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NEWSLETTER

INTERNATIONALER VERBAND ZUM SCHUTZ VON PFLANZENZUCHTUNGEN | UNION INTERNATIONALE POUR LA PROTECTION DES OBTENTIONS VÉGÉTALES | INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

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Sweden and the United Kingdom: Agreement on Cooperation in Examination

An Administrative Agreement providing for cooperation in the examination of plant varieties for distinctness, homogeneity and stability has been concluded between the *Statens Växtsortnämnd* (State Plant Varieties Office) of Sweden and the Plant Variety Rights Office of the United Kingdom. It entered into force on June 1, 1980.

Under that agreement, the United Kingdom, will examine the following on behalf of Sweden :

Latin	English	French	German
Chrysanthemum spp.	Chrysanthemum	Chrysanthème	Chrysantheme
Malus spp. (excluding ornamental varieties; including rootstocks)	Apple (excluding ornamental varieties; including rootstocks)	Pommier (sauf variétés ornementales; y compris les porte-greffes)	Apfel (ausser Ziersorten; einschl. Unterlagen)
Potentilla fruticosa L.	Shrubby Cinquefoil	Potentille ligneuse	Strauchfingerkraut
Pyrus spp. (excluding ornamental varieties; including rootstocks)	Pear (excluding ornamental varieties; including rootstocks)	Poirier (sauf variétés ornementales; y compris les porte-greffes)	Birne (ausser Ziersorten; einschl. Unterlagen)

Switzerland and the United Kingdom: Agreement on Cooperation in Examination

An Administrative Agreement providing for cooperation in the examination of plant varieties for distinctness, homogeneity and stability has been concluded between the *Büro für Sortenschutz* (Office for the Protection of varieties) of Switzerland and the Plant Variety Rights Office of the United Kingdom. It entered into force on June 1, 1980.

Under that agreement, the United Kingdom will examine the following on behalf of Switzerland :

Latin	English	French	German
Malus spp. (excluding ornamental varieties; including rootstocks)	Apple (excluding ornamental varieties; including rootstocks)	Pommier (sauf variétés ornementales; y compris les porte-greffes)	Apfel (ausser Ziersorten; einschl. Unterlagen)

PUBLICATIONS BY THE OFFICE OF THE UNION

Official Text of the Revised Convention in Spanish

The Spanish official text of the Revised Text of the Convention, of October 23, 1978, has been published by the Office of the Union in UPOV publication 295(S). It may be obtained from the Office of the Union at a cost of 3 Swiss francs per copy, surface-mail postage paid. It is recalled that the Spanish texts of the Convention of December 2, 1961, and of the Additional Act of November 10, 1972, are published in UPOV publication 293(S) (price: 3 Swiss francs per copy).

EVIDENCE SUBMITTED BY MR P.W. MURPHY, CONTROLLER OF THE UNITED KINGDOM PLANT VARIETY RIGHTS OFFICE, TO THE SUBCOMMITTEE OF DEPARTMENT INVESTIGATIONS, OVERSIGHT AND RESEARCH OF THE HOUSE OF REPRESENTATIVES AGRICULTURE COMMITTEE OF THE UNITED STATES OF AMERICA*

INTRODUCTION

1. I am Mr Patrick Murphy, Controller of the Plant Variety Rights Office (PVRO) in the United Kingdom (UK). The PVRO was established in 1964 by Act of Parliament and has the responsibility for administering the plant breeder's rights system in the UK. The UK system is broadly similar in concept to the plant variety protection arrangements operated in the United States of America (USA), but extends to both vegetatively and sexually reproduced species.

2. This evidence is submitted in response to a request from the subcommittee for information on the operation of the plant variety protection arrangements in the UK. This request also invited comments on the relationship between these arrangements and the system operated throughout the European Community for the control of seed marketing (i.e. "National List" or "Common Catalogue" system).

PLANT BREEDERS' RIGHTS - THE UK EXPERIENCE

3. The UK plant breeders' rights system has now been in operation for just over 15 years. A detailed description of the way our system works is contained in the appendix to this document, which is a copy of an article published last year in the European Intellectual Property Review.**

4. There were three main reasons why the UK introduced plant breeders' rights. The first was one of equity, i.e. that the plant breeder (like any other entrepreneur and inventor) deserved a reward for his work commensurate with its value to the community. The second reason was that by giving the industry the necessary confidence to undertake the long-term investment required, plant breeders' rights would encourage the development of a strong domestic plant breeding industry for the benefit of British agriculture. The third reason was to attract to the UK the best varieties produced by foreign plant breeders which were suitable for use under UK conditions.

5. If one regards the plant breeders' rights system solely in terms of the national interest, its principal objective must be the stimulation of investment in plant breeding. Two questions need to be answered in this connection. Firstly, is this a wholly desirable objective, i.e. what contribution can plant breeding make to agricultural productivity? Secondly, if it is a desirable objective, has the plant breeders' rights system been successful in directing private sector resources into this area of activity?

6. I can of course attempt to answer these questions only in terms of the UK's own experience, and in doing so I must take into account the agricultural, economic and legal framework within which the plant breeders' rights system operates. One important element in this framework is the operation of effective arrangements for the dissemination of independent advice on varietal value. It is not, after all, a requirement of the UK plant breeders' rights system that to be eligible for protection a new variety should have any particular merit. Merit (e.g. in terms of yield, disease resistance, quality, etc.) is something which can be left to the market to determine, but for the marketplace to operate effectively there has to be available some system for the objective evaluation of varieties. For the main agricultural and vegetable crops, such a system currently exists in the UK, and it is highly effective. As an example, over 95% of all sales of cereal seed in the UK are of varieties of proven merit included on the "recommended lists" issued by the advisory agencies, notably the National Institute of Agricultural Botany.

7. Perhaps I can now deal with the first of the two questions posed above. There is little doubt that over the last 20-30 years the use of modern improved plant varieties, with higher yields, improved resistance to pests and disease, better adapted to modern methods of cultivation and producing higher quality

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* Reproduced with the kind permission of the author.

** P.W. MURPHY, Plant Breeders' Rights in the United Kingdom, European Intellectual Property Review, September 1979, pp. 236-240 (not reproduced here).

products, has made a very substantial contribution to the improved efficiency of the UK agricultural industry. For the UK, this contribution can perhaps best be demonstrated by taking the cereals sector as an example, since here sufficient data are readily available in an easily comprehensible form.

8. A recent study* has shown that between 1947 and 1975 the average UK wheat yield per hectare increased by 84%, of which no less than 50% was attributable to new varieties. The same study showed that over the same period the barley yield increase amounted to 63%, of which 31% was attributable to new varieties. Various estimates have been put on the total annual value of these varietal improvements in wheat and barley; these range from £30 million to over £100 million, depending on what figure one takes for the current rate of varietal improvement. At the present time, the higher figure is likely to be nearer the mark.

9. Perhaps the most startling impact of plant variety improvement in cereals is on the level of UK self-sufficiency. In the early 1960s, we managed to produce little more than 60% of our requirements of the type of grain which it was possible to produce on a large scale in the UK; today, we are more than self-sufficient and the trend is continuing upwards. Some of this increase has resulted from increased acreage, improved methods of husbandry and developments in processing techniques, but a substantial proportion is the direct result of investment in scientific plant breeding in both the public and private sectors.

10. Plant breeding contributes to agricultural productivity not only in the form of yield increases. UK crop losses from pests and diseases run into the equivalent of hundreds of millions of dollars a year, and it has been shown that disease-resistant varieties have a major role not only in reducing these losses but also in reducing the heavy cost of chemical control (this point will be enlarged on below). Furthermore, plant breeders are facing demands for new varieties needed to satisfy changing consumer requirements, e.g. vegetables suitable for the deep freeze and potatoes less susceptible to mechanical damage, discolouration and waste. Plant breeders are also showing themselves capable of meeting changed processor and grower requirements. Examples include the breeding of malting barleys producing higher malt extracts, thereby reducing the costs of beer production, and grass varieties showing greater persistence, greater competitive ability, or more suitable seasonal growth patterns in terms of the demands of the livestock producer.

11. Finally - and this is a significant point which can be so easily overlooked - plant breeding represents the only means of increasing the potential yield of crops and grass. All other scientific or practical measures (e.g. improved forms or use of machinery, agrochemicals, drainage, and more efficient management and husbandry) can do no more than exploit or safeguard the genetic potential created by the plant breeder. It is therefore quite clearly desirable to ensure that adequate investment in plant breeding is maintained; without this, the unique contribution which the plant breeder can make to agricultural productivity is in jeopardy.

12. We therefore know what plant breeding can achieve. But what has been the specific contribution so far from the commercial plant breeder, who is likely to be the principal beneficiary under the plant breeders' rights system?

13. Before 1964, UK commercial plant breeding was in decline. This was the firm conclusion of the Committee on Transactions in Seeds, a government committee which examined the industry in 1960**. It concluded that "only a small number of commercial houses interest themselves in plant breeding in the agricultural and horticultural crops" and that "the commercial breeder who devotes himself solely to plant improvement, and seeks to make a living from it, is almost extinct." This situation must be compared to the one which obtains in the UK today. The number of companies actively involved in plant breeding in the UK has increased substantially since our plant breeders' rights legislation was introduced. As an example, the private sector membership of the British Association of Plant Breeders (BAPB) has increased from 10 in 1967 to 23 currently.

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* Mrs. Valerie Silvey (1978) Journal of the UK National Institute of Agricultural Botany, Vol. 14, pp. 367-384.

** Report of the Committee on Transactions in Seeds, July 1960, paragraphs 32-33 (Cmnd 1092)

These figures represent full private membership of the Association, which is open only to companies with a bona fide breeding "presence" in the UK. They include both small and large companies, but do not cover plant breeders active only in the ornamental sector. A further, and more telling, example is the growth in direct private sector investment in plant breeding over the last five years. This has increased by no less that 500% during this time.*

14. The increased activity in the private sector is being reflected in the flow of new varieties. In most species, it takes between ten and fifteen years before a breeding programme reaches the stage of producing finished varieties. It is therefore only in the last few years that the full impact of the plant breeders' rights system has been felt. This can best be illustrated by the numbers of new applications submitted for variety protection. These have increased from 107 in 1966 to 157 in 1970 and to 408 in 1978; the 1979 figure has however shown a decline to 276 but this is expected to be only a temporary phenomenon.

15. The increased private sector investment is also beginning to have a major impact on agricultural productivity. I have already referred to the study illustrating the improvements in cereal yields attributable to new varieties. This same study shows that in the ten years 1967 - 1977 the increase in average wheat yields due to variety totalled 30%; for barley, the figure was 10%, 7% of which has occurred in the last five years. These improvements do of course represent the fruits of both public and private sector research. The new wheat and barley varieties which have yet to be released on a fully commercial scale or which are still under official test are maintaining, if not accelerating, this rate of improvement; this is particularly so in the case of barley, which is the most extensive crop in the United Kingdom and in which the private sector plant breeding effort has been greatest. Virtually all the cereal varieties included on the advisory recommended lists issued in the UK are now subject to plant breeders' rights. These have therefore been bred (by private or public sector breeders) since 1964.

SPECIFIC POINTS ARISING FROM EVIDENCE AT EARLIER HEARINGS

16. Following these more general remarks, perhaps I can now turn to some of the specific points made at the subcommittee's hearings last year and on which comments based on the UK experience of plant variety protection might be relevant. I would like to deal with four of these, viz

a) the issue of "illegal" varieties marketed within the European Community;

b) the possibility that plant variety protection increases the risk of "genetic wipe-out";

c) the possibility that plant variety protection might lead to the exploitation of seed users by large multinational plant breeding companies;

d) the contention that it is in some way unethical or immoral to grant rights in new plant varieties.

