Intellectual property rights and transgenic varieties

The recent decision of the United States Patent Office denying intellectual property protection in the form of patents for more than 2000 cDNA sequences sought by the National Institutes of Health raises some fundamental questions about such patents, specially those granted to improved crop varieties produced through the recombinant DNA technology. Significantly, the rejection of the NIH application was on the grounds of obviousness and novelty[1]. The Patent Office held that there was nothing non-obvious about the reading of the DNA bases because the proposed sequences contained small fragments whose sequence has already been published. The Patent Office seemed to say that if you already know the sequence of the small fragments, it is no big deal to find the sequence of the larger DNA pieces containing them, and eventually of the entire gene. The Office further argued that the claimed sequences lacked legal novelty because they were derived using publicly available cDNA libraries.

The transgenic plant varieties are a different ball game, but it should be useful to examine how far they satisfy the criteria of non-obviousness and novelty. Transgenic varieties basically are not different from improved varieties developed through the classical methods of plant breeding—both involve recombination of genetic material from different sources. The difference is that in the case of a transgenic variety, a DNA segment containing a desirable gene is transferred and expressed into an existing variety, using recombinant DNA technology. The desirable gene could come from a completely unrelated species—plant or animal or from a microorganism. In developing transgenic varieties the modern biotechnologist has access to a much wider gene pool, unlike the classical breeder, who is limited for the most part to the variability available within the same species. Sexual recombination is a far more powerful tool for gene recombination but it is generally not possible to cross unrelated species.

Improved crop varieties developed through Mendelian techniques of plant breeding enjoy protection under the plant breeders' right legislation in many countries. The idea is to reward the company or the individual breeder for the investments made and for their skill in developing the new variety However, once the seed of the protected variety has been marketed through exclusive sale rights, any other plant breeder could use it as a parental line in future crop improvement programmes. In other words, the protection is granted for the variety and not for its genes. Also, farmers can continue to use their own harvested seed from the variety. In the case of transgenic plants, the US Patent Office has extended the provision of intellectual property rights to them in the form of regular patents, which go far beyond plant breeders' rights[2]. The varieties developed from these plants could not only earn royalty on the sale of their seed, but also other scientists may not use them as parental lines in the course of their hybridization work without permission. In other words, a transgenic variety, unlike the varieties which are the product of classical plant breeding, is not a genetic resource for wide distribution. The 'foreign' DNA which it contains has been described as a doubly protected property.

The legislation governing intellectual property rights stipulates that patents could be granted for inventions which were novel, non-obvious and useful. Non-obviousness meant that patents should be granted to recognize and reward an inventive step and that it should not be given for something which was obvious to someone skilled in the art.

The question we should be asking is: how far do the transgenic varieties meet the criterion of non-obviousness and novelty? That they are useful is not questioned. Development of transgenic plant varieties makes use of the recombinant DNA technology to produce a gene construct which includes the structural part coding for the function proposed to be transferred and the appropriate regulatory sequences controlling gene action[3]. Additionally, it employs a genetic transformation technology which makes it possible to deliver, integrate and express the gene construct in the host cell. Lastly, the transformed cell should be able to regenerate, giving rise to a transformed plant. It should be stressed that none of these technologies are so efficient at present that they could be routinely applied in many laboratories. The monocot plants which include some of the most important cereal crops like wheat and rice are particularly difficult to manipulate. Nevertheless, successful transformation leading to transgenic varieties has been possible in more than 20 plant species and the number continues to increase.

The biotechnologist producing such varieties uses materials and techniques created by publicly funded research in the same way as the NIH scientists used cDNA probes from publicly available libraries. Thus, the recombinant DNA technology marks the culmination of a number of major discoveries in biological and analytical sciences during the past 40 years, specially those relating to the discovery of the restriction enzymes and the technique for separation of macromolecules, cloning of DNA and those for *in vitro* expression of cloned genes and knowledge of gene regulation[4-6]. As regards the transformation technology, several methods including electroporation, microinjection of DNA, the use of the particulate gun, and more important, the use of *Agrobacterium tumefaciens* as a vector for delivery of the transforming DNA, are now available. Of particular interest in this context is the availability of many good plasmid vectors of this bacterium which are equipped with a strong regulatory region that allows powerful expression of the inserted gene[7]. As regards the isolation of the gene to be transferred, a wide range of probes are now available with the help of which the DNA fragments carrying the desired gene can be identified[8]. With all these techniques in the public domain, it is not the inventive step which limits the production of more transgenic varieties at present; it is the large costs involved in creating the necessary laboratory infrastructure and in assembling the trained scientific manpower. In other words, investments rather than inventiveness need to be protected.

