
| ***Leptospermum*** J.R. Forster *et* G. Foster (All/Alle spp.) | Myrtle/Mirt | A | 20 | 5 |
| ***Lespedeza cuneata*** (Dum. Cours.) G. Don | Chinese Bush-clover/Lespedeza | A | 20 | 5 |
| ***Lespedeza striata*** (Thunb.) Hook & Arn. | Annual/Eenjarige Lespedeza | A | 20 | 5 |
| ***Leucadendron*** R. Br. (All/Alle spp.) | Conebush, Yellowbush/Tolbos, Geelbos | B | 25 | 8 |
| ***Leucanthemum*** Mill. | Leucanthemum | A | 20 | 5 |
| ***Leucospermum*** R. Br. (All/Alle spp.) | Pincushion/Speldekussing | B | 25 | 8 |
| ***Libertia ixioides*** (G. Forst.) Spreng. | New Zealand Iris | A | 20 | 5 |
| ***Lilium*** L. (All/Alle spp.) | Lily/Lelie | A | 20 | 5 |
| ***Limonium*** Mill (All/Alle spp.) | Statice, Sea Lavender, Marsh Rosemary/Papierblom | A | 20 | 5 |
| ***Liriope muscari*** (Decne.) L.H.Bailey | Border grass | A | 20 | 5 |
| ***Litchi chinensis*** Sonn. | Litchi/Lietsjie | B | 25 | 8 |
| ***Lobelia erinus*** L. | Edging lobelia | A | 20 | 5 |
| ***Lobularia maritima*** (L.) Desv. | Sweet alyssum | A | 20 | 5 |
| ***Lolium*** L. (All/Alle spp.) | Rye grass/Raaigras | A | 20 | 5 |
| ***Lotus corniculatus*** L. | Birdsfoot Trefoil/Rolklawer | A | 20 | 5 |
| ***Lomandra*** Labill. (All/Alle spp.) | Lomandra | A | 20 | 5 |
| ***Lonicera*** L. (All/Alle spp.) | Honeysuckle/Kamferfoelie | A | 20 | 5 |
| ***Loropetalum*** R.Br. ex Rchb. (All/Alle spp.) | Chinese fringe-flower | B | 25 | 8 |
| ***Lupinus*** L. (All/Alle spp.) | Lupin/Lupien | A | 20 | 5 |
| ***Lycium*** L. (All/Alle spp.) | Wolfberry, Boxthorn/Lycium | A | 20 | 5 |
| ***Lycopersicon esculentum*** Mill. (=***L. lycopersicum*** (L.) Karsten *ex* Farwell) | Tomato/tamatie | A | 20 | 5 |