"ILLEGAL" EUROPEAN VARIETIES

17. Under European Community law, seed of the more important agricultural and vegetable crop varieties may only be marketed within the Community if the variety concerned has been found to be distinct, uniform and stable and has accordingly been entered on a National List of a Member State. In the case of varieties of agricultural crop species, a variety is subject to an additional examination to establish that it is of satisfactory value for cultivation or use. This legislation is designed to protect the European consumer through the elimination of synonyms and by ensuring that seed which is marketed is capable of reproducing itself true to variety. It has nothing whatsoever to do with plant breeders' rights. In the UK, for example, we introduced plant breeders' rights in 1964; it was only in 1973 that we applied the European Community system to agricultural and vegetable seeds, and we do not have any statutory marketing control over a large range of species for which plant breeders' rights schemes

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* BAPB estimate.

apply (e.g. fruit and ornamentals). Two of the nine Community Member States still do not have any plant breeders' rights legislation. There is therefore no connection whatsoever between the mandatory public law arrangements in Europe for the control of seed marketing (i.e. the National List system) and the voluntary private law system for plant breeders' rights. It is moreover quite wrong to suggest that the first is necessary for the enforcement of the second; the two systems stand on their own and in the UK are implemented under quite separate regulations. All they have in common is that the technical tests for establishing distinctness, uniformity and stability serve both for plant breeders' rights and National List purposes.

18. I understand that at the hearings on this legislation last year much was made of the "disappearance" of old vegetable varieties in Europe as a result of the EEC Common Catalogue system. Three points need to be noted in this respect:

a) as I have already pointed out, the Common Catalogue system has nothing whatsoever to do with plant breeders' rights;

b) many of the "old" varieties were not varieties at all but merely synonyms;

c) a large number of varieties would disappear anyway as a result of commercial pressures. This would happen whether or not plant breeders' rights or the National List system were in existence.

19. Perhaps I can add a little more background about the EEC Common Catalogue system and the multiplication of names. When the UK introduced the system in 1973, few problems were encountered with the more important agricultural plant species since varieties had previously been classified and synonyms largely eradicated. This work has been started as long ago as 1919 and UK interest in it had been stimulated by three main factors:

a) the need to distinguish disease-resistant potato varieties;

b) to ensure that cereal seed sold to growers was true to variety name and could thus be associated with the results of variety trials; and, later,

c) to deal with the problem of nomenclature in cross-fertilised species where there is a tendency in successive seed multiplication for the varietal characteristics to alter; this is sometimes referred to as "varietal shift."

20. Little work of this sort had been done in the vegetable field and it was here that difficulties were experienced. These arose principally from the fact that prior to 1973 many seed firms marketed seed of vegetable varieties under their own "brand" names; this often meant that seed of the same variety was sold in various parts of the country under different names. Occasionally, seed of different varieties was sold under the same name. This was confusing for both the purchaser and the trade. The Common Catalogue system means in effect that varieties are now being properly classified and synonyms are being phased out, although the variety itself remains on the market under a single and correct varietal name.

21. It has been suggested by some who gave evidence last year that it is against UK law not only to market seed of an unlisted variety but also to grow it. This is untrue. We do have an area in Essex which is a protected area for the purposes of seed production. In this area, growers of commercial crops of beet, brassicas and onions can be required to "top off" their bolting plants before flowering to prevent cross-pollination with registered seed-producing crops. Failure to do so can result in a fine of up to £20 for a first offence. This has nothing to do with plant patents, Common Catalogue or the like. Outside this area of Essex there are no restrictions whatsoever on the growing of the normal range of crop varieties.

"GENETIC WIPE-OUT"

22. The contention here appears to be that because the plant breeders' rights system gives direct encouragement to the production of improved varieties, this leads to the elimination of the older, less successful varieties and to the consequent loss of genetic resources. Three points might be made here. Firstly, in the case of the UK, one could argue that the risks of "genetic wipe-out", thanks to the investment in plant breeding, are less now than in the recent past. In the early 1960s, for example, UK winter wheat and spring barley production was dominated by two varieties, CAPELLE DESPREZ and PROCTOR; each of these accounted for between 60% and 70% of the total acreage of their respective crops. This was before we introduced plant breeders' rights, and gives some indication of the lack of varietal diversification at this time. Now, with a much larger choice of varieties available, it is deliberate advisory policy to recommend the diversification of varieties with different inherited disease resistance, so that (e.g. in the case of winter wheat) not more than 30% of the crop area is occupied by one variety.

23. Secondly, talk of "genetic wipe-out" tends to be associated with disease susceptibility. Here UK experience might be relevant. One of the most important objectives of plant breeding in the UK, particularly in the major agricultural crops, is to produce disease resistant varieties. In the case of wheat for example, fungicidal treatment against yellow rust is, for many varieties, unnecessary, since the level of genetic resistance against the disease is high. The commercial success of a new variety (in terms of royalty increase) reflects the quantity of seed purchased by growers. In many crops, this is dependent on its inclusion in an advisory "recommended list." A variety which has been found in trials to show a level of disease resistance below a minimum standard will not be included on these lists, and is therefore unlikely to achieve any commercial return for the breeder.

24. Thirdly, if "genetic wipe-out" represents a real threat, the answer must be to conserve genetic resources scientifically, e.g. in gene banks. Dependence on the random discovery of desirable material in the more remote areas of the third world is surely not a desirable position to be in. Nor is it reasonable to expect any country - developing or developed - to hold back its agricultural development in order to continue to be a source of genetic material for the rest of the world. In the case of the UK, for example, such a policy would currently be costing us well over 3 million tonnes of grain a year, if it meant the abandonment of all the improvements resulting from plant breeding since 1947. One of the best safeguards against the risk of "genetic wipe-out" is surely a dynamic plant breeding industry, in both the public and private sectors - which sees as essential to its success the maintenance of stocks of genetic material suitable for producing future improved varieties.

EXPLOITATION OF SEED USERS

25. Various suggestions have been made as to the means by which large plant breeding companies - particularly those which are also involved in agrochemical production - might take advantage of plant variety protection laws to exploit the seed user. It has been alleged, for example, that the price of seeds of new varieties will be much higher than would be the case if plant variety protection were not available. It has also been claimed that companies which produce both plant varieties and pesticide products will seek out and patent disease-susceptible varieties in order to boost pesticide sales, particularly in unsuspecting third world countries.

26. Here again, UK experience might be relevant. If we take the first allegation, it would not be at all surprising if seed of the newer, more productive, varieties commanded a premium over seed of the older varieties. This is in fact the general rule in the UK and is one of the means through which a breeder obtains a return on his investment. The purchaser will, however, only pay the higher price if (often on the basis of advisory trial results) the new variety shows him a sufficient economic improvement to justify the higher price; if it does not, he has two options. He can continue with the cheaper traditional variety, or he can (in some crops) buy a small quantity of seed of the new variety and multiply it up himself for his own use; this is quite permissible under UK law. If plant variety protection were not available, it might well be true that the new variety would not be able to command much of a premium; the likelihood is, however, that in this event there would not be many improved varieties coming forward for commercialization.

27. While it is important that the breeder should be able to obtain a fair return on his investment, it is equally important that he should not be able to abuse his statutory monopoly by attaching unreasonable conditions to the sale of material of a new variety. This is why the UK law contains a safeguard against abusive exploitation of plant breeders' rights, in the form of the compulsory licensing procedure under Section 7 of the 1964 Act.

28. The second allegation (about the link between plant breeding and pesticide production) is one which would be difficult to sustantiate in the UK. I have already explained that in the major agricultural and vegetable crop species it is difficult for a variety to achieve any significant commercial acceptance in the UK unless it is included on a "recommended list" produced by one of the advisory agencies, and that it is virtually impossible for a known highly disease-susceptible variety to be included on such lists. Governments can also take steps through legislative action to restrict the marketing of plant varieties which are a major risk to plant health. If therefore exploitation in this form is a serious possibility, the public authorities have a simple answer which at the same time protects the consumer and helps to direct the energies of plant breeders towards areas of work of genuine benefit to the agricultural community. In practice, of course, competition between plant breeders, backed up by official advice, usually provides sufficient protection for growers.

THE ETHICS OF PLANT BREEDERS' RIGHTS

29. It is often suggested that it is in some way unethical or immoral for plant breeders to receive a reward (in the form of a plant patent or plant breeders' right) for breeding a new variety. After all, so the claim goes, the breeder is doing no more than develop a process started many thousands of years previously when food crops first started to be exploited.

30. These arguments suggest that modern scientific plant breeding is in some way different to those other forms of scientific or industrial innovation which are subject to protection through e.g. patent rights. They also completely ignore the effort and costs involved in plant breeding, in particular the substantial investment which today's plant breeders must make before they can hope to receive any return whatsoever. Even if the breeder's first crosses are successful, he must tie up the necessary high-risk capital for a further 10-15 years before he can hope to market a new variety which will bring any return on his outlay. Plant breeding is therefore a long-term venture which in the absence of any form of industrial property right would, to say the least, offer an uncertain reward. Without plant breeders' rights we would be likely to return very quickly to the situation described by the Committee on Transactions in Seeds in their 1960 report.

CONCLUSION

31. Perhaps I can conclude by quoting the following extract from paragraph 112 of this same official report:

"Our firm conclusion from these facts and arguments is that steps should be taken to help the plant breeder overcome the disabilities under which he now works in this country. He should have the opportunity, which the grant of some form of protection against exploitation would give him, to share more fully in the wealth he helps to create. We believe this is justified as a matter of equity. At the same time, we think that a practicable scheme for encouraging plant breeding by private enterprise would benefit agriculture and horticulture, and serve the national interest."

32. I hope that I have been able to demonstrate in this evidence that experience of the UK plant breeders' rights system over the past 15 years has confirmed the wisdom of these remarks. Following the recommendations contained in the report, we now have an expanding and successful private sector plant breeding industry which, in conjunction with an independent advisory trials system, is making an increasingly important contribution to agricultural productivity. I hope too that I have been able to correct some of the misunderstandings which appear to have arisen within the USA concerning the operation of the UK plant breeders' rights system. If however the subcommittee has any further questions which it would like to put I would be happy to submit a supplementary paper.

OLD APPLE AND PEAR VARIETIES?

WHAT FOR?*

by C. POPULER**

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1. WHAT IS AN OLD VARIETY?

When one speaks of old varieties of apple and pear, this generally conjures up a picture of the range of fruit that was available on our markets before or just after the last war, as opposed to the varieties on sale nowadays. We in Belgium think of Transparente Blanche, Reinette Etoilée, Reinette de France, Court-Pendu Rouge, Jacques Lebel, which was bought for stewing, Keuleman, Petite Belle-Fleur and Belle-Fleur Double, and we remember pears such as Légipont, Jefke, Calebasse à la Reine or Wijnpeer, Double Philippe and the Saint-Remy cooking pear.

In fact, old varieties are not confined to these few commercial successes of yesteryear. If we go back a bit further to the beginning of the century, the number of apple and pear varieties was in the hundreds. Some of these varieties were grown in the vast walled gardens of castles and manors, while other, humbler varieties were grown as standard trees in open orchards for the local market. It is these innumerable varieties that concern us here.

