

# PLANT BREEDING AND INTELLECTUAL PROPERTY RIGHTS

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## INTRODUCTION

When asked to talk at this workshop, I sought the views of over 20 plant breeders throughout the world about plant breeding and IPRs in relation to the International Agricultural Research Centres. Responses varied and were at times emotive. One person suggested that the "patent network should be fouled up as much as possible because it benefits only rich countries." Another, from an IARC, felt that IARCs should take out IPRs "with the sole intention of keeping their varieties free for all to use." At the other end of the spectrum was the transnational company breeder who was surprised that I should seek his views at all and replied that it "is rather like asking members of a Trade (Labour) Union whether they are in favour of a pay rise." A common feature of responses was, however, the question "what use is to be made of royalties accruing from IPRs on products from the IARCs?" The answer to that question lies outside my remit but it is so important that I pose it at this stage of our debate.

A thought-provoking paper by N.W Simmonds has recently been published: The social context of plant breeding. *Plant Breeding Abstracts*, 60, 337-341 (1990). In it, the author argues that society will be best served by a non-monopolistic mix of both private and public sector plant breeding which has both competitive and collaborative aspects. He also contends that in Third World countries adherence to plant variety rights schemes would be both impracticable and unwise.

As a so-called public sector plant breeder, though these days I seem to be more of a hybrid between public and private, and at times have to adopt chameleon-like characteristics, my views on intellectual property rights (IPRs) are inevitably coloured by my own experiences and my experiences, especially in the UK and Europe, have been closely interwoven with the evolving relationships between private and public plant breeders. I mention this at the outset because I think that central to our discussions is the thorny question of such relationships, whether we are thinking of the release from public to private of basic, primitive genotypes from gene banks or highly developed, advanced breeding material. I recognize, of course that movement from public to public, or more specifically from IARCs to NARs is of extreme importance and clearly must also feature prominently in our discussions. In view of the fact that IARCs are increasingly undertaking collaborative links with private industry and with

universities and research establishments throughout the world, my presentation may also be timely.

After describing the plant breeders' rights scheme in the UK, I would like to describe the evolving relationship between private and public plant breeders in the UK in the 25 years that have passed since the 1964 Plant Varieties and Seeds Act became law.

I will then try to outline for you how royalties accruing from Plant Breeders Rights are collected. In passing I shall mention a few of the problems that occur in the operation of such rights. Lastly I shall try to cover the current status of plant breeders' rights and patents in relation to plant breeding.

## **PLANT BREEDERS' RIGHTS LEGISLATION**

The 1964 UK Act implements the International Convention for the Protection of New Plant Varieties (the UPOV Convention 1961). Throughout the 60s and 70s UPOV Member States introduced their own national laws. In the UK a grant of rights is made by the Plant Variety Rights Office (PVRO) based at Cambridge who contract out statutory work to other agencies (currently under review). We should perhaps at this stage recognize the difference between Rights and National Listing. If any agricultural or vegetable variety (irrespective of the granting of Rights) is to be sold legally within the EC countries, it must be registered on a National List after passing DUS tests similar to those for Rights and, for some species, undergoing satisfactory value for cultivation (VCU) trials. *If anyone is interested, I have with me a copy of the protocol for conducting trials of potato varieties to establish value for cultivation and use for NL purposes.*

Entry on to a country's National List (NL) qualifies a variety for entry on to the EC Common Catalogue. The VCU criteria that are applied in the UK are not without their critics who claim that "official" trials are of limited accuracy, number and poor geographical distribution. One can argue that these criticisms can be readily overcome but only at a very increased cost. For some crops Recommended Lists further complicate matters. Several UPOV states (e.g. USA and Italy) grant special plant patents for varieties instead of rights. Currently a debate is taking place within UPOV and patent circles on the question of "double protection". It is expected that there will be a move to allow a variety to be registered either for rights or patent, although probably not for both at the same time (at least in the UK).

I have described what has happened in the UK but a number of variants to the UK approach exist on the Continent. Present UPOV discussions may mean that within the next 18 months a single submission for Rights will cover all EC countries. At the moment submissions have to be made for each country, though entry on to a National List qualifies a variety for inclusion (with about, a

12 months lapse) on the EC Common Catalogue. Entry on to National Lists and Common Catalogue permits sale of seed but as indicated earlier does not, of course, provide any royalty cover. Within Europe the costs of PBR and NL schemes are forcing countries to move towards sharing testing and trialling, i.e. country X will become responsible for crops A and B, while country Y covers crops D and C etc..

