greater output in terms of collaborations at faculty–faculty, institute–institute/industry, faculty–institute/industry levels, which is also encouraged by Government-funding agencies, for efficient manpower utilization and to give a fair deal to the partnership, the curriculum as well as in tellectual property developed at various levels. Mere signing of MOUs between participating institutions to boast that they have collaborations with such and such agencies will not help to solve this problem. A nationwide awareness programme on 'scientific contributions' will help to chalk out a path to facilitate scientists, students, colleges and universities for effective contributions and prevent conflicts that may arise in future.

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US patents on plant varieties and beyond?

With the invasion of 'impact factor' on the Indian science horizon we had a slogan 'publish or perish' in nineties that has gradually acquired a dominant role in decision-making in academic institutions and academies. However, in the commodity-based research institutions there is prominence of its new *avatar* 'patent or perish' in the new millennium, although the authorities seek to strive for a composite version 'patent, publish and prosper'. True, the latter is complementarily pragmatic and deserves to be expeditiously realized into practice, but we in India could always find holes even in the best of the policies to serve our vested interest. With the declining standards in Indian science and increasing interest in patent regime, there has been a desperate urge among some scientists to go for patents in the absence of publications. In this context, the *Nature* News[1] that carried a story about racing for US patents for anything and everything seems quite timely and 'thought' for introspection. This is all the more pertinent when it comes to patenting plants and other natural wealth[2].

Lately, there has been an increasing interest in IPR even in agricultural sciences[3] that have so far been serving the societal concerns. In addition to the other means of IPR protection of plant varieties, USPTO (US Patent and Trademark Office) is the only agency that grants patents on plant varieties. USPTO could be a powerful instrument in the hands of multinational companies developing GE crop varieties. However, a desire has been growing among the so-called 'high profile' Indian scientists associated with public-funded institutions to go for US patent on plants – as an easy means to inflate their biodata. This is mainly because any plant variety/selected clone could be granted US patent when money for patent filing fee is easily available, and one can attach a 'big' US tag to his/her CV. There are several instances where the same team of scientists has gone on procuring series of US patents on plant varieties of the *same species* in succession without waiting to realize the economic benefits of the preceding variety. It is easier to obtain a patent in US than any other part of the world[4].

As a person associated with plant genetics I feel deeply concerned, when we in India attempt to obtain US patent on plant varieties – especially vegetatively propagated ones – for which USPTO is an easy and only instrument as a patent granting authority. I am aware of many instances where a simple selection (better call it as collection?) of a non-conventional crop plant (say a traditional medicinal plant – there may be thousands of such species) for which no standard commercial cultivar could be registered, are granted US patent. With little effort, a clever scientist having public money available for patent fee just describes the characteristic identification features of a vegetatively propagated plant (clone), claims it as a first standard variety (because there is no existing variety 'check') and goes ahead for obtaining US patent, and the same is granted.

However, there could be serious apprehensions in venturing for US patents on plants of Indian origin vis-à-vis realizing commercial gains for which patenting is intended.

- Grant of US patent does not ensure that the plant could be introduced in USA for commercial cultivation just on the wish of the licensee. There are very strict plant introduction and tough quarantine laws, and cultivation regulations in US. Therefore, there is no guarantee to realize commercial benefits even if the plant species patented is worth demanding in US.
- An obligate asexual species of Indian/alien origin having seed forming capacity holds the potential to become invasive in US, thus inviting litigation from US Environment Protection Agency.
- Transfer of plant material of Indian origin to US under US patent license may overlap/clash, with the provisions of CBD for which India is a signatory (but not USA), and with our own plant variety protection measures.
- There may not be many takers in US for cultivation of a non-conventional plant of alien/Indian origin – then why waste huge amount of public money on obtaining US patent and maintenance fee, without any feasibility study on its prospective demand in US?
- For some region-specific species having high international demand including in US, we should prefer to restrict their cultivation within or territorial confines and venture for value addition to facilitate export potential. For example there are many region-specific high value species in Latin America, e.g. Brazilian plant *Pilocarpus jaborandi* (a rich source of pilocarpine, the only effective remedy for glaucoma – having no substitute in modern medicine) that remains virtually under captive cultivation in its native land.