Moreover, the fact that we are using the expression "old varieties" suggests that there must be other, more modern ones. There are indeed but, contrary to what one might think, it is not among them that the main varieties in today's small commercial range have been recruited. Golden Delicious, which alone accounts for 50% of the area covered by commercial low-stemmed apple orchards in Belgium, was discovered in the United States of America in 1890. Belle de Boskoop, which is Dutch, dates back to 1856. Cox's Orange Pippin was raised in England around 1825, James Grieve in Scotland around 1890 and Jonathan in the Unites States of America in 1826. None of these five everyday varieties, therefore, which represent 92% of Belgian low-stemmed orchards, was raised in the present century. None of them, moreover, is the result of the work of a research station: Belle de Boskoop, Cox's Orange Pippin and James Grieve were all raised by nurserymen, Jonathan was discovered on a farm, and the first Golden Delicious tree grew spontaneously on pastureland high up in the Allegheny mountains. Belgium's main imported apple, Granny Smith, which comes to us from the Cape Province, is another freak growth that appeared in an Australian garden in 1868, just where the lady in question used to throw her peelings.

The origins of the pear varieties in our commercial low-stemmed orchards are no more modern. The Conférence pear, which leads the field with 48% of the planted area, was raised in an English nursery around 1885. If to this variety we add Durondeau, which was raised in 1811 by a brewer of Tongre-Notre-Dame in the province of Hainaut, and Doyenné du Comice, a product of the horticultural association of Maine-et-Loire which dates back to 1849, the proportion rises to about 90% of the Belgian low-stemmed orchards. And among the lesser varieties that make up the remaining ten per cent, we find the oldest of our commercial varieties, Bon-Chrétien Williams, which either seeded itself or was seeded--no one is sure--in the garden of an English schoolteacher before 1770.

In fact the only modern thing about these varieties is that they are still grown. The really modern varieties, which for the most part are hybrids produced at research stations between the wars, or mutants discovered in commercial plantations, are only to be found among the lesser varieties in our commercial range, in the company of old varieties, or again are still being tested by forward-looking fruit growers. Of these lesser varieties, we should mention Tydeman's Early Worcester, created in 1929 at the East Malling Research Station in the United Kingdom, and, of the varieties that are still being experimented with in Belgium, Idared, Jonadel and Melrose, bred at about the same time in American stations, the Canadian Spartan, the Japanese Mutsu and many others.

Clearly, then, we must be careful not to class old varieties at the outset among the products of a bygone era, merely on the assumption that anything old is bound to be less good than its new counterpart. One might have cause to wonder, however, whether this modern commercial range of varieties of old origin is not the result of careful selection from among the great diversity that existed in the past, and whether the varieties that have been abandoned in fact are still of any interest. A small historical survey will show us just what a diversity of varieties there was, and how it changed, at the same time enabling us to see that, while there was indeed some selection, it was really no more than crude sorting and far from complete. What has been unearthed of this diversity, and what can yet be expected of this casually abandoned heritage will be explained afterwards.

2. THE FORMER WIDE RANGE OF FRUIT VARIETIES

History begins with written records, and for fruit-tree growing history starts in Belgium at around the middle of the 18th century. This does not mean that before then our provinces were a desert bereft of fruit trees. It would seem that a considerable range of fruit varieties existed as long ago as in the 16th century: Rembert Dodoens, a doctor and botanist from Malines, reported naively that the names of pears varied from one village to the next and that there was therefore no point in giving them. The popular varieties that were classified and described by the French pomologists of the 16th and 17th centuries were no doubt also to be found in the gardens of castles, abbeys and manors. For it was France that dominated this and indeed all agricultural sciences at the time, whereas the regions of Belgium had not yet advertised themselves by any specific contribution.

In 1758, and during the following few years, an abbot of Mons called Nicolas Hardenpont introduced a dozen new pear varieties one after another, all originating from seeds sown by himself. A feature these pears had in common was that they were soft, whereas most known varieties of the time had firmer flesh. How did the abbot achieve this feat? It is not known for certain, but it is thought that he was the first to apply controlled pollination to pear trees, and that he practised it deliberately on the small number of soft varieties available to him.

The Golden Age

After a lull of a few years, Abbot Hardenpont's example began to be imitated and gradually, towards the end of the 18th and in the early 19th century, a real craze for raising pear seedlings developed in Belgium. One has only to read the writings of the time to have an idea of the zeal that seized our compatriots, comparable only to the tulip-mania that had so exercised the Dutch two centuries earlier.

The pear seedling raisers appeared in various parts of the country, but mainly in the province of Hainaut. Of the 146 breeders recorded by Gilbert in 1874 in his "Abrégé historique de la pomologie belge," 69 were from Hainaut, and almost half of those from the Tournai area. Indeed, in the publications of the pomologists of this province, Hainaut is proudly presented as "the cradle of Belgian pomology."

However, all the authors of the time prefer to ascribe the main impetus given to pomology in our provinces to the energy of one man, Jean-Baptiste Van Mons. This incredibly busy man, who was at once a pharmacist, a chemist, a doctor, a university professor and a politician, well known and respected by such intellectuals as Europe then had, nevertheless found the time to produce some 500 new pear varieties, not to mention many other fruit, and to devise a curious theory for plant breeding. The influence of this human dynamo on his contemporaries was enormous: he was an indefatigable letter writer, and kept up correspondence with a multitude of Belgian or foreign breeders, dedicating new varieties to them, exchanging grafting material with them and kindling the fire of enthusiasm everywhere. In the United States of America Van Mons became the recognized authority on everything concerning pear growing and he is spoken of there as the "Titan of pomology". His nurseries, first sited in Brussels and then transferred to Louvain, still contained so much unpublished material at the time of his death in 1842 that Alexandre Bivort, another Belgian pomologist, collected what he could in order to carry on the work of his illustrious predecessor. For years afterwards he was still extracting from this material varieties which he called the "posthumous achievements of Van Mons," including the Belle de Louvain plum which is still grown today.

Apart from Van Mons, the most noteworthy Belgian breeders were Major Esperen, of Malines, breeder of some 40 varieties of pears as well as plums and a bigarreau cherry which are still sold by nurserymen; Alexandre Bivort, of Fleurus, who from his own seed raised about 60 pear varieties and some stone fruit; and finally Xavier Grégoire-Nélis, of Jodoigne, to whom we are indebted for a good hundred pear varieties. This predominance of pear over other fruit was a general trend with the Belgian breeders of the time: in 1874, the work above-mentioned by Gilbert recorded about 1,100 pear varieties produced by our seedling raisers, compared with a mere 60-odd apple varieties

These breeders all belonged to the well-to-do class: landowners, doctors, horticulturists, lawyers, churchmen, lords of the manor, tanners, brewers, notaries, politicians or businessmen. They had their own horticultural societies, organized fruit shows, published costly reviews and maintained vast collections of fruit. They exchanged their new varieties among themselves and also with their friends in neighboring countries, where our varieties soon acquired considerable fame.

"If we look for the birthplace of our new pear varieties," wrote nurseryman André Leroy, the most famous French pomologist of his time, in 1867, "we find that it is more often than not Belgium." The pomological dictionary, in the introduction to which this tribute to Belgian breeders appears, includes no fewer than 311 Belgian pear varieties among the 915 described, whereas for apple it covers only 17 Belgian varieties out of a total of 527. In the catalogue of the Simon-Louis nurseries in Plantières near Metz, the largest in Europe, the 115 varieties of pear considered first class included 49 Belgian varieties. This ratio is moreover to be found in the majority of assortments of good varieties published in France right up to the beginning of the 20th century. In the United States of America, in a work devoted to the description of pear varieties, in 1921, Hedrick also devotes to Belgium an enthusiastic chapter, which begins with these words: "Providence designated Belgium for the production of modern pear... Pear has been improved more in Belgium in one century than in all the preceding centuries."

The main period of fruit breeding in Belgium does indeed seem to have spread more or less over a century, as in the last quarter of the 19th century the zeal of the seedling raisers cooled off. After the death of the last great Belgian breeder, Grégoire-Nélis, in 1887, and even until after the Great War, our chroniclers lamented the small number of seedling raisers left in our country, whereas in France breeding activity, which had started later and followed the Belgian example, continued for some time longer.

Why this loss of interest? There was a change of attitude no doubt, especially since there was no longer Van Mons to fire them with his enthusiasm. There was perhaps also an element of saturation, considering the number of varieties that had accumulated. And of course the seedling raisers were more in the nature of amateurs and artists. One has only to see the disdain with which Barthélemy du Mortier, mentioning in his "Pomone Tournaisienne" that the Seigneur Esperen pear had been renamed Beurré lucratif, added that "the name 'lucratif' comes from a fruit merchant and not a seedling raiser." At the end of the century, horticulture "went professional." It is symptomatic of this that in 1894, the "Revue de l'Horticulture Belge et Etrangère" abruptly changed its approach, abandoning fruit varieties with the comment, in a notice to readers: "the gracious art of horticulture, which our fathers understood with the faith of real amateurs, has never ceased to be under threat from the competition of industry."

It was the same pressures that also brought about a change of character in the competitions at which these amateurs showed new fruit or lots of 50, 100 or 200 varieties in the hope of securing an award. A tendency grew among organizers to require that only varieties in demand on the market should be shown. As from the eighteen-seventies, which was the period in which the great Belgian, French, English or German works on pomology flourished, lists based on the science inherent in those works, published by the same experts as were found on the juries of the competitions, were soon to be advising "the top 50"--if not "the top 12"--pear varieties" or alternatively "the best varieties of apples for growing." This rationalizing tendency was necessary at the outset, if only to bring some order to the wealth of new varieties bred in the course of the century, but, when combined with the commercial connotations that competitions were acquiring, it was to stifle all innovation. "If an exhibitor," wrote an editorialist in a horticultural magazine in 1909, "chooses to make up his exhibit by submitting, along with the classical varieties, varieties which he personally knows to be of better quality, but which are not known to the pomologists, he may be sure that his collection will not be rewarded as it deserves." Another result was that the varieties that were nevertheless produced at the very end of the 19th and at the beginning of the 20th century were to remain little known.

The growing techniques which the amateurs of the 19th century borrowed from the gardens of the castles and manors of the previous century, developing them to an unprecedented degree of perfection, survived for quite a long time after the actual breeding work ceased. Low-stemmed trees, grafted on to quince stocks

for pear and on to Doucin or Paradise stocks for apple, trained on to espaliers or reverse espaliers to give them shapes often incredibly tortuous and ornate (for instance, one pear tree was trained flat, forming the cross of the "Légion d'honneur" and a framework of scrolls with its branches), continued to be grown in private collections, and also in commercial orchards in more sensible forms, until after the First World War. In 1909 a Belgian magazine mentioned the 500 apple varieties grown on Paradise stocks in the gardens of the Bovelingen property, together with 100 hectares orchard of standard trees belonging to the same owner. At the beginning of the inter-war period, commercial growers were still to be found in France producing high-quality fruit with trees trained on to espaliers along kilometers of wall.

Eventually these growers, like the private collectors, also succumbed one after the other to the change in social and economic conditions. Many horticultural magazines which had stopped appearing during the war did not reappear after 1918; the others changed their approach and abandoned the former conceptions of fruit growing. La culture fruitière bourgeoise et commerciale (Private and Commercial Fruit Growing), to quote the title of a French work on fruit tree growing published at the beginning of the century, had had its day.

But what fruit varieties were grown in farm orchards during this time? As in the time of Dodoens, there was a range of regional or local varieties which differed almost from one village to the next, and which was scarcely touched on by literature because it was taken for granted and also because it formed part of another world. Standard apple trees in meadow-orchards, producing the everyday fruit for the market and for winter storage, standard pear trees also, providing pears "in cratefuls and sackfuls," as we said in Belgium, or "in shovelfuls" as the French put it. A proportion of the pears were exported by rail and sea to England. The Koolstok of Limbourg, the Double Philippe of the province of Waes, the Dijzeling of the Sleidinge region and other varieties supplied the London market from the 1880's until 1935, at which time England introduced protectionist measures and stopped imports.