Breeders' rights in Europe are granted (according to species) for 20 to 30 years but can, during that time, be withdrawn if a breeder fails to maintain a variety. Moreover, other breeders are free to use a protected variety in their own breeding programmes to create a new variety, although UPOV will be introducing a "dependency" position to deal with cases where varieties have been bred using genetic manipulation techniques (i.e. there will be a dependency payment to the breeder of the original variety used in the breeding of a newer one). The award of rights automatically carries with it an obligation on the part of the rights holder to maintain a protected variety. For both patents and PBRs in the UK there is a provision for the granting of compulsory licenses. To the best of my knowledge there have been relatively few such cases and few licenses issued.

The compulsory license is, in my opinion, not as effective as it should be in ensuring that everyone has ready access to a variety. For example, a company may have rights on a potato variety which is marketed through 20 outlets well dispersed throughout the UK, all outlets being effectively subsidiaries of the main company. The farmers' needs, those of the wholesale and retail trade, and of the processing industry are well catered for and I doubt if a party outside the main company were to bother applying for a compulsory license it would be successful. In this way the rights holder has total, control over the movement of the protected variety. Those law breakers indulging in the illegal propagation and use of "small ware" potatoes (to which I shall return later) will claim they have been driven at this stage by "non-availability" of tightly controlled, highly valuable varieties.

Plant breeders' rights have a superficial resemblance to the exclusive rights of a patent holder but provide more limited protection. While in principle any variety of plant may be eligible for protection under the Act, not every crop in the UK is statutory subject matter. A variety within the scope of the Act must be examined in statutory trials to meet set standards for a grant. The technical criteria of protectability are distinctness, uniformity and stability (DUS). Standards within each criterion vary according to species and varietal form, i.e. whether it is inbred, hybrid, synthetic, open pollinated etc.

One of the purposes of the 1964 Act in the UK (subsequently revised and updated in 1983) was to stimulate commercial plant breeding. In simple terms the Act provided the means, whereby breeders were granted legal property rights in varieties that they bred and were able to exact royalties on the use of these varieties.

## **PUBLIC/PRIVATE SECTOR RELATIONSHIPS**

There is no doubt that for crops like cereals, which occupy large acreages both in the UK and in Continental Europe and therefore provide high royalty income, there was a determined push by the private sector to capitalize on the provisions of the Act. Interestingly, potato breeding by the private sector did not take off and even now within the UK there is relatively little private potato breeding, though things are changing. This is in direct contrast to The Netherlands where potato breeding in the private sector has been strong for many years.

Despite a determined effort by a few private plant breeding companies after the 1964 Act, public sector plant breeding of finished varieties did not diminish in the post-1964 years in the UK. In part this was due to the fact that many public sector programmes had been established well before the Act and also partly due to the Government's wish to encourage competition between private and public sector programmes. Indeed in an expansionist phase of public spending in the 1970s, public sector breeding proliferated and we had barley breeding programmes at the Plant Breeding Institute, Cambridge, at the Welsh Plant Breeding Station and the Scottish Plant Breeding Station. On the potato breeding front the PBI and SPBS and the Department of Agriculture in Northern Ireland (DANI) produced potato varieties in direct competition with each other, one (PBI) insisting that it was breeding for the ware market in England while the other two claimed to meet the needs of the whole UK.

In plant breeding terms the PBI was highly successful, particularly with its barleys, then with its wheats and there was a large capital investment at the PBI in the 1960s and 1970s to provide excellent facilities for public sector breeders, not only for the production of finished varieties but for the basic and strategic research essential to maintain a steady stream of enhanced germplasm. Indeed it might be said that indirectly the development of finished varieties, the money that accrued from them and their favourable impact on agricultural productivity in the UK, were instrumental in making the PBI one of the finest, and certainly one of the best known, breeding and genetical research centres in the world.