The existing legislation on plant breeders' rights already provides an example of the kind of protection that can be extended to transgenic varieties. In the case of plant breeders' rights, the breeder is not required to provide proof of non-obviousness. For transgenic varieties also, non-obviousness has become irrelevant because of rapid advances in the recombinant DNA and transformation technologies. Transgenic varieties can be considered novel in the sense that they contain a small DNA sequence in an 'unnatural' place. But then, DNA is not species-specific. It is only the different gene combinations which become isolated in different species in the course of natural selection. Also, we have learnt in recent years that DNA observes few rules. It seems to multiply without apparent reason giving rise to a large amount of non-coding sequences, it can jump in and out of chromosomes[9], and it has coding and non-coding sequences in the same gene. Some authors have called it selfish[10]. If we can now move it around, it is only an indication of our improved understanding of its nature—an understanding to which many scientists in the past forty years have contributed.

Also, it does not seem right that intellectual property protection in the form of patents should be granted to transgenic varieties, specially when the biotechnologist has free access to improved varieties produced through classical breeding. Most developing countries do not have legislation on plant breeders' rights at present and they make their improved varieties freely available to scientists all over the world. Also, the International Agricultural Research Centres of the CG system, which have been set up to provide support to the agriculture of the developing countries working in close collaboration with their research institutions, freely distribute their improved genetic material to scientists both in the public and the private sector in the developing and developed countries. The transgenic varieties derive their yield potential and most other desirable attributes from the parental variety developed by the classical breeder. Further, most plant genetic resources which are the starting point of all varietal improvement programmes—classical or molecular—are a product of generations of selection by farmers. It is they who are selected for such traits as adaptibility to stress environments, disease and pest resistance, acceptable grain quality and yielding ability under traditional systems of agronomic management.

If transgenic varieties continue to be granted patents, many developing countries will have to take recourse to legislation on plant breeders' rights. A recent amendment of the international convention for the protection of new varieties (UPOV convention) lays down that a biotechnologist who adds limited genetic information into a variety protected by plant breeders' rights will have to obtain the original breeder's permission before using it in a transformation programme.

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SCIENTIFIC CORRESPONDENCE

Magnesium level

Apropos the article on the reciprocal relationship between magnesium and cerium as a common basis for coconut root (wilt) disease and a human cardiomyopathy (by Valiathan *et al.*[1]), it is seen that Mg level has been presented as $\mu g\ g^{-1}$ wet weight in this article. It is customary to present mineral concentration in plant tissues on dry weight basis, as it is the most accurate and dependable method. By taking the dry weight/wet weight ratio of the middle leaf of palm as 0.39 in diseased and 0.44 in healthy plasm (Chacko Mathew, *J. of Plantation Crops*, 1981, **9**, 51–55) and converting the values as percentage on dry matter, the figures of Valiathan *et al.* become 0.065% in diseased palms, 0.059% in healthy-looking palms in Quilon and Alleppey, 0.077% in Bombay and 0.086% in Manavalakurichy, which are exceedingly low, and with such low levels, the palms would show acute Mg deficiency symptoms like severe yellowing of foliage. The critical level of Mg (frond 14) is 0.2% on dry matter basis. The magnesium contents of healthy plantations in most of the coconut-growing countries of the world range from 0.2 to 0.4% of dry matter (Manciot *et al.*, *Oleagineux*, 1979, **34**, (12), 576–580). Based on such a data the different situations were qualified as deficient or sufficient with respect to magnesium and the authors ventured to justify that the 'palms in the affected