INTELLECTUAL PROPERTIES RIGHTS-A STRONG DETERMINANT OF ECONOMIC GROWTH IN AGRICULTURE- A REVIEW

Mohan Lal , Love Kumar Singh and Munmun Rai,
Central Soil Salinity Research Institute,
Karnal - 132 001 India

ABSTRACT

In the past few decades the subject of intellectual property rights (IPRs) has occupied center stage in debates about globalization, economic development and poverty elimination. This study concerns the strengthening of IPRs in the plant breeding industry and its effect on agriculture in India. In India, most of the population relies on agriculture for its livelihood. India is self-sufficient in wheat and paddy, but deficient in other agricultural products. Patents are good indicators of research and development output. Patent analysis makes it possible to map out the trend of technological change and life cycle of a technology - growth, development, maturity and decline. Patent information and patent statistical analysis have been used for examining present, technological status and to forecast future trends. One can determine the directions of corporate R&D and market interests by analyzing patent data. The present study is an attempt to analyze patents granted in India in the field of agriculture and importance of biotechnology-based innovations in agriculture

Key words: Intellectual property rights, Patents, Agriculture.

Agriculture in developing economies is rural based with majority of poor people dependent on it. Hence, any new technology that would result in improving the crop yield or reducing the cost will be highly useful. Particularly, bio-technology innovations have several useful applications in agriculture and are useful for developing countries. How-ever, when such new technologies are protected by intellectual property the implications are different. The plant protection system available in India enables the farmer to save, use, sowing, exchange, or shares the seeds of protected variety, besides offering protection on farmers’ variety, ex-tant variety and essentially derived variety. In this paper, an attempt is made to discuss the options available in providing IPRs in agriculture, and importance of biotechnology -based innovations in agriculture

Origin of Indian legislation

According to the Indian Patent Act 1970 and subsequent Patent (Amendment) Act, 1999 and 2002, patents could be applied mainly for agricultural tools and machinery or the processes for the development of agricultural chemicals Sharma (2005). However, methods in agriculture or horticulture, life forms of other micro-organisms like plant varieties, strain/breeds of animals as well as products derived from chemical/biochemical processes, and any processes for me-dicinal, surgical, curative, prophylactic or other treatments of animals or plants to render them free of diseases or to increase their economic value or that of their products as such, did not constitute the patentable subject matter under the previous patent regime. Till 2004, now the inventions related with agrochemicals as products can be patented.
according to the Patent (Amendments) Act, 2005. Earlier, India did not have any legislation to protect plant varieties and no immediate need was felt. However, after becoming a signatory to Trade Related aspects of Intellectual Property Rights (TRIPS) agreement, such legislation was necessitated. TRIPS provide protection for plant varie-ties by mandating their protection by patents or by an effec-tive sui generis system or by any combination thereof. The sui generis system for protection of plant varieties was de-veloped integrating the rights of breeders, farmers and vil-lage communities. Sui generis enables the design of one’s own system of protection for plant varieties as an alterna-tive or addition to a patent system for protecting plants.

**IPR options in agriculture**

Under the Trade Related Intellectual Property Rights Sys-tem (TRIPS), developing countries can choose to provide patents or develop a sui generis system to protect innova-tions in agriculture. They also have a third option of joining the Union International Pour la Protection Des Abstentions Vegetables (UPOV). UPOV has been an obvious choice for many countries between the tough standards of patents and the task of developing a sui generis system as it provides an off-the-shelf solution to developing such legislation. India has chosen to develop a sui generis system, which is known as the ‘Protection of Plant Varieties and Farmers’ Rights Bill 2001’ (referred to as Indian Plant Act in this paper). These are discussed in the following paragraphs.

Under Article 27.3 (b) of the TRIPS Agreement, members of the World Trade Organization (WTO) may exclude from patentability ‘plants and animals other than microorganisms and essentially biological processes for the production of plants or animals other than non-biological and micro-biological processes Watal (2001). All plants and animal varieties pro-duced by asexual methods of production become eligible for patent protection or sui generis protection or both. This stipulation extends IPR protection to advances made in plant genetic engineering and plant biotechnology. Accord-ingly, a plant or a part of the plant can be protected under patents or plant variety protection or plant breeders’ rights (PBRs). Not all the countries have protected their plant va-rieties. While the US believes that anything under the sun made by man is patentable, there is a considerable amount of resistance in the European Union including their varieties and even define microorganisms narrowly. Developing countries, such as Argentina, Brazil and the Andean Group, that have implemented TRIPS, so far, only allow patents for microorganisms and micro-biological processes excluding plants, animals, genes and other biological material even if isolated by technical proc-esses. These countries have also allowed for compulsory licenses and research exemptions in their patent laws Watal, 2001 and Biotech International, 2001.