Not only did the PBI and its sister institutes WPBS and SPBS and breeding units at the National Vegetable Research Station, the Glasshouse Crops Research Institute, the Scottish Horticultural Research Institute, East Mailing Research Station and Long Ashton Research Station, involve themselves in research and the production of finished varieties, but they trained plant breeders for the private sector and large numbers of overseas breeders, especially those from developing countries. They provided technology for use by the private sector and readily and freely made available to the private sector basic germplasm, either from gene banks or breeders' working collections. They did not, however, make available to private breeders advanced breeding material that would help the private sector compete directly and

immediately with public sector breeders. This was in contrast to the policy that existed in The Netherlands where half-bred material was (for a few) made available on an equitable basis to Dutch breeding companies of proven capabilities.

Not surprisingly the private sector in the UK objected strongly to what they claimed was unfair competition with large sums of tax payers' money being used to underpin large Government research centres which produced finished varieties without any need to consider economic viability and, more important, profitability, public breeders responded with the argument that it was in the public interest for them to produce varieties with characters such as disease and pest resistance and novel quality characters at a time when the private sector was ill-equipped or ill-prepared to invest in the capital and recurrent expenditure necessary for such tasks. Moreover, argued the public breeders, as soon as an improved variety was National Listed or granted Rights it became available to all to make use of it in breeding programmes of their own. There was no doubt that public sector breeders were able to adopt much longer term views of work that might not have a pay-off for 20 to 30 years. In addition, the public sector was able to invest in so-called minor crops such as fruit and vegetables, and in some major ones such as potatoes, which, for sound economic reasons, private breeders were hesitant to take on board.

Interestingly it was for vegetables in the UK that the first close links were forged between private and public plant breeders in a scheme for the development of hybrid varieties of brassicas and onions (see Innes, Hort Science 19, 1984, 803-808), whereby there were roughly equal breeding inputs by both parties. This scheme started to operate in 1980 and by the mid-1980s, partly as a consequence of pressures by private plant breeding companies and partly because of the British Government's political ideology, there was a strong pressure for the privatisation of varietal breeding work in the UK.

In the breeding of hybrids there is not the same need for protective rights, as the parental material - usually inbreds - remain under the control of the breeders. Jointly-bred hybrid varieties of Brussels sprouts and onions were not therefore submitted for Rights but had, of course, to undergo statutory tests to be National Listed, thereby qualifying them for inclusion on the European Common Catalogue.

The British Association of Plant Breeders (BAPB), founded to represent the interests of private plant breeders in the UK, fought hard to represent the interests of private breeder constituents in Government circles. BAPB held amicable annual meetings with representatives from the public sector to discuss common ground and in 1978 public sector Institutes with breeding interests became members of BAPB, the National Seed Development Organisation (NSDO) having become a member in 1974.

Shortly after the introduction of the 1964 Act, the NSDO was

formed by the Ministry of Agriculture with Board members as nominee shareholders to commercialize and market varieties from Government-supported stations. Though run as a profitable commercial company - it could hardly be other than profitable obtaining its varieties at no cost except that of fees for statutory trials and the multiplication of breeders' and basic generations of seed - NSDO's profits were transferred to central Government's Treasury. NSDO passed to the Exchequer 50% of the royalties it received on sales, as well as any dividend. In 1985/86 Government received £3.5m in royalties and £2.5m in dividends from NSDO. I doubt if the recurrent budget of PBI - whose varieties were the main source of revenue to NSDO - was half of the £6m returned to Government in 1986.

Ultimately the NSDO was sold after open competition, along with that part of the Plant Breeding Institute which was responsible for applied breeding work, to the multinational company Unilever. The new combine retains the acronym PBI which now stands for Plant Breeding International. However, not only did Unilever acquire PBI's portfolio of varieties but it also inherited all other public sector varieties that were being marketed by NSDO at the time of its purchase by Unilever in 1987. Other UK Government research Institutes involved in plant breeding had then to rethink their approaches to the breeding of finished varieties, as they were instructed to ensure that any near-market research was supported - not by core Government funds but by private sector money. The ways in which each Institute has dealt with this change in the game rules are varied but basically mean that the cost of trial ling potential varieties, seed production, statutory tests and marketing are borne by private companies and profits from accrued royalties are shared between private and public partners.