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| ***Lycianthes rantonnetii***(Carriere) Bitter (see ***Solanum rantonetii*** (Carriére) Bitter | | | | |
| ***Lysimachia*** L. (All/Alle spp.) | Money wort/Penningkruid | A | 20 | 5 |
| ***Macadamia*** F. Mueller (All/Alle spp.) | Macadamia/Makadamia | B | 25 | 8 |
| ***Magnolia*** L. (All/Alle spp.) | Magnolia | B | 25 | 8 |
| ***Malus*** Mill. (All/Alle spp.) | Apple/Appel | B | 25 | 8 |
| ***Malva*** L. (All/Alle spp.) | Mallow/Malva | A | 20 | 5 |
| ***Mandevilla*** Lindl. (All/Alle spp.) (=***Dipladenia*** A. DC.) | Chilean jasmine/Chileense jasmyn | A | 20 | 5 |
| ***Mangifera indica*** L. | Mango | B | 25 | 8 |
| ***Medicago*** L. (All/Alle spp.) | Lucerne, Medic/Lusern, Medic | A | 20 | 5 |
| ***Melia azedarach*** L. | Persian lilac, Bead tree, Seringa/Sering | B | 25 | 8 |
| ***Melilotus*** (l.) Mill. (All/Alle spp.) | Melilot, Sweet clover | A | 20 | 5 |
| ***Merwilla*** Speta (All/Alle spp.) [including/ insluitend ***Scilla natalensis*** Planch.] | Merwilla, Blue Hyacinth/Merwilla, Blou Hiasint | A | 20 | 5 |
| ***Mesembryanthemum*** L. (All spp.) | Icicle plant | A | 20 | 5 |
| ***Mimetes*** Salisb. (All/Alle spp.) | Cape bottlebrush/Stompie | B | 25 | 8 |
| ***Miscanthus x giganteus*** J.M. Greef & Deuter ex Hodk. & Renvoize | Giant Miscanthus | B | 25 | 8 |
| ***Monarda*** L. (All/Alle spp.) | Wild bergamot, Horsemint/Monarda. | A | 20 | 5 |
| ***Monopsis*** Salisb. (All/Alle spp.) | Wild violet/Wilde viooltjie | A | 20 | 5 |
| ***Moraea*** Mill. (All/Alle spp.) | Butterfly iris | A | 20 | 5 |
| ***Moringa*** Adans (All spp.) | Moringa | B | 25 | 8 |
| ***Murraya paniculata*** (L.) Jack | Oranje jasmine/ Oranje jasmyn | A | 20 | 5 |
| ***Musa acuminata*** Colla | Banana/Piesang | B | 25 | 8 |
| | | | | |
| ***Nandina*** Thunb. (All/Alle spp.) | Heavenly Bamboo, Sacred Bamboo/Hemelse, Heilige Bamboes | A | 20 | 5 |
| ***Narcissus*** L. (All/Alle spp.) | Narcissus/Narsing | A | 20 | 5 |
| ***Nemesia*** Vent. (All/Alle spp.) | Nemesia | A | 20 | 5 |
| ***Neonotonia wightii*** Whight & Arn. J Lackey. | Neonotonia | A | 20 | 5 |
| ***Nephrolepis*** Schott (All/Alle spp.) | Sword fern/Swaardvaring | A | 20 | 5 |
| ***Nerine*** Herb. (All/Alle spp.) | Nerine/Nerina, Berglelie | A | 20 | 5 |
| ***Nerium*** L. (Alle/Alle spp.) | Oleander/Selonsroos. | B | 25 | 8 |

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| Botanical name<br>Botaniese naam | Common name<br>Gewone naam | Category<br>Kategorie | Period of plant breeder's right (years)<br>Termyn van Planttelersreg (jare) | Period of sole right (years)<br>Termyn van alleenreg (jare) |
| ***Nicotiana tabacum*** L. | Tobacco/Tabak | A | 20 | 5 |
| | | | | |
| ***Ocimum basilicum*** L. | Basil, Sweer basil/Basiliekruid, Soetbasilkruid | A | 20 | 5 |
| ***Olea*** L. (All/Alle spp.) | Olive/Olyf | B | 25 | 8 |
| ***Ophiopogon*** Ker-Gawl. (All/Alle spp.) | Lilyturf, Mondo, Snake's-beard/ Mondo, Slangbaard | A | 20 | 5 |
| ***Ornithogalum*** L. (All/Alle spp.) | Chincherinchee/Tjienkerientjee | A | 20 | 5 |
| ***Ornithopus compressus*** L. | Yellow Serradella/Geel Serradella | A | 20 | 5 |
| ***Ornithopus sativus*** Brot. | Serradella | A | 20 | 5 |
| ***Orothamnus*** Pappe *ex* Hook. (All/Alle spp.) | Marsh rose/Vleiroos | B | 25 | 8 |
| ***Oryza sativa*** L. | Rice/Rys | A | 20 | 5 |
| ***Osteospermum*** L. (All/Alle spp.) | Bitou/Bietou | A | 20 | 5 |
| | | | | |
| ***Pandorea*** Spach (All/Alle spp.) | Pandorea | A | 20 | 5 |
| ***Panicum*** L. (All spp.) | Panicum | A | 20 | 5 |
| ***Parahebe cattaractae*** (G FOrsst) WRB Oliv | Parahebe | B | 25 | 8 |
| ***Paranomus*** Salisb. (All/Alle spp.) | Paranomus | B | 25 | 8 |
| ***Paspalum*** L. (All spp.) | Paspalum | A | 20 | 5 |
| ***Passiflora*** L (all spp. Excluding ***P. caerula*** L., ***P. mollisima*** (Kunth) L.H. Bailey, ***P. suberosa*** L. and ***P. subpeltata*** Ortega) | Passion flower | A | 20 | 5 |
| ***Pastinaca sativa*** L. | Parsnip/Witwortel | A | 20 | 5 |
| ***Pelargonium*** L'Herit. (All/Alle spp.) | Geranium, Pelargonium/Malva | A | 20 | 5 |
| ***Pennisetum clandestinum*** Hochst. Ex Chiov. | Kikuyu/Kikoejoe | A | 20 | 5 |
| ***Pennisetum glaucum*** (L.) R.Br. *emend.* Stuntz | Pearl millet/Babala | A | 20 | 5 |
| ***Pennisetum purpureum*** Schumach | Elephant grass | A | 20 | 5 |
| ***Pennisetum setaceum*** (Forssk.) Chiov. (only sterile hybrids) | Fountain grass | A | 20 | 5 |
| ***Pennisetum squamulatum*** Fresen. | - | A | 20 | 5 |
| ***Penstemon*** Schmidel (All spp.) | Bears-tongue | A | 20 | 5 |
| ***Pentas*** Benth. (All/Alle spp.) | Pentas | A | 20 | 5 |
| ***Pericallis*** D.Don (All spp.) | Ragwort | A | 20 | 5 |
| ***Persea americana*** Mill. | Avocado/Avokado | B | 25 | 8 |
| ***Petroselinum crispum*** (Mill.) Nyman ex | Parsley/Pietersielie | A | 20 | 5 |