The Age of Standardization

It was also around 1935 that apples imported from the United States of America and Canada began to invade the European market, where they were readily absorbed by a growing demand. The imported fruit were well sorted and wrapped and of healthy appearance, and were preferred by the trade and the consumer to the fruit from our standard tree orchards. Fruit growing organizations in Belgium and France therefore began to concern themselves with adopting the American methods of standardization and with reducing the too-great diversity of varieties grown as standard trees, there being a different variety virtually in every village, to a few commercial varieties. France called this "reorganization of the French orchards" and Belgium called it "rationalization."

In 1939 our National Pomology Committee published a list of varieties recommended for standard trees in Belgium, which included nine national apple varieties and six pear varieties, both eaters and cookers. By adding to these the varieties recommended for regional or experimental growing, we reach a total range of 36 apple varieties and 32 pear varieties. In France the recommended range was different and included a few more apples and half as many pears. Both countries encouraged their producers to top-graft their old varieties grown as standard trees with the varieties selected by the trade. Immediately after the Second World War and until 1955 this policy continued to be impressed upon producers. It is the range grown at that time that is still remembered now by city-dwellers when they talk of the "varieties of the old days" which we mentioned at the beginning of the introduction.

For apple and pear alike, the recommended range consisted of regional varieties that were widely known before the time of standardization, and of the breeders' varieties that had already been adopted in standard tree orchards. The other breeders' varieties, the behavior of which as standard trees was not known, never having been attempted, were not even considered. The same is true of local varieties because, not having been listed, they were for the most part unknown to pomologists.

To be recommended, the varieties had also to correspond to a set of criteria, numbering eight in Belgium and nine in France. It was clear that this system, which was the only one possible for the selection of varieties immediately acceptable to the trade, ruled out many a variety that was interesting in certain respects but failed to comply with one of the criteria, for instance an apple variety that resisted scab but had a fruit lacking in color or irregular in form, or was not fertile enough. The fact that a variety was not suitable for marketing did not mean that it was devoid of interest as parent material for further crossing.

This sorting of varieties gave ample cause for regret, of course: it was reported in horticultural magazines of the time that members of the pomological commissions who took part in the drawing up of the lists of recommended varieties wondered afterwards whether such and such a variety should really have been "condemned". There were also references to varieties making a "comeback."

For all its shortcomings, the standardization of standard tree orchards represented a considerable amount of well-intentioned work. And yet, within a few years, it was to be swept aside by the development of high-output low-stemmed orchards.

Modern Industrial Fruit Growing

Even at the beginning of the standardization era, around 1935, it was already being recommended that fruit production should no longer be engaged in as a complementary activity within a multi-purpose agricultural operation--farming associated with livestock breeding in meadow-orchards--but should be concentrated in specialized low-stemmed orchards. For after the war, around 1950, Belgium possessed about 2,000 hectares of low-stemmed orchards and 45,000 hectares of standard tree orchards, producing pome and drupe fruit.

In the nineteen-sixties high-output low-stemmed orchards entered a period of very rapid development. The rootstocks used were quince for pear, and, for apple, the M9 Type, which is none other than the Paradis Jaune of Metz on to which the low-stemmed apple trees beloved of the old amateurs had been grafted. The shapes had by now become very free but were nevertheless distantly related to the espaliers trained on wire or the bushes and "quenouilles" of the private growers of former times, thereby vindicating those obsolete techniques in a curious way.

With apple, the varieties experimented with were for the most part foreign and, after some groping, the present range, described in the introduction, established itself. Of all the varieties grown today, only Belle de Boskoop featured in the range formerly recommended for the standardization of standard tree orchards. As for pear, the principal modern varieties, namely Conférence and Doyenné du Comice, were only mentioned among the varieties to be experimented with, and Durondeau did not even appear on the list.

The new criteria are first and foremost sustained yields, good appearance and suitability for cold storage. The use of new pesticides and the improvement of methods of treating plants now make it possible for varieties with a high susceptibility to disease to be grown without difficulty. Low-stemmed plantations are easier to prune and harvest than standard tree orchards, and the latter are rapidly disappearing. In 1970 low-stemmed orchards covered about 10,000 hectares in Belgium; standard tree orchards had dropped in area to about the same figure, and are hardly kept going at all except for a small number which supply a specialized trade in varieties such as Reinette de France and Court-Pendu. The ratio of dessert pears from standard tree orchards to those from low-stemmed orchards, which was 10 to 1 in 1962, fell to 1 to 6 in 1975.

This success of the low-stems was not without its drawbacks. In the case of dessert apple, the increase in low-stemmed orchard areas rapidly created a glut of fruit. The surplus was withdrawn from the market by order of the authorities; in 1968 the cost of this intervention in EEC countries was about one thousand million Belgian francs. In order to remedy the situation, bonuses were used to encourage the uprooting of poor-quality industrial plantations and old standard tree orchards.

By the end of the nineteen-sixties, the disappearance of standard tree orchards and the growth of secondary industries--jams, canned fruit, ciders and syrups--was beginning to cause a shortage of industrial fruit. In spite of repeated warnings from the experts in specialized magazines, this situation continued to deteriorate, partly on account of the bonuses for uprooting, the purpose of which had been to rationalize the dessert fruit market, and considerable quantities of industrial fruit began to be imported.

On the eating apple market, Golden Delicious was subjected to the most extensive withdrawal measures. It was thought that other, more recent varieties, some examples of which we mentioned in the introduction, could be partly substituted for it. The undertaking was not an easy one, as the prospective substitutes had to contend with the uncommonly high yield of Golden Delicious. Most of them were the product of crosses of the latter variety with other New-World varieties such as Jonathan, Delicious or McIntosh, thus remaining within the range of fruit of "American" taste, with a low acid and sugar content, and the fraction of the public that preferred the traditional apple from our part of the world was consequently no more satisfied than before.

This situation was not peculiar to our country alone. The 1968 annual report of the East Malling Research Station, in the United Kingdom, said that "clearly, fruit improvement has had practically no impact on the apple industry in Europe up to now." This was echoed in 1976 by a publication of the Station d'Arboriculture Fruitière of Angers, in France, which said that "The new hybrids created in various parts of the world during the last 30 years by various research bodies have not yet succeeded in finding favor with producers." Both emphasize, moreover, the need to look for a greater diversity in parent material used for breeding, by keeping a record of the potential of old varieties.

Some more questions might be in order here. How was it that the methodical work done by research stations, involving extensive hybridization programs, was only moderately profitable? And yet how was it that Richard Cox, a nurseryman from Colnbrook Lawn in Buckinghamshire, managed in 1825 to produce two commercial varieties, Cox's Orange Pippin--first on the British market and third on ours--and Cox's Pomona, from the sowing of just nine Ribston Pippin seeds?

For the moment, however, let us see what useful elements may still be found among our own old Belgian varieties, with particular reference to disease resistance, which is the main object of our work.

3. DISEASE RESISTANCE IN OLD VARIETIES

Commercial low-stemmed plantations of apple and pear, with the present range of varieties, need to be sprayed with fungicide a large number of times. Apple, for instance, need eight to fifteen sprayings in an average year, including treatment for scab and powdery mildew and end-of-season treatments for storage-related diseases and canker. As for pear, with which scab is practically the only fungus problem in our region, the number of fungicidal sprayings is at present from six to twelve a year. To these will no doubt soon be added specific interventions against the fearsome fireblight disease, which found its way into our country recently.

It is not surprising therefore that research is concentrated on the breeding of disease-resistant varieties. Research on apple, which had developed most, has been in two direction, involving either a search for resistance sources within the varieties that are or were grown and that derive from the crab of our European forests, *Malus sylvestris*, or a recourse to resistance characteristics found in other *Malus* species originating in Asia.

The latter direction has been followed mainly by breeders in the United States of America and Canada, and then in France and the United Kingdom, with a view to breed resistance against scab and powdery mildew into apple. And it has indeed been found that various Asian *Malus* species resist one or other of these two fungi, the resistance being controlled in each case by one dominant gene. This type of monogenic resistance is unknown in cultivated apple varieties. The gene most widely used for scab is that of *Malus floribunda*. At present there are several commercial varieties that possess this gene in the United States of America and Canada, and a variety of the same type, identified at the Station

d'Arboriculture Fruitière of Angers among American-bred lines, namely the Priam variety, is now available also in France and Belgium.

For apple powdery mildew, breeding is still in progress. The two species *Malus robusta* and *Malus zumi*, both of which possess a dominant resistance gene, are being used in breeding work in the United Kingdom, while *Malus hupehensis* is used in France.

The various Asian species of *Malus* all belong to the ornamental types of apple, with minute, evil-tasting fruit of about the size of a cherry. Crossing such a species with a cultivated variety gives first-generation progeny with fruit of intermediate type, every other seedling possessing the resistance factor. Several successive back-crosses have then to be carried out with cultivated varieties in order to eliminate the undesirable characteristics of the small-fruit species and produce a fruit of satisfactory quality and size. When a hybrid has eventually been obtained that has an acceptable fruit and still possesses the resistance gene, it may obviously be used also as parent material for resistant varieties. Despite the long drawn-out process, monogenic resistance has many attractions for the breeder, because it is inherited in a simple, readily-verified way.

There is nevertheless a risk of monogenic resistance being effective only on certain strains of the fungus--including necessarily those present in the course of the breeding process--but not against other strains that might be more scarce in the growing environment. Experience with other cultivated plants has shown that it is the large-scale distribution of a new variety possessing this type of resistance--appropriately called "race-specific resistance" in English--that precipitates encounters with these scarce strains and thus initiates their multiplication. The popular expression for this is that the resistance of the new variety has "collapsed" after a certain number of years of large-scale cultivation. Apple breeders are well aware of this risk and some of them are now planning to create hybrids that combine two resistance mechanisms, one with monogenic control and the other with polygenic control, or alternatively to rely on the latter resistance alone.

Polygenic resistance to a fungus, as its name suggests, comes from the combined effect of a large number of genes, called minor genes, as opposed to the major gene in monogenic resistance. Resistance of this type acts on all strains of the pathogenic fungus, consequently affording lasting protection against the disease. However, the large number of genes involved means that this resistance is inherited in a complex way and is much more difficult to handle in crosses than monogenic resistance.

In cultivated apple varieties, scab resistance is governed by a polygenic mechanism, and the same applies to powdery mildew resistance. As the level of polygenic resistance is determined by the specific combination of genes present, a whole range of scab or powdery mildew resistance levels may be found in a population of varieties, from very low to very high. It can thus be appreciated that a large number of varieties have to be examined in order to find those that possess satisfactory resistance. The most wide-ranging survey of this kind was made for apple powdery mildew on 2,139 submissions stored in the collections of National Fruit Trials, in Faversham, United Kingdom, and the findings were published in 1969. Of this total, 213 submission, representing 112 different varieties (many of the varieties having been entered in the collection more than once from different sources), showed a high, albeit not total, resistance to powdery mildew. Of these resistant varieties, only one was grown commercially at the time of the trials; 70 other varieties grown commercially in one country or another showed average to high susceptibility. It should be pointed out that many Belgian varieties, especially our rural varieties, are not included in this inventory. For apple scab, the record of resistance levels of old varieties is much more limited: the most extensive study in this area was made in Germany in 1902, on only 160 varieties, including practically none of our varieties.