A plant or plant variety becomes eligible for protection if it satisfies the criteria of stability, novelty, non-obviousness, uniformity and being distinct, which, however, creates con-flicts and differences in defining the criterion of protection. Most developed countries now recognize that novelty is met if the claimed biotechnological product or process does not exist in the prior art. Patents are the strongest form of intellectual property pro-tection in the sense that they allow the rights 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 inter-mediate technologies) for further research and breeding purposes. One of the concerns in providing patent protec-tion to biotechnology-based research is that it could lead to patenting of research tools or the grant of broad patents that could potentially block further useful research. Under TRIPS, developing countries can choose to provide patents or develop a sui generis system. Countries also have a third option of joining UPOV. UPOV has been an obvious choice for many countries between the tough standards of patents
and the task of developing a sui generis system as it provides an off-the-shelf solution to developing such legis-lation. UPOV appeared as an international agreement in 1961 for administering the rules on plant variety protection and gave a new thrust to the recognition of plant breeders’ rights in many countries. The main advantage of the 1961 UPOV Convention, as revised in 1978 and 1991, is the re-ciprocal national treatment or the same treatment to foreign right holders as accorded to nationals for the protection of new plant varieties from member countries. Unlike other subjects under TRIPS, there is no mention of adherence to UPOV in TRIPS, perhaps due to the fact that there was no agreement among industrialized countries regarding the details of an effective system of protection for plant varieties.

Although TRIPS only specifies that there should be a patients/sui generis regime, or both, pressure has been exerted on various countries to join UPOV in the context of bilat-eral trade agreements. The minimum period of protection increased to 20 years (25 years for vines and trees) in the 1991 version (from 15 and 20 years previously). The 1978 Act allowed breeders to use pro-tected varieties as a source for new varieties, which could then be protected and marketed themselves. The 1991 Act has preserved the breeder’s exception but the right of the breeder extends to varieties, which are ‘essentially derived’ from the protected variety, that cannot be marketed without the permission of the holder of the original variety.

Essentially, UPOV 1991 permits farmers to reuse their own crop for seed purposes on their own holdings but does not allow for formal sale. In contrast, TRIPS only requires that there should be some form of IP protection for plant varie-ties and does not define in any way the exceptions that may be provided to the rights of owners of protected varieties. Because of the restrictive rights of farmers in UPOV 1991, although some of the Asian countries allowed patenting of microorganisms and microbiological processes even before this was a TRIPS requirement, not all of them became members of UPOV other than China until mid-2000. Given the ambiguity in defining the term ‘effective’, and the lev-erage available in UPOV 1978, following UPOV 1978 would be a preferred option for many, although presently, membership to UPOV 1991 alone is open.

Apart from the use of patents and plant varieties protection, intellectual property in plants can also be appropriated by technological means. For instance, crops such as commer-cial hybrid of maize cannot be reused if hybrid yield and vigour are to be maintained. This characteristic of some ‘hybrids confers a natural form of protection by which seed companies can more readily capture a return on their in-vestment through repeat seed sales’ (Report of the Com-mission on Intellectual Property Rights (RIIPRDP), 2002). These are the types of IPR options available in plant protec-tion. In the following paragraphs, we discuss the sui generis system as adopted in India.

**Growth of patenting activity in agriculture**

Analysis of the data indicates that agriculture patents con-stitute ~ 2% of the total Indian patents (Table 1). The growth of patenting activity during 1995-2004 is shown in (Table 1). It can be concluded that there is a gradual increase in the number of patents. The number of patents reached a maximum during 2001-2002, while it declined during 2003-04 Mittal et al (2005).

**Country-wise distribution of patents**

Data from the country of the applicants were analyzed in order to ascertain the countries of the research group active in R&D in agriculture. Data on the number of patents granted to different countries indicate that 113 Indian appli-cants obtained 288 (64%) patents and the rest 161 (36%) patents were granted to 98 foreign applicants. Applicants from the United States, United Kingdom and Japan are on the top three foreign countries in terms of the number of patents granted in India ipindia.nic.in (2010) and Koo et al (2004).