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|---|---|---|---|---|
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| A.W. Hill | | | | |
| ***Petunia*** Juss. (excluding/uitgesonderd ***Calibrachoa***) | Petunia | A | 20 | 5 |
| ***Phalaris aquatica*** Hack. | Phalaris | A | 20 | 5 |
| ***Phalaris arundinacea*** L | Reed canary grass, Ribbon grass/ Rietkanariegras, Bandgras | A | 20 | 5 |
| ***Phaseolus coccineus*** L. | Kidney Bean/Nierboon | A | 20 | 5 |
| ***Phaseolus vulgaris*** L. | Dry Bean, Garden Bean/Droëboon, Tuinboon. | A | 20 | 5 |
| ***Physocarpus*** (Cambess) Raf. (All spp.) | Ninebark | B | 25 | 8 |
| ***Philodendron*** Schott (All/Alle spp.) | Philodendron, Elephant's ear/ Olifantsoor | A | 20 | 5 |
| ***Phlox*** L. (All/Alle spp.) | Phlox/Floks | A | 20 | 5 |
| ***Phoenix dactylifera*** L. | Date palm/Dadelpalm | B | 25 | 8 |
| ***Phormium*** J.R. Forster *et* G. Forster (All/Alle spp.) | Flax/Vlas | A | 20 | 5 |
| ***Photinia*** Lindl. (All/Alle spp.) | Photinia | B | 25 | 8 |
| ***Physostegia virginiana*** (L.) Benth. | Obedient plant | A | 20 | 5 |
| ***Pimelea*** Banks *et* Soland. (All/Alle spp.) | Riceflower/Pimelea | A | 20 | 5 |
| ***Pinus*** L. (All/Alle spp.) | Pine/Den | B | 25 | 8 |
| ***Pistacia*** L. (All/Alle spp.) | Pistachio/Pimperneut | B | 25 | 8 |
| ***Pisum*** L. (All/Alle spp.) | Dry Pea, Garden Pea/Droë Ert, Tuinert | A | 20 | 5 |
| ***Pittosporum tenuifolium*** Gaertn. | Pittosporum | B | 25 | 8 |
| ***Plectranthus*** L'Herit. (All/Alle spp.) | Spurflower, Coleus/Spoorsalie, Coleus | A | 20 | 5 |
| ***Plumbago*** L. (All/Alle spp.) | Leadwort/Loodkruid | A | 20 | 5 |
| ***Polygala*** L. (All/Alle pp.) | Milkwort, Snakeroot | A | 20 | 5 |
| ***Polypodium*** L. (All/Alle spp.) | Polypody/Polypodium | A | 20 | 5 |
| ***Portulaca afra*** Jacq. | Spekboom, pork bush | B | 25 | 8 |
| ***Potentilla*** L. (All/Alle spp.) | Cinquefoil/Vyfvingerkruid, Ganserik | A | 20 | 5 |
| ***Protea*** L. (All/Alle spp.) | Protea, Sugarbush/Protea, Suikerbos | B | 25 | 8 |
| ***Prunus amygdalus*** Batsch. [See/Sien ***Prunus dulcis*** (Mill.) D. Webb] | | | | |
| ***Prunus armeniaca*** L. | Apricot/Appelkoos | B | 25 | 8 |
| ***Prunus avium*** (L.) L. | Sweet cherry/Soetkersie | B | 25 | 8 |
| ***Prunus cerasifera*** Ehrh. | Cherry plum, Myrobalan plum | B | 25 | 8 |