At the Scottish Crop Research Institute we have an agreement for our agricultural crops with a Consortium of Nickersons Seeds (which was owned by the oil company Shell and is now owned by the French co-operative Limagrain) and Dalgety Agriculture. Our agreement with this Consortium was made after negotiations involving ourselves and thirty potential partners. We have separate arrangements for the financial support and marketing of our soft fruit varieties but I will not bore you with the details. As yet the royalties coming in for our new varieties are not of a scale to concern the Department of Agriculture which provides our Institute's annual recurrent core budget of £6m. To give an idea of the sort of money that could be involved we can look at our matting quality spring barley Tyne (now owned by Unilever). In 1989 it occupied about 1,000 ha in Scotland, or about 8% of the spring barley total, thereby providing about over £100,000m in royalties. This year it has been the highest yielding control variety in the national trials in England and Wales and as a consequence there could be £500K in royalties in 1991. Annual royalty collection from a successful variety of winter wheat in the UK often exceeds £500K in royalties in 1991. Annual royalty collection from a successful variety of winter wheat in the UK often exceeds £1m.

Our SCRI Consortium agreement is such that *we* still have the flexibility to do breeding research or create breeding material under contract for third parties provided we keep the Consortium informed. We already have such contracts. We also reserve the right to exchange freely genetic resource material or "unimproved" material from our working collections in the breeding pool.

As a non-profit making organisation with charitable status, SCRI is unable to involve itself in commercial-like activities where profits (and losses) accrue directly to the Institute. A separate commercial company, Mylnefield Research Services has therefore been incorporated, to deal with the commercial aspects of SCRI's research products, and will covenant money to SCRI as and when MRS is profitable.

(For a historical perspective let us look at Fig 1, which should also help us to remember the meaning of some of the acronyms that I have used. It should also serve to stress the bureaucracy that can accompany intellectual property protection.)

As I indicated earlier, my own experience relates mostly to Europe and the UK. I did, however, obtain from Ed Ryder of the USDA - Agricultural Research Service in Salinas, California - an update on the issue of plant breeders' rights in the USA. In the USA, asexually produced plants are covered by the Plant Patent Act (PA) of 1930 and sexually produced plants by the Plant Variety Protection Act (PVAV) of 1970. The former is administered by the US Patent & Trademark Office, the latter by the USDA Plant variety Protection Office. Legal rights are issued on the basis of information supplied by the breeder. A description of the US schemes is provided by T J Centner in "Policy issues regarding property rights on biological inventions" (Hort Science 24, 426-429, 1989). USDA-ARS is still not obtaining protection for its varieties, either through utility patenting or PVP. Nearly all the ARS breeders present at a Research Leaders' meeting in Washington DC last April (1990) were supportive of that stance. (I have with me a copy of their decisions.) There is, however, much variation in the university experiment stations where the principal driving force is mostly the perceived need for extra income to support breeding programmes (c. f. UK public sector breeders).

## **COLLECTION AND DISTRIBUTION OF ROYALTIES**

With the UK, seed certification schemes (usually based on varietal identity, and health purity and germination), which are essentially consumer protective, afford mechanisms to collect royalties. In some cases crop areas registered under marketing/levy boards also assist.

The organisation formed to collect and distribute royalties for its members was the Plant Royalty Bureau, which merged with the British Association of Plant Breeders in 1987 to become the British Society of Plant Breeders (BSPB).

Royalty collection varies for the species involved and is radically different for vegetatively propagated species and cereal seed. In the UK royalties on potatoes are paid on the basis of the area entered for seed certification, whereas cereal royalties are payable on the quantity of certified seed that is sold. Royalty rates are set by individual breeders according to the merit of their varieties. The BSPB, which collects royalties, has nothing to do with the setting of rates. If merchants and farmers feel that rates have been increased to unreasonable levels they can, under the Act, apply to the Controller of Plant Variety Rights for a Compulsory Licence. (I have with me copies of Sub-Licences for potatoes and cereals issued by BSPB if anyone would like to inspect the complexities.)

## **CONTENTIONS AND ISSUES**

Inevitably plant breeders' rights bring in their wake considerable fees to cover the costs of administration and statutory trials and testing. For the major cereals and oilseed rape fees relative to potential financial income are small. However, for minor crops such as vegetables and fodder crops or for a highly specialised variety of a major crop which has a comparatively small niche in agriculture, they constitute a major problem and breeders of such varieties have not been slow to voice their concern. There are fees for both NLs and PBRs, not only at the time of submission and to cover (where applicable) DUS and VCU costs but there is also an annual renewal fee.