Majority
of applicants that accounted for total patents granted in India are American Cyanamid Co, USA (17), Zeneca Ltd, UK (11) Sumitomo Chemical Co, Ltd, Japan (6), CSIR (58), United Phosphorous Ltd, (12), Sulphur Ltd, (11), Montari Industries Ltd (7), Rallis India Ltd (7) are the major players. Among foreign countries, USA topped the list with 66 patents followed by UK 23, Japan 21, Australia 9, Germany and Israel, 7 each. The remaining 28 patents were granted to countries such as Brazil, Canada, Denmark, France, Italy, Korea, Luxembourg, Malaysia, Mauritius, Norway, South Africa, Spain, Sweden, Switzerland and USSR. It may be concluded that maximum number of patents was granted to the home country. USA received patents for cotton harvester; cultivation of fungi; watering arrangements for growing plants; cheese making apparatus; milk protease production; feeder apparatus for birds; device for egg-collection; insect-killing device; preservative composition for animals; pesticide; herbicidal and fungicidal composition and acyclic compounds, organic nitrogen compound or heterocyclic compounds Gazette of India (1977) and Frame et al (1977). In Japan, the main focus of patenting activity was on preparing bactericide containing inorganic com-ounds; herbicides; vapor or smoke emitting composition; biocides containing acyclic compounds or organic nitrogen compounds; mushroom cultivation; container for marine animals; beehive device and device for catching insects. Further analysis of data indicates that majority of the Indian applicants were individuals (47%), while 41% was industries and the rest R&D institutions. Patenting activity in the ICAR (six patents) was low, while CSIR (58 patents) played a significant role. However, in case of foreign applicants, 82% belonged to industry, 13% individuals and the rest 5% R&D institutions. Like the number of patents, the number of applicants also was highest for USA (33) followed by Japan (13), UK (12), and Australia (8).

**Discipline-wise classification of patents in agriculture**

Discipline-wise analysis and classification of patents in agriculture according to the total number of patents granted, has been categorized into ten classes of IPC. The subclass number covering medicinal preparation containing materials from plants has been clubbed with subclass biocides and plant growth regulators. The IPC class A01B (soil working in agriculture or forestry; agricultural machines or implements), all the patents were granted to Indian applicants for developing agricultural and gardening tools set, seed-cum-fertilizer drill, hu-man-propelled tiller, ploughing-cum-sowing implement, mattock cultivator, rotary tilling device, shaft-driven timing system for internal combustion engines, improved plough with a mounted adaptor, adaptor for plough and improved process for manufacturing tractor discs Schubert (1986). In the IPC class A01C (planting, sowing and fertilizing), out of 15 patents Indian applicants received 10 for developing portal digital soil salinity tester, air screen cleaner machine, preparing in situ

### Table 1: Total output of Indian patents in agriculture.

<table>
<thead>
<tr>
<th>Block Year</th>
<th>Total no. of granted</th>
<th>Total no of patents</th>
<th>Block year patents in agriculture percentage</th>
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<tbody>
<tr>
<td>1995-96</td>
<td>2780</td>
<td>47</td>
<td>1.69</td>
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<tr>
<td>1997-98</td>
<td>4780</td>
<td>100</td>
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<td>1999-2000</td>
<td>3250</td>
<td>91</td>
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<td>2001-02</td>
<td>3820</td>
<td>109</td>
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<td>2003-04</td>
<td>5930</td>
<td>102</td>
<td>1.78</td>
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<tr>
<td>10 years</td>
<td>20560</td>
<td>449</td>
<td>2.18</td>
</tr>
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compost, machine for cleaning and grading of seeds, preparation of synergistic fertilizer composition from agri-cultural compost and agricultural waste, groundnut planter, animal-driven agricultural apparatus, manufacturing a slow-release urea fertilizer by nitrification inhibition, sowing device and composition for increasing herbage and essential oil yield in Palmarosa. In the IPC class A01G (horticulture, cultivation and forestry), out of 33 patents 22 were granted to India, 4 to USA, 2 to the Nether-lands, and 1 to France, Israel, Italy, Japan and Mauritius respectively. Indian applicants received patents for khurpa for gardening and sowing, automatic device for soil irri-tation for shallow rooted agricultural farms/ gardens, under-ground subsoil irrigation, automatic drip irrigation system, improved dripper, tractor for use in horticulture operations, rain guard for a latex yielding tree, implements for garden-ing and sowing, device for supporting latex collection re-ceptacle, cutting and gripping device, water can-dle for automatic watering of plant and apparatus for irri-gating plants Karki et al (1997), Guruprasad (2004) and Wu and Liu (2004). Foreign applicants received patents for pre-paring a substrate for culture of fungi, drip irrigation tape and emitter, irrigator, fluid distributing system and plant protection device.