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| ***Prunus cerasus*** L. | Sour cherry/Suurkersie | B | 25 | 8 |
| ***Prunus domestica*** L. | European plum/Europese pruim, Pruimedant | B | 25 | 8 |
| ***Prunus dulcis*** (Mill.) D. Webb (=***Prunus amygdalus*** Batch) | Almond/Amandel | B | 25 | 8 |
| ***Prunus laurocerasus*** L. | Cherry laurel | B | 25 | 8 |
| ***Prunus persica*** (L.) Batsch | Peach/Perske | B | 25 | 8 |
| ***Prunus persica*** (L.) Batsch var. ***nucipersica*** Schneid. | Nectarine/Nektarien | B | 25 | 8 |
| ***Prunus salicina*** Lindl. | Japanese plum/Japanse pruim | B | 25 | 8 |
| ***Psidium guajava*** L. | Guava/Koejawel | B | 25 | 8 |
| ***Psylliostachys*** (Jaub. & Spach) Nevsk (All/Alle spp.) | Psylliostachys | A | 20 | 5 |
| ***Punica granatum*** L. | Pomegranate/Granaat | A | 20 | 5 |
| ***Pyrus*** L. (All/Alle spp.) | Pear/Peer | B | 25 | 8 |
| ***Ranunculus*** L. (All/Alle spp.) | Buttercup, Crowfoot | A | 20 | 5 |
| ***Raphanus sativus*** L. | Garden Radish, Fodder Radish/Radys, Voerradys. | A | 20 | 5 |
| ***Raphiolepis*** Lindl***.*** (All/Alle spp.) | Hawthorn | A | 20 | 5 |
| ***Resnova*** Van der Merwe [See/sien ***Ledebouria*** Roth.] | | | | |
| ***Rhododendron*** L. (All/Alle spp.) | Rhododendron, Rosebay, Azalea/Azalea, Bergroos | A | 20 | 5 |
| ***Rhodohypoxis*** Nel (All/Alle spp.) | Rose grass | A | 20 | 5 |
| ***Rhus*** subgen. ***Thezera*** (DC.) K. Koch) (southern African species of *Rhus* see ***Searsia)*** | | | | |
| ***Ribes*** L. (All/Alle spp.) | Currant, Gooseberry/Kruisbessie | B | 25 | 8 |
| ***Ricinus communis*** L. | Castor bean, Castor-oil-plant/Kasterolie | A | 20 | 5 |
| ***Rosa*** L. (All/Alle spp.) | Rose/Roos | B | 25 | 8 |
| ***Rosmarinus*** L. (All/Alle spp.) | Rosemary/Roosmaryn | A | 20 | 5 |
| ***Rubus*** L. (All/Alle spp.) | Bramble, Raspberry/Braam, Framboos | B | 25 | 8 |
| ***Rudbeckia fulgida*** Aiton | Early coneflower, orange coneflower | A | 20 | 5 |
| ***Ruscus aculeatus*** L. | Butcher's broom | B | 25 | 8 |
| | | | | |
| ***Saccharum officinarum*** L. | Sugar cane/Suikerriet | A | 20 | 5 |