Certain old varieties have also been found to possess resistance to other pathogenic fungi such as *Gloeosporium perennans*, the main cause of rot in stored fruit, *Nectria galligena*, the cause of canker, and *Phytophthora cactorum*, the cause of collar rot. For these diseases the inventory of the old varieties is even less complete.

Little is known about scab resistance of pear, concerning either the way in which it is transmitted genetically or its presence in old cultivated varieties. A recent study made in Israel has shown that "race-specific" resistance does exist in cultivated pear varieties, but it is not known whether this is exclusive and whether, as in the case of the cultivated apple, there is not also a resistance of polygenic type that acts on all races of scab. An inventory has been made in the United States of America of the reactions to fireblight of American or European varieties--all of which are derived from the *Pyrus communis* of our European forests--and also on hybrids of oriental *Pyrus* species. The recent appearance of fireblight in continental Europe, including Belgium, will no doubt create renewed interest in the behavior of our old varieties when they are exposed to this disease.

It will therefore be understood at this stage why a program has been set up at the Station de Phytopathologie for the evaluation of the disease resistance of old apple and pear varieties.

4. SEARCHING FOR OLD VARIETIES

In 1975, when we started to collect old varieties in order to investigate their resistance factors, we gave priority to varieties of Belgian origin; there were various reasons for this.

First, as we have seen, resistance inventories drawn up abroad have given little coverage to old Belgian varieties, mainly because many of those varieties did not exist in foreign collections. It is of course in Belgium itself that one is best placed for finding Belgian varieties. Moreover, the fruit-growing past of our country gave us cause to hope, at the start of our program, that a considerable amount of genetic material would still be found in what was left of our national heritage of varieties.

Second, these varieties of Belgian origin, having been produced in our own soil and climatic conditions, are more likely to be suited to them than others. With regard to fruit varieties in general, a small proportion, while being particularly suited to a given climate, possess a versatility that enables them to flourish in climates very different from the ideal one. This is true of the Golden Delicious apple, for instance, which is now grown practically throughout Europe. There are many varieties that do not have this versatility, however, and grow well only in a limited area. The early American varieties with monogenic scab resistance, which were raised in regions with a very continental climate, have performed very poorly in England. In order to benefit from this resistance, such varieties would have to be crossed with others that are more suited to local environment. It is obvious therefore that, if the task of the breeder is not to be complicated, it is preferable to look first for parent material providing resistance among varieties that are at the outset readily adaptable to local conditions, and this is particularly important in the case of polygenic resistance, which is difficult to transmit by means of classical breeding processes.

Adaptation to local conditions involves not only the vigor or fertility of the plant, but also the quality of its fruit. In this connection there are some very relevant remarks to be found in du Mortier's "Pomone Tournaisienne": "Experience has shown," wrote this author in 1869, "that pears from the South are almost always only of second quality in Belgium. This no doubt has to do with the fact that our climate does not provide a sufficient amount of warmth for these varieties. The effect of this is that, in Belgium, top-quality Belgian pears are in fact of higher quality than their French counterparts; and all those who acquired the latter eventually had to dispose of them. This rule applies moreover to all fruit: peaches and grapes from the South of France are far from being as good in temperate climates as the varieties of peaches and grapes produced in those climates; northern Europe is bad for them, whereas the varieties bred in less hot countries retain their qualities, and indeed further improve them if they are planted in more southerly climes. This explains the superiority of our varieties over those of the South of France."

It is a fact that all the French pomologists of the 19th century have some very flattering things to say about the quality of Belgian pears grown in France. We have moreover been able to observe personally, by means of an experiment

on autumn and winter pears produced in an old Belgian collection, that the majority of the old French breeders' varieties which were classified as being top-quality in their country of origin, lost all their merit in Belgium when they were compared with old Belgian varieties. Du Mortier's opinion does not therefore seem to be inspired by a chauvinistic attitude as much as by concrete experience, and this gave us another reason for evaluating varieties of Belgian origin as much as possible.

The non-Belgian varieties that we collected from old Belgian collections for resistance evaluation were chosen according to the following criteria:

(1) varieties originating in neighboring countries and formerly grown in our regions, which presumably were recognized as being suitable for them;

(2) varieties having appeared in or before the 18th century; this criterion was based on the assumption that the selection work of the amateurs of the last century, which was concentrated on the development of prestige fruit or very tasty fruit might in the process have neglected the resistance characteristics that were present in the original material;

(3) varieties absent from the major collections of France and the United Kingdom, which were the main collections of western Europe.

Prospecting In Belgian Collections

The first stage of the work involved searching in the fruit collections of the horticultural training or research institutions of our country for Belgian varieties of all periods and old foreign varieties that met the criteria given above. We should mention here that all those responsible for the collections were extremely helpful.

Of the major collections, the oldest are those of the Hoger Rijksinstituut voor Tuinbouw in Vilvorde, the Faculteit van de Landbouwwetenschappen of Ghent University, and the Faculté des Sciences Agronomiques de l'Etat in Gembloux. Other large collections that have been set up more recently are those of the Station de Cultures Fruitières et Maraîchères in Gembloux, the Hoger Rijksinstituut voor Tuinbouw in Melle and the Provinciaal Instituut voor Tuin- en Landbouw in Louvain, which have been built up partly from material borrowed from other national collections and partly from original entries. Certain old varieties have also been found in the smaller collections of the Institut Supérieur Provincial d'Enseignement Horticole in Brussels, the Ecoles Techniques Horticoles Provinciales de Mariemont, the Institut Communal d'Enseignement Horticole in Liège and the Vrij Tuinbouwinstituut in Roeselaere. Finally, the Centre d'Essais pour la Promotion Fruitière au Pays de Herve, in Cerexhe-Heuseux, which for the last 15 years has been collecting old apple and pear varieties from the area, mainly with an eye to industrial fruit, was also very useful to us.

If we disregard the latter institution, all the other collections derive their contents from the great collections of the amateurs or nurserymen of the past. Indeed the basis of the assortments to be found there is provided by the varieties of Belgian or foreign amateurs of the last century, as well as a small number of very old European varieties, mainly French, which were in the collections of the castles and abbeys of the 18th century and thereafter passed on to form the foundation of the private collections of the 19th century. The Belgian rural varieties which we will deal with later, are very poorly represented, if at all. Finally, the most recent collections also contain varieties, especially apple varieties, that have been introduced or tested in commercial orchards in Belgium or neighboring countries during the last two or three decades. A certain number of small school collections, which have not been mentioned above, predictably consist almost exclusively of current commercial varieties, to meet the needs of teaching directed towards immediate practice.

A few dozen old Belgian varieties that no longer exist in our institutions have also been obtained from National Fruit Trials in Faversham, in the United Kingdom, and from the Station d'Arboriculture Fruitière in Angers, in France.

The older breeders' varieties, of both apple and pear, are generally dessert fruit (also called "knife fruit"). With regard to pear, the majority were once considered top-quality, and many of them would still be so considered now; a minority of these varieties are of second or third quality as eaters, and sometimes first quality as cookers. The very old pear varieties from the old European range, which date back to the 18th century or earlier, are more uniformly distributed over the three categories of quality. As for apple, the breeders' varieties are distributed more or less like the breeders' pears, but the very old European varieties are more often than not dual-purpose, some of them--the best example of this being Court-Pendu Rouge which dates back to before the 17th century--being still sold nowadays as top-quality fruit.

Among the Belgian breeders' varieties, as mentioned earlier, pears far exceed apples in number. At the end of 1978, for instance, we recorded 202 pear varieties and only 37 apple varieties in the total range of Belgian breeders' varieties.

How to identify old varieties. The labels and the registers of the collections that we included in our survey generally give only the names of the varieties, and just occasionally their maturity dates. In order to spot the varieties we were looking for, we traced the origin of all the varieties in these collections in the relevant literature. The information on pear was found in pomological works by European or American authors and in Belgian and French horticultural magazines of the second half of the 19th and the beginning of the 20th century. Apple varieties were to a considerable extend identified with the aid of the monumental National Apple Register of the United Kingdom. Even though this work mentions more than 6,000 varieties of all origins, certain varieties were not found there--this was particularly true of Belgian varieties--and for those we followed the same bibliographic route as for pear.

Ascertaining the origin of varieties is complicated by the high degree of synonymity, often inconsistent, or contested or even just wrong, affecting a number of old varieties. Not only is the same variety found under different names in different collections: one cannot always rely unreservedly even on the best pomological works. An example of this is the confusion, in Leroy's Dictionnaire Pomologique, in other respects a remarkable work, between the old Belgian varieties Délices d'Hardenpont and Fondante de Panisel, which the author places together under the name of Archiduc Charles. The same author also gives Keuleman as being synonymous in apple with Belle-Fleur de Brabant, a blatant error drawn from an earlier Belgian work. An article in the Bulletin Horticole which was published in Liège in 1897, commenting on this and other errors, began with the words "Be wary of book learning ..." Another example is that of the very old varieties Royale d'Angleterre and Reinette d'Angleterre, which were relegated to synonymity by the highly respected Congrès pomologique de France in 1867, not to be reinstated in their separate identities until 1938, when an article by Chasset, the Secretary General of the same Congress, put an end to a long controversy. And yet a perfect distinction was made between these two varieties in Leroy's Dictionnaire Pomologique which appeared in 1873... We have found these two varieties in collections under both of the names mentioned, plus the name Reinette Royale d'Angleterre, which adds that touch of compromise for which we seem to have the knack.

Problems have also been caused by spelling mistakes in denominations, which occur frequently in collections. These mistakes are for the most part clearly due to incorrect reading or copying of a handwritten inscription or phonetic alternation of a name. While one gets used to the lesser ones quite quickly--Reinette de Beaumon instead of Reinette de Baumann, La Sotiale instead of La Solsticiale, Hantworden instead of Hawthornden, Bonnes-Soeurs de St-Denis instead of Bonneserre de St-Denis--others can give rise to more confusion. The name Madame Pirmez, which is not mentioned in the relevant literature, is surely a corruption of Ministre Pirmez, which is mentioned and which might have been shortened to Min. and then copied as Mme. And the Bergamotte de Wetteren, which is not to be found in any literature, might well be the Beurré de Wetteren described by Leroy. In principle the question can be settled by comparing the variety in the original collection with its description. For that of course there has to be such a description, and not only a bare mention, which only shows that a variety has in fact existed under that name. And then what to do if the tree in the collection does not produce any fruit, which is the main criterion for ascertaining its identity? Or, for that matter, if the tree in the collection is 40 years old and the description of the foliage and branches of the variety is based on two-year-old nursery specimens, as it is in Leroy's Dictionnaire Pomologique?

Mistaken identities. The most awkward problem is that of mistaken identities in original collections. One can imagine the pleasure of discovering, for instance, that a variety introduced three years previously under the label Reinette de Saintonge--and described by old works as being a rustic, bronze-skinned apple that ripens between January and April--has managed to drop all its fruit, uniformly scarlet in color, in the middle of September. After a first round of collecting single specimens of varieties, we began to introduce the same varieties, duplicated or even triplicated, from other collections. Material from different sources having the same appellation is budded side by side in the nursery and compared on the one-year growth the following season. This comparison is infallible, as no two varieties are capable of resembling each other with respect to speed of bud bursting, speed of stem growth and end-of-season size, feathering, color gradation along the herbaceous shoot, speed of lignification, shape, attitude, color, brightness and pilosity of the leaves at different levels, etc.

If one-year-old plants are compared with two-year-olds or, worse, three-year-olds, comparison becomes far less reliable. Not only are the axial growth parameters lost, because they are no longer comparable, but the characteristics of the stem are no longer exactly the same, and there are greater variations in leaf shape in older plants. On first-year growth, moreover, it is also easy to ascertain differences in the state of health of the material, material from certain sources being more affected by viruses than others, particularly in the case of pear. Apart from that, all morphological differences are more pronounced in pear than in apple, and the latter therefore require more careful comparison.