Status of biotechnology in India

With the establishment of National Biotechnology Board (NBTB) in 1982, a move was made to develop biotechnol-ogy in India PPVFR (2001) and Agricultural statistics at a Glance (2007) . One of NBTB’s tasks was to coordi-nate the biotechnology research done by various agencies like the Department of Science and Technology, Depart-ment of Atomic Energy, Council of Scientific Research, Indian Council of Agricultural Research, Indian Council of Medical Research and various universities. NBTB’s role was to improve research initiatives on BT, develop infra-structure and skills required for R&D in BT and other strategies like bio-safety, regulation, intellectual property rights, etc. In 1986, the Department of Biotechnology (DBT) replaced NBTB. Under this move, infrastructure and research facilities were created; besides the facilities for maintenance of cell lines, acquisition of research biological at a central point and distribution was created. Under DBT’s guardianship, financial institutions started encouraging in-vestments in BT commercialization by entrepreneurs. An interface organization called Biotech Consortium of India was established to serve as a link between research organi-zations and industry located either in India or abroad. A survey of Indian patents in biotechnology during 1972- 1988 carried out for the Department of Biotechnology and subsequently updated until 1991 showed that patenting in biotechnology is foreign-dominated with nearly 75% of the patents owned by foreigners. In the agricultural sector, it covers plant growth regulators, veterinary vac-cines, plant cells and tissue culture. In the food industry, dairy and fish products, yeast and food additives, starch products, glucose and fructose syrups are covered by the biotechnology patents. However, what is significant is that biotech patents are marked by a shift towards newer areas employing gene manipulation techniques.

Huge resources are spent on introducing new traits in plants through GMOs, and all over the world, the field of trans-genic crops has been expanding ever since such products were introduced in 1996James (2001) and Qaim (2001) . It is considered that use of transgenic crops results in sustainable and resource-efficient crop management practices, aside from reducing the use of pesticides in crop production, and thus impact positively on biodiversity. Because of these advantages, the total land area used for transgenic crops increased from 1.7 million ha in 1996 to 58.7 million ha in 2002. In the United States alone, the total land area used for these crops in-creased from 1.5 to 39 million ha (majority under trans-genic cotton), where patents and UPOV 1991 protect inno-vations in plant varieties. In 2000, a total of 13 countries, 8 industrial and 5 developing countries, grew GM crops. In some developing countries, even if the technical capacity
to regulate for bio-safety is strong, approvals for GM crops have been delayed because of political pressures from local and international anti-GM activist groups and uncertainty regarding consumer acceptance of GM products in international markets. GM crop technologies created by private companies restrict technology transfer to poor farmers in poor countries because of the privately held intellectual property rights. Lack of protection for intellectual property rights in developing countries demotivates the entry of the private sector.

Research in this area is nevertheless expanding. For instance, there are about 50 public research institutions in India, which are engaged in modern biotechnology tools for agriculture. At least 10 of these are engaged in plant genetic engineering with rice, chickpea, oilseeds, cotton and number of horticultural products. Furthermore, there are about 45 private and foreign companies carrying out research in agricultural biotechnology. Most of the crops have been developed elsewhere and Indian manufacturers are back-crossing the local hybrids with transgenic seeds to develop commercially viable hybrids that can be grown in different agro climatic regions of the country, by paying a license fee. Once they are successful, the Indian manufacturers can register their 'essentially derived varieties' under the Indian Plant Act Sharma (2003). Already, such a variety owned by Monsanto of the United States has been obtained by the Maharashtra-based MAHYCO (Indian collaborator of Monsanto) on payment of license fee to introduce transgenic or Bt cotton in India. This has been commercially approved for sale in a few states. As evident from, much of the research on transgenic cotton is focused on developing plants that are resistant to lepidopteron pests. This is because cotton cultivation utilizes about 9 million ha and accounts for roughly 50% of pesticide consumption in India. Cotton cultivation in India has been plagued with rising costs of cultivation, ineffective pesticides, adulterated seeds and other factors leading to consecutive crop failures and heavy indebtedness have led to suicides by farmers.

**CONCLUSION**

An attempt has been made to analyses the trends of patent-ing and patented technologies in India in different areas of agriculture also innovations in biotechnology and its several useful applications in agriculture is discussed. The study also interprets innovative activities in the agricultural sector with regard to patent statistics. The result of the study will provide a global scenario of applicants who have obtained patents in India. While patents prevent further research, a sui generis system adopted by India benefits both the farmers and the breeders, and diffusion is possible. This paper highlighted some of the issues that emerge from the context of extending protection to extant and essentially derived varieties, and the implications for agricultural research in the context of adopting transgenic technology. While protection may encourage the private sector to go for research in commercial crops, it may also divert the resources of the public sector from investing in research on food crops to regulating and monitoring the research in private sector. Nevertheless, the task that confronts developing countries like India is in focusing on developing the physical and scientific infrastructure to provide plant protection effectively.

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