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| ***Saintpaulia ionantha*** H. Wendl. | African violet/Usambaravioolt jie | A | 20 | 5 |
| ***Salvia*** L. [excluding/uitsluitend ***S. coccinea*** Etlinger, ***S. reflexa*** Hornem., ***S. runcinata*** L. f., ***S. sclarea*** L., ***S. stenophylla*** Burch *ex* Bent., ***S. tiliifolia*** Vahl and/en ***S. verbenaca*** L.] | Sage/Salie . | A | 20 | 5 |
| ***Sambucus*** L. (All/Alle spp.) | Elder/Vlier | A | 20 | 5 |
| ***Sandersonia*** Hook. (All spp.) | Christmas Bells | A | 20 | 5 |
| ***Sarcococca*** Lindl (All/Alle spp.) | Sweetbox, Christmas box | B | 25 | 5 |
| ***Scabiosa*** L. (All/Alle spp.) | Pincushion flower/Koringblom, Scabiosa | A | 20 | 5 |
| ***Scadoxus*** Raf. (All/Alle spp.) | Blood lily | A | 20 | 5 |
| ***Scaevola*** **L.** (All/Alle spp.) | Scaevola | A | 20 | 5 |
| ***Schizocarphus*** Van der Merwe (All/Alle spp.) | Schizocarphus | A | 20 | 5 |
| ***Schlumbergera*** Lem. (All/Alle spp.) | Crab cactus, Christmas cactus/Kersfeeskaktus, Krapkaktus | A | 20 | 5 |
| ***Scilla*** L. (All/Alle spp.) | Squill | A | 20 | 5 |
| ***Sclerocarya birrea*** (A. Rich.) Hochst. subspp. ***caffra*** (Sond.) Kokwaro | Marula/Maroela | B | 25 | 8 |
| ***Searsia*** F. A. Barkley (All/Alle spp.)<br>(= *Rhus* subgen. *Thezera* (DC.) K. Koch) | Searsia | B | 25 | 8 |
| ***Secale cereale*** L.… | Rye/Rog | A | 20 | 5 |
| ***Selago*** L. (All/Alle spp.) | Selago | A | 20 | 5 |
| ***Senecio brachypodus*** DC | Mustard caranary creeper | A | 20 | 5 |
| ***Serruria*** Salisb. (All/Alle spp.) | Spider bush, Blushing bride/Spinnekopbos, Bruidsblom | B | 25 | 8 |
| ***Setaria*** P.Beauv. (All/Alle spp.) | Bristle grass | A | 20 | 5 |
| ***Setaria nigrirostris*** (Nees) Dur. *et* Schinz | Black seed bristle grass/Swartsaadmannagras | A | 20 | 5 |
| ***Setaria sphacelata*** (Schum.) Stapf *et* C.E. Hubb. | Common setaria/Gewone setaria | A | 20 | 5 |
| ***Sideroxylon inerme*** L. | Milkwood | B | 25 | 8 |
| ***Sinapis alba*** L. | White mustard/Wit Mosterd | A | 20 | 5 |
| ***Skimmia*** Thunb. (All/Alle spp.) | Skimmia | A | 20 | 5 |
| ***Solanum melongena*** L. var. ***esculentum*** Nees | Egg fruit, Aubergine, Brinjal/Eiervrug | A | 20 | 5 |
| ***Solanum rantonetii*** (Carriére) Bitter<br>(=Lycianthes rantonnetii(Carriere) Bitter) | Blue potato-bush | B | 25 | 8 |