In many cases the material from various origins is identical, but in others it is not. The question to be settled is therefore which is the material true to the variety name. We have not yet carried out enough comparisons to be able to make an accurate reckoning of the frequency of error, but it appears to be higher in pear than in apple, and also in certain collections as opposed to others. Some of the errors are visibly due to the misplacing of labels in the collections, whereas others no doubt date back to the time of grafting, or sometimes are even older, judging by the complaints of amateur fruit growers published in old horticultural magazines on the subject of errors in varieties supplied by nurseries. Other errors are due to the fact that the authentic variety has been replaced, without anyone noticing, by another variety used as intermediate stock. It is interesting to note here that, in a consignment of pear trees imported by the Station d'Angers from a Belgian collection after the last war, four out of 24 varieties confirmed as being erroneous after years of growing were of the Curé pear--widely used in the past as intermediate stock--while there were 12 Doyenné du Comice and eight miscellaneous varieties. One might wonder whether Doyenné du Comice has not been to pear collections what the joker is to a deck of cards, but it will be agreed that this is anything but convenient in an orchard devoted to the evaluation of varieties.

Prospecting In the Country

We saw earlier that Belgian collections contained only a small number of rural varieties, without any known breeder, which were once grown in our standard tree orchards, both pear and apple, and which corresponded to the traditions of a region or even of one village. This poor representation reflects the indifference to such varieties of the pomologists of the last century, who had eyes only for award-winning novelties and new varieties introduced from France, England, Germany and even Russia and America, catering thus for the contemporary predilection for the exotic. Unlike breeders' varieties, the rural varieties did not spread far, because international exchanges took place only at the amateur level, and it is not surprising therefore that they should be almost completely absent from the large foreign collections.

The only Belgian collection that does not conform to this rule is at the Centre d'Essais Profuit in Cerexhe-Heuseux, which has concentrated particularly on the regional varieties of the Herve country formerly used for the making of cider and the famous pear and apple syrups of the region.

During the early years of our collection, we had already had the opportunity of collecting some local varieties which had been reported to us by chance. We gradually realized that there was quite an astonishing range of these varieties in old orchards and gardens, and also of non-grafted specimens raised from seeds with interesting characteristics, and even some forgotten rootstock types. So in 1978 we began to search more systematically for this material in rural areas and, in the course of the summer of 1979, several dozen undocumented varieties, located in rural areas in the course of the winter, also found their way into our collection.

Unlike Belgian breeders' varieties, in which pear far outnumber apple, the rural varieties are for the most part apples. As a rule, only a small number of pear varieties are to be found, except in the province of Liège, where many varieties have been and often still are grown for the making of syrups. Pear syrups have also been made in other regions, but no doubt on a smaller scale or longer ago, and in any case the number of pear trees is now quite small in the old orchards. When they were not used for the making of syrup, the varieties served to make cooked pears or pears in vinegar, or again for the making of tarts in certain regions, like the Sint-Michielpeer in the Courtrai region and the Saint-Mathieu pear in the adjoining Hainaut region and the north of France. These uses are still quite widespread, moreover, and the preservation of sterilized pears has been added to them. Certain pear varieties were once used as dessert fruits, for instance Beau Présent in Liège and Winterkeizerin in the Ghent region. Most of these table varieties would now be regarded as second-rate, however. Rural apple varieties, on the other hand, include a number of very excellent cookers and eaters, and even dual-purpose fruit, comparable in quality and indeed sometimes surpassing the breeders' varieties.

Local traditions. The tracing of these varieties can just about only be done through people who still know them. Chance may well arrange for one's attention to be drawn to a rather odd-looking tree during a trip in the country, but that is bound to be a rare exception. The main thing therefore is to trace the people who know, and to do that one has to combine a network of personal contacts with appeals to the public.

The results of such quests are very variable: some paths prove disappointing, but the majority lead to one or more interesting finds, and sometimes a whole collection of undocumented varieties is discovered. Some of our most successful hunts have enabled us, in Hainaut, the Herve country and Gaume, to meet owners of 10 to 20 old varieties, preserved with their exact names, a third to half of them being new to our collection. There is also the case of varieties that we are told about during our tours, but which seem impossible to pin down. A typical example of this is the Triomphe du Luxembourg apple, which we had heard mentioned any number of times, always in the past tense, and which was becoming something of a mirage when the Service de l'Horticulture in Arlon told us of the owner of a whole group of trees of this variety.

When talking to the people who still know old varieties, we should not conclude too hastily that we have gleaned most of what they know, on the contrary: we have to take the time to steer them along the path of their memories and wait for those memories to surface. It often happens that a visit to an orchard has lasted half an hour before our guide suddenly comes up with: "What do you think of this one, then?" This might be an old tree that he had not thought about at first, at the other end of the orchard or elsewhere in the village, or even in another village. We also rely on the recollection of fruiterers and syrup manufacturers who have collected fruit in many an orchard and still do so in those that remain.

These contacts are greatly facilitated by the spirit of cooperation that is always shown when old varieties are being collected, and also by the kindness with which people go out of their way to help us, sometimes taking up a considerable amount of their time. One remarkable feature is the generosity of the people who possess a variety that is sometimes quite rare and yet are only too willing to share it. All this is tied up with their reluctance to see old varieties disappear, and it is expressed in many different ways, either resigned ("let's face it, things aren't what they used to be"), trusting ("so you're going to bring these old ones back, then"), knowing ("perhaps then you could graft a young one on for us") or self-reliant ("I've taught myself how to graft, and I'm going to plant a whole orchard in my spare time"). What we often notice, moreover, is anxiety to find someone who will graft an ageing variety on to a young rootstock, as there is hardly anyone left in the villages who still knows how to graft, and there are not many nurserymen who agree to do it if it means selling only one tree, which is understandable.

The most abundant recollections are to be found in older people, of course, but there are also young and even very young people who have kept some fragments of tradition going, in which case it is a conscious action on their part. These memories concern mainly the names of the varieties, their qualities and their culinary uses--including recipes--their suitability for storage, their fertility, the former demand for them on the market and the frequency with which they were planted in orchards, where in the region they were mainly found, or other details.

It is symptomatic that accurate information on picking or ripening dates is hard to obtain except for fruit that ripen at the traditional picking time, the point being that the fruit are picked "when you can see they're ready" and not in the way adopted by the experts of the profession, who go by written rules.

Again, memories almost exclusively concern local or regional varieties, with country names, which are still remembered by many, along with other traces of village tradition: there is the Poire de Gros and the Cwastrêsse, in the area of Namur, the Grisette and the Pomme de Côtes in the region of Couvin, the Rosée, Brûlée and Notre-Dame pears in Thudinie, the Rode Keiing in the Waes country, Cooremans in Steenhuffel, Gris Braibant in the province of Liège and around Namur, the Poire de Gauniau in the Ath country, the Berglander in the Payottenland and many others. The breeders' varieties, which the zeal of former horticultural experts had caused to be spread everywhere in gardens and against farm walls, are often still to be found, but their fragile, compound names, which are foreign bodies in the cultural eye of the village, have been extensively forgotten. Jargonelle d'Automne, Nouvelle Fulvie, Beurré des Trois Tours, Président Defays-Dumonceau, Orpheline d'Enghien, Reinette Coulon la Jaune, are so many esoteric names that are hardly ever found now outside certain learned circles.

Checking authenticity. Rural varieties are even more poorly represented in old literature and the old catalogues of commercial nurseries than in collections. Some widely-grown varieties, such as the Belles-Fleurs, have been extensively described. As for the others, it is already something if they are mentioned in the short texts written almost like works of anthropology and published by pomologists interested in the rustic character of these varieties. In the absence of a published description, which is practically the rule, identity can only be checked by comparing material collected from different places and that is given the same name, by side-by-side budding in nurseries.

In this way we have been able to establish that oral traditions are generally highly reliable with regard to rural varieties. For instance, in Steenhuffel we found a pear tree of centenarian aspect whose name, as pronounced by its owner, seemed to be Verherbruggen or Verheerbruggen. A nursery comparison showed it to be identical to material labelled Verkerrebrugge in a collection. Later we found an article published in 1909 which said that a variety called Vereert-brugghen was grown at that time in various villages west of Brabant, including Steenhuffel. In this instance, then, the oral tradition proved more accurate than the label in the collection.

We have also discovered, in a number of Gaume villages, that the local connaisseurs made a distinction between two calville apples which at first sight seemed identical and were given there the names Reinette à Côtes and Reinette des Vergers. The first is a very tasty fruit and the second barely good enough for cooking, and the foliage of the two varieties is different. These varieties are related or identical to the famour Cwastrêsse of the Namur country, of which it is sometimes said that it existed in two forms, one "simple" and the other "double." And yet all the old pomological works that mention the denominations attribute them quite wrongly to one and the same variety. And that is not all. There has in fact been, in the field of fruit varieties as in others, a whole peasant folklore which has been ignored or misunderstood by cognoscenti, and which as a result is now finally disappearing.

Orchards of seedlings. Alongside the rural varieties, which used to be distributed locally or regionally, were propagated by grafting and were given a name, there is a completely different range of material of rural origin made up of specimens grown from seeds. Apple and pear trees of this kind are occasionally found in various parts of our countryside, having grown from an orchard windfall or been found in the woods, and kept because the fruit was appreciated. A certain number of breeders' varieties and many well-known rural varieties have no other origin, but the specimens in question here have always retained their lone character and have never been propagated by grafting.

In certain regions, however, such as the valley of the Meuse between Namur and Liège, we found not just isolated trees grown from seeds but whole apple orchards containing a high proportion of specimens grown from seeds--all different--mixed in with grafted trees. Professor A. Lecrenier had already reported to us that orchards of apple trees grown from seeds had been planted there, with close spacing, the less interesting trees being removed after a few years to make room for the others.

These seedlings have no name, of course, and, unlike the rural varieties which had a local or regional status, do not belong to a tradition. If the trees have not been abandoned, an idea can be obtained from their owner of their fertility, the quality of their fruit, their earliness and their storage potential, but of course this cannot be compared with information from elsewhere, as the trees are unique specimens. These elements are taken into consideration at the same time as the appearance of the fruit and above all, the health of the tree--absence of canker and leaf and fruit diseases--so that those worth picking for our collection may be selected.

There remains the case of apples trees of which two or three grafted examples are found in one place without anyone knowing anything about their origin. Is this the vestige of a forgotten local variety, or is it a seedling formerly grafted on just a few stocks? The paradox is that in this category we have found some old apple trees of quite incredible health, vigor and fertility, alongside some speckled and ragged and yet classic Belle de Boskoop trees in the same orchard.

Preservation and Evaluation

When they are introduced to the Station, the varieties are grafted on M9 rootstocks for apple, and on Type A quince stocks, perhaps also with an intermediate stock, for pear. The following year two plants of each variety are transferred to a conservatory, where they are trained in vertical strings at 50-centimeter intervals between trees and 2 meters between rows, and are given chemical protection to ensure the survival of the weakest. A third plant is made into a bush and planted at 2 x 4 meters spacing in an untreated testing orchard. In the conservatory the varieties are installed in the order of arrival, whereas in the testing orchard they are grouped by earliness and by breeder, or by region of origin for rural varieties.

Classification by earliness was adopted to facilitate both the work of picking and storing the fruit and the orchard observations: fruit collections are generally planted in the order of introduction of the varieties, which in fact is a form of organized disorder, and as soon as the number of varieties reaches a certain level confusion begins to set in.