For the breeder the bureaucracy attached to completing application forms and technical information questionnaires (TQs) is also irksome but perhaps, no more so than for a breeder to get the official stamp of approval for the general release of a new variety in India. (I have copies of TQs with me.)

More serious, and certainly more contentious, is that of farmers' privilege or exemption, whereby in the past farmers have 'saved' seed (FSS) from their own fields for sowing, either on their own or neighbouring farms, without payment of royalty - such seed lying outside the certification scheme. Partly because of economic pressures and partly because many farmers are capable of producing fairly healthy seed of high germination, this practice has intensified in recent years and seems to be becoming more widespread in both Europe and the USA. In the UK discussions are on-going between the BSPB, the National Farmers' Union and the United Kingdom Agricultural and Supply Trade Association (UKASTA) to recognize this practice and to make arrangements for relatively small sums of money to be paid to breeders by farmers using FSS outside the certification scheme. The issue is currently under address by UPOV in its drafting of new legislation for the protection of varieties. There does not appear to be an answer that will satisfy all interests and countries. The collection of royalties on FSS in LDCs appears to me to be politically, economically, and practically impossible.

I should emphasize that there is a difference between *farmers' privileges* and *farmers' rights*. The latter is the formal recognition of the important role of farmers in developing countries in the conservation and development of germplasm. In 1987 the FAO Commission on Plant Genetic Resources suggested that IBPGR might provide a mechanism whereby such farmers could benefit directly.

As I mentioned earlier the production of uncertified stocks of "small ware" by a few non-law-abiding farmers or merchants for sale as potato seed has caused problems in the UK. The BSPB has been successful in court action against known offenders.

## **PATENTS VERSUS PLANT BREEDERS' RIGHTS**

Many of the breeders (both public and private) with whom I come into contact are clearly apprehensive about patenting varieties of plants though they acknowledge that genes and gene transfer technology at a biotechnological level should be covered by a patent system. In general, plant varieties have hitherto been excluded from the grant of a patent by most patent systems, for reasons that seem to be unclear. As stated earlier, some countries, e.g. the USA, do issue patent protection for plant varieties (PPA). The award of such protection in the USA appears to be possible without the rigours of DUS tests that apply to PVRs in Europe

Without revealing the source, I quote the views of one UK private breeder;

1. Plant varieties should be protected by Plant Breeders' Rights and not by patents. The only conditions under which patents would be acceptable, would be if such varieties conformed to the D, U & S requirements of PBR and there was no restriction on the use of such varieties as parents in conventional breeding programmes.
2. Varieties which have been derived almost exclusively from a previous variety, that is, they are genetically (not phenotypically) very similar, should not be granted Plant Breeders' Rights without the permission of the breeder of the original variety. Thus varieties produced by repeated back crossing, chromosome doubling, the introduction of a single gene via transformation etc. would fall into this category.. This is the so called "dependency clause".
3. Patents should be available on novel genes which have been introduced into a species. However, the use of a variety containing a patented gene by a breeder who is not the patent holder should be freely allowable and the commercialization of such a variety should be guaranteed (provided it is not a dependent variety) on payment of a

suitable license fee to the patent holder. It is on this second point that we are not in agreement with BSPB. The BSPB view is that the patent holder has the right to prevent the commercialization of such a variety if he so wished. BSPB believes that the patent holder would not do that and that commercialization would be guaranteed through commercial pressures.

4. As implied in 3, Plant Breeders' Rights and patents can coexist, That is, I can envisage a variety protected by Plant Breeders' Rights containing genes which have patents protecting them.
5. There must be a guaranteed recompense to breeders for their intellectual property, even on farm-saved seed.
6. If Plant Breeders Rights are not able to give adequate protection, particularly against farm-saved seed, then I believe the majority of plant breeders will opt for a patents system.

There is a recognition (even among plant breeders) that patents provide much stronger and necessary protection than PBR for the products of biotechnological research (e.g. a gene).

Much of the concern about a switch to patents for plant varieties stems from the fact that a patent will prevent a breeder making speedy and free use of a protected variety in his own breeding programme. Interestingly, a colleague has pointed out that one attraction of patents is that they may reduce the speed of turnovers of varieties but could intensify monoculture tendencies!