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| ***Solanum retroflexum*** Dunal | Wonderberry | A | 20 | 5 |
| ***Solanum tuberosum*** L. | Potato/Aartappel | A | 20 | 5 |
| ***Solidago*** L. (All/Alle spp.) | Goldenrods | A | 20 | 5 |
| ***Sorghum*** Moench. [***S. almum*** Parodi, ***S. sudanense*** (Piper) Stapf and/en hybrids/hibriede] | Forage sorghum/Voersorghum | A | 20 | 5 |
| ***Sorghum bicolor*** (L.) Moench | Grain sorghum/Graansorghum | A | 20 | 5 |
| ***Spathiphyllum*** Schott (All/Alle spp) | Spathe flower, While sail/Seilbootjie | A | 20 | 5 |
| ***Sporobolus fimbriatus*** (Trin.) Nees | Rush Grass/Fynvleigras | A | 20 | 5 |
| *Spiraea* L. (All spp.) | Spirea | B | 25 | 8 |
| ***Spiraea*** L. (All spp.) | Spirea | B | 25 | 8 |
| ***Stachytarpheta*** Vahl. (All/Alle spp.) | Stachytarpheta | A | 20 | 5 |
| ***Stenotaphrum secundatum*** (Walt.) O. Kuntze .. | Buffalo quick grass, St Augustine grass/Buffelskweek | A | 20 | 5 |
| ***Strelitzia*** Ait. (All/Alle spp.) | Strelitzia. | A | 20 | 5 |
| ***Stylosanthes hamata*** (L.) Taub. | Caribbean Stylo/Karibbiese Stylo | A | 20 | 5 |
| ***Sutera*** Roth (All/Alle spp.) | Sutera | A | 20 | 5 |
| ***Symphoricarpos albus*** (L.) S. F. Blake | Waxberry, Snowberry/Wasbessie, Sneeubessie | A | 20 | 5 |
| ***Syzygium*** Gaertn. (All/Alle spp) | Waterwood tree/Waterhoutboom | B | 25 | 8 |
| | | | | |
| ***Tagetes*** L. (All/Alle spp.) | Marigold/Afrikanertjie | A | 20 | 5 |
| ***Tamarix*** L. (all spp. Except *T. ramosissima* Ledeb. And *T. chinnesis* Lour.) | Tamarix | B | 25 | 8 |
| ***Tanacetum*** L. (All/Alle spp.) | Tanacetum | A | 20 | 5 |
| ***Thea sinensis*** L. [See/Sien ***Camellia sinensis*** (L.) O. Kuntze] | | | | |
| ***Tibouchina*** Aubl. (All/Alle spp.) | Glory bush tree/Gloeriebosboom, Lasiandra | A | 20 | 5 |
| ***Thuja occidentalis*** L. | Eastern white cedar | B | 25 | 8 |
| ***Trifolium*** L. (All spp./Alle spp.) | Clover/Klawer | A | 20 | 5 |
| ***X Triticosecale*** Witt. (*Triticum x Secale)* | Triticale/Tritikale, Korog. | A | 20 | 5 |
| ***Triticum*** L. (All/Alle spp.) | Wheat/Koring | A | 20 | 5 |
| ***Tropaeolum*** L. (All/Alle spp.) | Nasturtium/Kappertjie | A | 20 | 5 |
| ***Tulbaghia*** L. (All/Alle spp.) | Wild garlic/Wilde knoffel | A | 20 | 5 |
| | | | | |