As such, there are reasons to apprehend that under the garb of 'US patent tag'

some influential scientists in public institutions in India may have used public money to obtain/obtaining US patents as an easy alternative to publications just to enhance their biodata – I would better call such patents as 'biodata patents'. Such patents are hardly supported by peer-reviewed publications to satisfy the slogan 'patent, publish and prosper', because in many instances they cannot be published, and in others they are found to be non-sustainable to scientific scrutiny. Although, only a specific situation with respect to US patents on plants is covered here, the same could hold true with most US patents granted to public-funded institutions to a reasonable extent. Could we transform the hype for indiscriminate patenting into real property.

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Bt cotton for pest management or pest management for *Bt* cotton?

The first biotechnological tool in Indian agriculture is the *Bacillus thuringiensis Cry IAc* gene incorporated cotton, and has been commercially cultivated since 2002. Ever since the release of *Bt* cotton hybrids, there have been debates on the environmental issues and *per se* field efficacy at farm level of the released cultivars. Today we have 14, 29 and 25 *Bt* genotypes for North, Central and South zones, respectively among a total of 59, approved for cultivation. The very fact that the area under *Bt* cotton is on the rise, from 38038 ha in 2002 to 37.1 lakh ha in 2006–07 season, spells out obviously yield maximization at one hand and cost savings on the other. It is a feel-good factor of the *Bt* cotton, and we have been adopting it for socio-economic welfare of our country. Conscious of the anticipated field level problems such as resistance development by bollworms and secondary pest problems in the given Indian cotton insect pest scenario, research entomologists are on their toes to develop pest management practices/packages, without however drawing clear-cut demarcations between the role of *Bt* cotton in minimizing the losses due to bollworms wherein *Bt* cotton becomes a component of pest management, and as a genotype that requires pest management on the production side. These differences need to be kept in mind for micro and macro-level analyses of the impact of *Bt* cotton. Assessing the bio efficacy and the quantification of loss minimization by the *Bt* cotton genotype against the bollworms *per se* needs its evaluation against its non-*Bt* counterpart. In this way we get a clear picture of the efficacy or otherwise in a given season with low or moderate or high levels of one or other bollworms. Also such an approach allows a fair comparison of the efficacy among *Bt* genotypes. However, agronomic performance of *Bt* cotton and development of a suitable protection package for *Bt* cotton cultivars require their comparison with any other cotton conventional cultivar(s) other than their non-*Bt* counterparts. This is because, there are situations wherein yield levels of conventional cultivars are on par or even better than *Bt*, depending upon the soil and seasonal conditions, apart from the level of bollworm incidence. Such a situation, when combined with equal or more number of sprays against sucking pests depending upon the genotype, does not even prove the effectiveness of the *Bt* in terms of limited plant protection cost. Therefore care needs to be exercised while we discuss the efficacy and performance of *Bt* cotton wherein the approaches to comparison need to be different. From the entomological perspective, *Bt* cotton as a component of pest management fits under host plant resistance as well as the applied biological control and technically it pre-empts the use of other bioagents, viz. *Trichogramma chilonis* and *Helicoverpa armigera* nuclear polyhedrosis virus (HaNPV), mechanical control, use of pheromones and insecticides against bollworms. Therefore, the need of the hour is to rationalize the bollworm resistance development and formulate highly optimized sucking pest management, both from a production system viewpoint. For example, the limited economic returns accruing in rainfed farming systems rarely carry economic justification for pesticide use, even on conventional cotton not to defend for *Bt* cotton. From the ecological perspective, there would be a changing pest scenario and the associated native entomofauna which we need to harness to our advantage. On the extension front that assesses *Bt* technology *per se* and of the other management interventions on *Bt*, it is prudent to compare the yields only when growing conditions are kept similar or else, the variations would be so wide that an extremely poor and a better performance at a single farm could mislead the performance *in toto* and misrepresent the common man and the policy planners alike. Be it the *Bt* cotton for pest management or the pest management for *Bt* cotton, the sole objective should be gains in reduction of production costs, more economic access of benefits to the growers, and conservation of the resilience and integrity of the ecosystem.

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