For breeders' pears, which are far more numerous than breeders' apples, we regrouped the varieties by breeder within each category of earliness. The reason for this is that the breeders have often worked with a small quantity of parent material, that one can therefore expect to find certain characteristics common to the varieties of one breeder and that it seems sensible to keep them together when the purpose is precisely to carry out genetic evaluation. Evidence of the existence of some "genetic families" is provided by the Major Esperen's pear varieties, which we have in our collection, where the bergamot shape--a small to medium-sized, globular fruit--appears in half the 16 varieties, a most unusual frequency which leads one to believe that parent material of that type had been used repeatedly by the famous Malinois breeder. A further clue is that of the very unequal distribution of categories of earliness among the products of the main pear seedling raisers: for instance, the category that ripens latest, in December and beyond, is represented by one variety out of 33 for Van Mons and by none out of 14 for Bivort, compared with five out of 21 for Grégoire-Nélis and six out of 16 for Esperen. It is also interesting to note that Bivort's distribution of categories is very close to Van Mons', in view of the fact that the former took over the collections and continued the work of the latter (fig. 1).

Early authors give highly detailed information on the earliness of breeders' varieties, especially for pear, whose ripening period is more clear-cut than that of apple. There is sometimes disagreement between authors, but it is usually only slight. For many rural varieties we have only approximate information on earliness, and those varieties therefore cannot be classified more specifically than as summer, autumn and winter varieties. The earliness of a small minority of varieties is not even known.

All the documentation found in literature on the varieties in our collection is filed in the form of photocopies. This documentation varies considerably in amount, ranging from a comment disposing of a variety in five lines to a

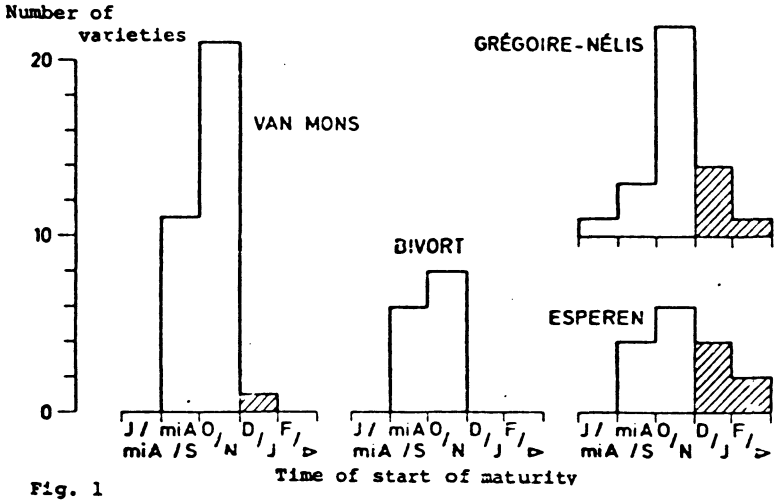

Fig. 1

Maturity times of the pear varieties of the four main Belgian breeders at the Station de Phytopathologie, according to specialized literature. Compare with figure 3a. J/Mi A = July/mid-August, O/N = October-November, etc.

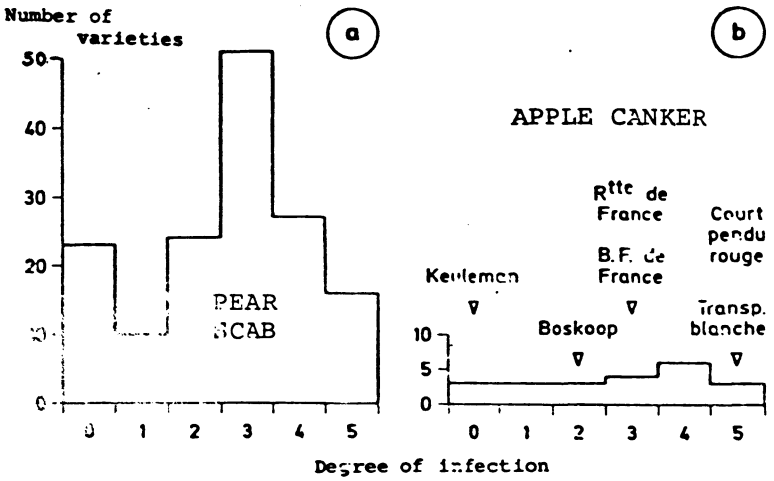

Fig. 2

(a) Degree of scab infection on the leaves of 151 pear varieties in one collection in 1978. (b) Degree of Nectria canker infection of the branches of 22 apple varieties in a standard tree orchard, in 1975. The names are those of the varieties used for reference.

monograph devoting several pages to it. It gives the description of the fruit and sometimes of its foliage and branches--with occasionally some very beautiful old color-engravings--and details on the earliness and quality of the fruit, fertility, compatibility with the rootstock, or just one or some of these data. The publications of the inter-war period, which concern only a small number of varieties, sometimes contain certain indications, of varying reliability, of susceptibility to disease. Such indications are almost totally absent from earlier publications.

The number of varieties collected in this way at the Station de Phytopathologie was 230 for apple and 430 for pear at the end of 1878. Of this total, varieties of Belgian origin account for 84 in the case of apple, including 37 breeders' and 47 rural varieties, and 244 in the case of pear, including 202 breeders' and 42 rural varieties*. The rest of the material consists of foreign varieties and specimens found in our countryside but which do not have any recognized name. This collection will be further increased by the varieties--most of them rural--which we have been endeavoring to collect in the country.

No evaluation of the resistance of varieties can be undertaken until the trees have grown sufficiently and set fruit. The first varieties introduced to the Station attained their fourth growing year in 1979, and we may reasonably expect to start making observations in 1980, and then repeating them over a number of years in order to obtain reliable data.

5. THE GENETIC POTENTIAL OF OLD VARIETIES

The number of years that elapse between the introduction of a variety to a collection and the end of its evaluation is somewhat demoralizing. There is reason to wonder, therefore, whether it would not be simpler and quicker to carry out the evaluation in existing collections and in the country.

A first reply to this is that we are in fact carrying out such an evaluation, as far as possible. Fig. 2(a) shows the results of an evaluation of susceptibility to scab in 151 pear varieties of different origins, which was carried out at the end of July 1978 in a collection in which plant health had been neglected, which is an exceptional situation. In the course of our prospecting trips to the country, we make a note of the state of health of the varieties we collect, if possible comparing them with fairly commonplace varieties, whose susceptibility is known and which are present in the same orchard, which then serve as reference varieties; examples of these are Transparente Blanche, Reinette de France, Court-Pendu Rouge, Belle-Fleur de France, Belle de Boskoop and Keuleman for apple trees. Fig. 2(b) gives an example of a report on susceptibility to canker in 22 apple varieties, seven of them unidentified, found in an old abandoned orchard containing about 120 standard trees. The report shows the range of susceptibility of the reference varieties.

In old orchards, susceptibility to canker in relation to local conditions can be ascertained in one observation, because the lesions accumulated on the branches show the total amount of infections during a great number of years. On the other hand, for leaf and fruit diseases, observations made when the grafting material is taken are generally insufficient. In some years, like 1979, scab plays havoc and powdery mildew is practically absent, whereas in other years the opposite occurs; there are also years in which the diseases spread only slightly. Here, therefore, the observations must be repeated over a period of several consecutive years before susceptibility can be correctly ascertained.

This leads us to the second reply, which is that this kind of on-the-spot observation cannot be carried out in a sufficiently systematic fashion. First, there is the practical consideration that it is not possible to go right round the country every year to observe a whole series of collections and a quantity of trees scattered all over the place: this would try the patience of their owners; apart from that there are years without any fruit, and many trees that are no longer in a fit state to be observed or that are disappearing.

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* These varieties of Belgian origin are listed, with notes on their origin, in the following publication: Populer, C. Listes des anciennes variétés belges de pommiers et de poiriers réunies à la Station de Phytopathologie à Gembloux. Note technique 3/23, Centre de Recherches Agronomiques de l'Etat, Gembloux, 70 pp., 1979.

These observations also presuppose that the trees have not been given any chemical protection during the three or more years that are necessary for the observation of foliage and fruit diseases; for canker of the branches the period is even longer. Furthermore, the trees under observation should not be located alongside a plantation that is receiving treatment, from which they might pick up drifting fungicids. Finally, it has to be possible to make artificial inoculations on trees under observation. Working conditions such as these, which are bound to cause many of the trees to deteriorate, are unacceptable in collections, the purpose of which is the preservation of varieties, or their use for instructional demonstration.

Furthermore, all these country collections and plantations are to be found in conditions that do not really lend themselves to comparison from the point of view of soil, fertilization, exposure, etc.--certain collections are trained against a wall, others are exposed to the wind and face in different directions--not to mention the age of the trees and the type of rootstock and intermediate stock, the pruning and also the inoculum, whereas in fact all these factors condition the reaction of the varieties to disease. During our tours of the country, we have thus occasionally come across old, untreated orchards which are nevertheless very healthy, in which even varieties known for their susceptibility to disease were in an acceptable condition. These have been in ecologically favorable places, formerly known for their high-quality fruit for which purchasers came from far afield. An isolated tree can also owe its good state of health to the fact that it has no neighbors to contaminate it. Observations carried out in the country therefore have to be regarded as preliminary, and they have to be verified by systematic testing in an evaluation orchard.

In any event, these country observations lead one to presume at the outset that many rural varieties of apple have a high resistance at least to scab and canker. Unexpectedly, orchards of apple trees raised from seedlings also promise to be an important source of resistance characteristics; no doubt the system of dense plantation of a very heterogeneous population of seedlings, followed by the removal of the least interesting among them, which seems to have been the practice in these orchards in the past, has had a selective effect favouring resistance. As no monogenic resistance to scab has yet been found in cultivated apples, it may be hoped that the high resistance of certain apple trees of rural origin is of the polygenic type. As for pear trees of rural origin, while resistant ones are also found in the country, the prospects are less promising because the range of varieties is smaller, the fruit of lesser quality and the resistance to scab, at least in certain cases, not likely to cover all strains of the fungus.

As for breeders' varieties, we still have only few direct observations, as for the most part they come from well maintained and treated collections. It is possible that this category of varieties contains fewer sources of resistance than the rural varieties, because the selective pressure has been towards the production of high-quality fruit of good appearance. In the collections of the castles and manors of the past, it was a lesser handicap if a variety was very susceptible, because if its fruit was worth producing, it was trained against a sunny wall and sheltered by glass or canvas windbreaks, and the fruit were even enclosed in protective bags. The diagram in fig. 2(a) nevertheless gives an idea of what can be expected in the way of scab resistance in breeders' varieties of pears, with the proviso made earlier regarding the possibility of this resistance being of a transitory nature. For breeders' apples, one cannot begin to form an opinion until results have been obtained from observations in an evaluation orchard.

Properties Other Than Resistance

There are also other things than sources of resistance to be looked for in old varieties. Difference in ripening periods is not the least of these. Fig. 3 gives the distribution of maturity dates of apple and pear varieties already incorporated in the evaluation orchard of the Station. These dates are grouped according to the two-month classes adopted by the National Apple Register. It is difficult to be more precise for apple, but for pear the beginning and end of maturity can be given in far greater detail, as fig. 4 shows. As a French tree growers' manual mentioned in 1918 in the introduction to its descriptions of apple varieties: "The maturity periods differ less (than for pears), as the great majority of apples are late, and their slow ripening prolongs their consumption period considerably."