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| ***Urochloa brizantha*** (Hochst. Ex A. Rich.) R.D. Webster (=***Brachiaria brizantha*** (Hochst. *ex* A. Rich.) Stapf) | Bread grass | A | 20 | 5 |
| | | | | |
| ***Vaccinium*** L. (All/Alle spp.) | Blueberry, Cranberry/Bosbessie | B | 25 | 8 |
| ***Veltheimia*** Gled. (All/Alle spp.) | Veltheimia | A | 20 | 5 |
| ***Verbascum*** L. (All/Alle spp.) | Mullein | A | 20 | 5 |
| ***Verbena*** L. (All/Alle) spp.) | Vervain/Verbena | A | 20 | 5 |
| ***Veronica*** L. (All/Alle spp.) | Speedwell/Veronica | A | 20 | 5 |
| ***Vicia faba*** L. | Broad Bean/Boerboon | A | 20 | 5 |
| ***Vicia sativa*** L. [including/insluitend ***V. angustifolia*** L.] | Common Vetch/Gewone Wiek | A | 20 | 5 |
| ***Vicia villosa*** Roth [including/insluitend ***V. dasycarpa*** Ten.] | Hairy vetch, Woolly-pod vetch/Harige wiek | A | 20 | 5 |
| ***Vigna unguiculata*** (L.) Walp. [including/ insluitend ***V. sinensis*** (L.) Savi *ex* Hassk. and/en ***Dolichos biflorus*** L.] | Cowpea/Akkerboon | A | 20 | 5 |
| ***Vigna subterranea*** (L.) Verdc. | Bambara groundnut | A | 20 | 5 |
| ***Vinca*** L. (All/Alle spp.) | Periwinkle/Maagdeblom | A | 20 | 5 |
| ***Viola*** L. (All/Alle spp.) | Violet/Viooltjie | A | 20 | 5 |
| ***Vitis*** L. (All/Alle spp.) | Grape/Druif | B | 25 | 8 |
| | | | | |
| ***Watsonia*** Mill (All/Alle spp.) | Watsonia/Watsonia, Suurknol, Pypie | A | 20 | 5 |
| ***Weinmannia*** L. (All/All spp.) | Weinmannia | A | 20 | 5 |
| ***Westringia*** Sm. (all spp./alle spp.) | Westringia | A | 20 | 5 |
| | | | | |
| ***Xanthosoma*** Schott. (All spp.) | Malanga | A | 20 | 5 |
| ***Xerochrysum bracteatum*** (Vent.)Tzvelev (=***Bracteantha bracteatum*** Anderb. & Haegi) | Everlasting, Immortelle, Strawflower/Sewejaartjie, Strooiblom | A | 20 | 5 |
| | | | | |
| ***Yucca filamentosa*** L. | Adam's needle | A | 20 | 5 |

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| | | | | |
| ***Zantedeschia*** Sprengel (All/Alle spp.) | Arum lily/Aronskelk, Varkoor. | A | 20 | 5 |
| ***Zea mays*** L. | Grain maize/Graanmielie | A | 20 | 5 |
| ***Zea mays*** L. var. ***saccharata*** Bailey | Sweetcorn/Soetmielie, Suikermielie | A | 20 | 5 |
| ***Ziziphus jujube*** Mill. | Jujube | A | 20 | 5 |

Annexure 2: Questionnaire

1. FARM DETAILS:

1.1 Farm Name: .....

1.2 Province:.....

1.3 District Municipality:.....

1.4 Local Municipality:.....

1.5 Village/Town:.....

1.6 No. of Hectares:.....

2. PLANT BREEDERS' RIGHTS ACT, 1976 (ACT. NO. 15 OF 1976):

2.1 Are you familiar with the Plant Breeders' Rights Act which aims to protect the rights of breeders of new plant varieties? (Please tick the most appropriate)

Yes ☐

No ☐

Heard of it, but I do not understand it ☐

3. FARM SAVED SEED

3.1 Do you save seed from your harvest to use the following year?:

Yes ☐

No ☐

3.2 If yes, please complete the table below:

| Crop type (maize, wheat, etc.) and variety names (if known) | No. of hectares under cultivation | Do you save seed of varieties protected by plant breeders' rights? [Yes (Y), No (N), Do not Know (D)] |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

3.4 Why do you save seed? (Please tick the most appropriate):

| Reason | Most important | Important | Less important |
|---|---|---|---|
| i) To save money | | | |
| ii) To sell to other farmers | | | |
| iii) To exchange with other farmers | | | |
| iv) For own use (in my own farm) | | | |
| v) To use in creating improved varieties (e.g. selection) | | | |
| vi) To take it to cooperatives for further processing (e.g. milling) | | | |
| vii) Other: please specify …… | | | |