The patenting of plant breeding techniques has also raised serious questions among breeders about "state of the art". Eight years ago, as Chairman of the then British Association of Plant breeders, I wrote to the scientific journal *Nature* to protest about the award of a patent for techniques that had been part of the stock-in-trade of plant breeders for a considerable time and had already been used commercially.

In applying for the award of a patent, information concerning the product has to be kept confidential, which can delay scientific publication and the sharing of knowledge on a wide front. Certainly our experience at SCRI in contract biotechnological research with private companies is that it usually created high levels of secrecy if there is any thought that patenting will be involved.

Patent costs seem to be higher than fees for PBRs, at least in the UK. Our experience at SCRI is that specialist patent lawyers have to be employed in the preparation of patent submissions. One of the features of patents can be the large number of litigation cases. Rightly or wrongly the plant breeder sees patents as a money spinner for the legal profession.

(For those who are interested I have with me a circular from COMASSO, the Association of Plant Breeders of the European Economic Community, listing patent applications made by plant breeders/geneticists to the European Patent Office during the period 13 July to 4 October 1990.)

So far I have deliberately avoided mentioning genetically manipulated organisms (GMOs) in relation to plant breeding. The issue would merit a workshop of its own. Suffice it to say that in the Western world it is a highly emotive and sensitive issue, creating yet more committees to ensure that the public and the environment is not only protected, but is seen to be protected, from the release of plant varieties that, as a consequence of the use of recombinant DNA technology, could conceivably create harmful effects.

## **CONCLUSIONS**

At a time when globally there are increasing financial constraints and competition for the funding of international agricultural research intensifies, it is understandable that the IARCs should turn their attention to private sector sources for possible additional or supplementary funding. Certainly the political and philosophical mood throughout the world seems to be encapsulated in the word "privatization". Irrespective of political philosophy, I firmly believe that in both the developed and developing world, the best way forward in the breeding of cultivated varieties is to harness the respective strengths of both private and public sectors.

I have described briefly for you my own experiences at the interface of private and public sector plant breeders and hopefully have provided a few thoughts on the pros and cons of intellectual property rights in relation to plant breeding technology and products. It is important to recognize that PBR legislation must be left to individual countries. The introduction of a PBR National Listing scheme is costly, bureaucratic and requires a good infrastructure and a strong and sophisticated seeds industry (whether it be public or private or a mix of both).

In a way we are faced with a chicken and egg situation, and it is possible to argue that without IPRs private industry will not invest, though the protection afforded by hybrids undoubtedly overcomes some of this reluctance. When in place PBR undoubtedly provides financial rewards to the successful plant breeder, especially those involved with so-called major crops, and it is anticipated that royalty returns from patented products, or even technology, on the biotechnological front will be extremely high (otherwise the transnational companies would not be making their current investment in research). It is interesting to note that in Eastern European countries public sector breeders are enthusiastic about the introduction of PBRs in their countries because of the anticipated financial returns to the maintenance and improvement of their breeding programmes.

The current International Undertaking on Plant Genetic Resources rightly promotes the widest possible free exchange of plant genetic material between all areas of the world. Plant genetic resources are traditionally regarded as cultivated varieties, obsolete cultivars, primitive cultivars and wild and weedy species. I think that Plant Variety Rights legislation as it applies in the UK does not prevent such exchange, though with new varieties it may delay it, and if such varieties are cultivated as opposed to being used for research or further breeding work, will involve royalty payments. ' Utility patents **are** undoubtedly much more restrictive.

Perhaps for the IARCs the best motive for protection of plant varieties and breeding technology is the aim to make such protected products freely and widely available to the national agricultural research programmes while ensuring that private sector breeders are made to return to the IARCs some of the profit resulting from access to IARC enhanced germplasm. In making this statement I emphasize "enhanced". Wild and unimproved germplasm in gene banks should, in my opinion, as under the International Undertaking on Plant Genetic Resources, continue to remain free to all. The adoption of such a policy would perhaps also serve to maintain the public's good perception of the IARCs, while still allowing private sector companies to make a fair profit in developing countries. Would it also indicate to the donor community that individual companies were not exploiting the research capabilities and genetic resources and breeding prowess of the IARCs without due recognition and reward?