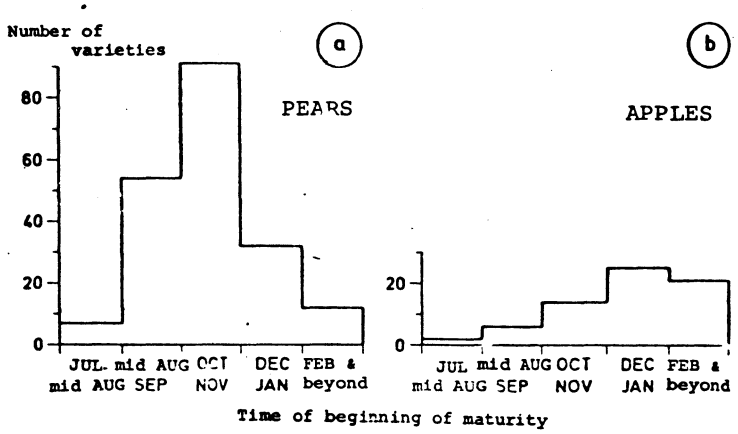

Fig. 3

Maturity times of 196 pear and 68 apple varieties at the Station de phytopatnologie, according to specialized literature.

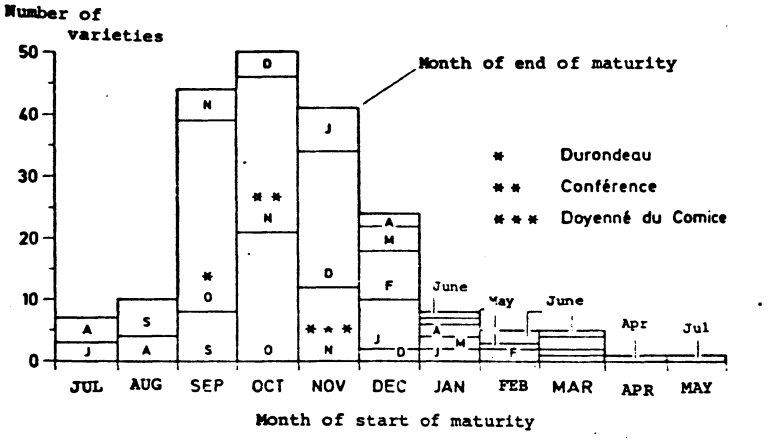

Fig. 4

Maturity times of 196 pear varieties at the Station de Phytopathologie. Same information as in figure 3, but more detailed.

Figure 4 shows the classes of maturity into which the main present-day commercial pears fall as compared with the range of varieties in our collection. While there are relatively few earlier ones, which might be considered uninteresting, there are, on the other hand, a great number of varieties capable of being kept far longer. The leader of the field in this respect is La Solsticiale, so named because it ripens in apple lofts, without refrigeration, around the June solstice of the year following picking. This variety is described in the "Pomone Tournaisienne" as being "demi-cassante"--today we would say semi-hard--"très sucrée, très parfumée et fort bonne." It is closely preceded in the calendar by the Délices d'Avril pear, whose name conveys the opinion held of it formerly. Apples do not fare any worse: without going as far as the germanic hyperbole which gave to certain varieties the name of "Drei Jahre dauernder Mutterapfel," our Belgian varieties include Marie-Joseph d'Othée and Président Henri Van Dievoet which can be stored naturally until the first summer apples of the following year arrive. For the latter variety, which is a second-generation product of a seed brought back from Russia by a veteran of Napoleon's armies, the descriptions of the time even state that it "does not give the best of its taste until the period from the end of May to the middle of July."

Even if these varieties do not all have the desired flesh quality, they are nevertheless invaluable parents if ever the need to save energy should make it necessary in future to store fruit with less refrigeration. Moreover, this suitability for storage is not confined to recognized and named varieties. At the end of March 1979, a man from Aubange sent us some apples that he had kept in his apple loft, which were perfect in appearance, tight-skinned and well colored, with a firm flesh and a pleasant flavor and still so fresh that the juice ran from the knife: and these fruit came from an ungrafted tree which had grown quite by chance in his garden!

Another area of diversity is that of shape, color, flesh texture and above all flavor of these old fruit, the extent and indeed existence of which is often not realized. A chemist visiting the Station recently told us that with tomato, flavor was determined by a very simple substance. With pear, he added for our information, it should be the same thing. This offhand opinion was certainly not that of the pomologists of the last century, or for that matter of the French agronomist Olivier de Serres, who wrote, two centuries before the great leap forward in fruit diversity: "Il n'y a Arbre entre tous les privés qui tant abonde en espèces de fruits, que le Poirier, dont les diverses sortes sont innumérables, et leurs différentes qualitez esmerveillables. Car despuis le mois de Juin jusques à celuy de Decembre, des Poires bonnes à manger se trouvent sur les Arbres. En considérant particulièrement les diverses figures, grandeurs, couleurs, saveurs et odeurs des Poires, qui n'adorera la diverse sagesse de l'Ouvrier? Des Poires se voient rondes, longues, goderonnées, pointues, mousses. Des petites, moiennes, grandes. L'or, l'argent, le vermillon, le satin vert reluisent aux Poires. Le sucre, le miel, la canelle, le girofle y sont savourés. Et flairés, le musc, l'ambre, la civette. Bref, c'est l'excellence des fruits que les Poires, et ne seroit digne Verger, le lieu auquel les Poiriers defaudroient."

The apple is equally well defended in an article of the journal of the Royal Horticultural Society of 1949, in which the author says: "The shades of flavour which the Apple can offer are, *sui generis*, almost inexhaustible. In some of the choicer dessert varieties they are of the greatest refinement, the subtlest delicacy. It is in no sense an exaggeration to say that, except for the world's few really great wines, nothing we eat or drink presents such fascinating diversity of savour within the compass of a single generic type, or affords such rare delight to the epicure."

It must be said that, while France and Belgium have always been the countries of pear enthusiasts, in England only the apple was formerly regarded as being worthy of the male palate, while pears and other kinds of fruit were regarded as a concession to ladies' tastes or a "natural medicine" for children.

In these old varieties there are still other interesting and usable characteristics: a high degree of shock resistance in the fruit, for instance, or a resistance to bletting in summer pear, or a tendency to late flowering which allows the last frosts to be escaped, etc. We even have two varieties of apple of rural origin in our collection that have the unusual ability to multiply by cutting or layering.

Indeed, as a French breeder pointed out recently, it is certain that the variability encountered in the cultivated apple has not been properly exploited. This is probably also true for pear.

Imaginary Qualities in Old Varieties

The enumeration of this diversity must not convey the impression that old varieties are necessarily all excellent in all respects. Old varieties are interesting at the outset because of their genetic diversity, and one should not make a cult of whatever is old. Some of these old varieties may perhaps find a place in professional orchards--as did the Général Leclerc pear, which was introduced to commercial growing recently in France--others have sufficient merit to be grown by amateurs, where there is less demand for productivity but more for rustic qualities; still others, which may have only one characteristic to recommend them, may yet have a future as parent material in an improvement program. However, a large number of these old varieties are not interesting to grow as such, and whoever wishes to restore pride of place systematically to old varieties merely because they are old is headed for many disappointments.

For instance, not long ago Belgian periodicals published an interview with a nurseryman from a neighboring country, whose nursery was not far from our border, it included the following passage: "Les espèces fruitières anciennes ont été sélectionnées par la nature. Seuls les spécimens les plus forts survivent et se reproduisent." And in the Dutch language version: "Die oude soorten hebben gelukkig een prima weerstandsvermogen, die kunnen zonder spuitgedoe best rooien." These articles also claimed that modern commercial varieties were treated 30 to 35 times a year, which is 2 to 3 times as much as they in fact are treated.

One can readily imagine the effect on the public of such statements, which are the result of a naïve albeit well-meaning enthusiasm. Before varieties, old or otherwise, can be recommended, they have to be subjected to thorough growing tests. This moreover is why the list of the Belgian varieties at the Station, which follows this note, is confined to data on their origin, without any description of the fruit or of the maturity period, which might be a temptation to start growing them again too early.

6. A HERITAGE IN DANGER

The old standard tree orchards that still exist in our countryside consist to a very large extent of the few commercial varieties of the inter-war period that we have already mentioned several times. These varieties are not liable to disappear in the immediate future, all the more so since they still feature alongside the modern commercial varieties in the catalogues of our nurserymen. These are the apples Belle-Fleur de France, Belle-Fleur Large Mouche, Court-Pendu Rouge, Jacques Lebel, Reine des Reinettes, Reinette de Chênée, Reinette de France, Reinette Descardre, Reinette Rouge Etoilée and Transparente Blanche, and the pears Double Philippe, Légipont and Saint-Remy. On the other hand, there is something to be gained by examining certain of these varieties in the old orchards, as many sub-types can be found that differ in vigor, fertility, coloring, taste and size of fruit, etc. It is interesting to do this sort of research on a variety like Reinette de France, because for a whole section of the public it is the epitome of the old reinette, and because it could perhaps experience a revival of commercial interest in spite of its susceptibility to powdery mildew and canker.

Other varieties that used to be common have become relatively difficult to find in the country, and no longer exist in nurseries. This is true, for instance, of the apples Belle-Fleur de Brabant or Petite Belle-Fleur, Berglander, Cwastrèsse, Gris Braibant and Rambour d'Hiver; some but not all of these varieties are still to be found, subject to errors of identification, in one or two Belgian collections. There is thus a very definite need to collect these varieties in orchards.

This need becomes a matter of urgency, however, for the great number of old rural varieties that are missing from the collections, being for the most part underrated, but which still survive in the country, as we have seen earlier, usually represented by a few specimens only. Those varieties are now in great danger of extinction. One example among others is the Thisnes pear, which once was grown exclusively in the village bearing that name and exported to England via the Saint-Trond market, the last three specimens of which the Service de l'Horticulture de Liège was able to locate for us, the first dying and the other two having been top-grafted with Joséphine de Malines. Everything **we have heard and seen of this** Thisnes pear testifies to its being a variety with an exceptional rustic quality. In the village of Walhain we found another example, an apple variety called "Spéche" which is remarkable for its fertility, long storage and resistance to scab. This purely local variety, of which an inhabitant of the village told us that he had known a dozen trees in his childhood, now has only one surviving example. We are constantly coming across similar cases, not to mention the famous apple seedlings we spoke of earlier which, by definition, exist in one specimen only.

Since the last war, the gradual shrinking of the areas occupied by standard tree orchards, which was accelerated during the nineteen-seventies by the award of felling grants, has wrought havoc among all these rural varieties. Many of them have probably already disappeared. Those that have escaped the saw are now threatened by the onset of old age, and even those owners who are attached to them, as indeed many are, do not know how to make them last. Most of the people who still know how to recognize these old varieties are also getting well on in years. Five to ten years from now there will not be much left either of the varieties or of the knowledge.

With regard to material kept in official collections, it is a mistake to believe that it is truly safe. Many collections have disappeared or have been top-grafted with standard varieties in the course of recent decades, because the large assortments of varieties that used to be kept no longer correspond to modern teaching requirements or because space was required for classrooms, dormitories, greenhouses, laboratories or car parks. Even now they are still disappearing. Since 1975, which was when we began to pick varieties in Belgian collections, a whole collection of old apple trees and part of a collection of pear trees have been uprooted to make way for building projects. We arrived too late to save the apple collection; the registers, which still exist, show that it contained a great number of varieties that are not to be found elsewhere. The people responsible for the collections usually try to defend them, but with varying degrees of success; we met some who were very disappointed.

Even in collections that are not yet suffering from such major reductions, varieties are regularly disappearing as a result of accident, because they were planted in one specimen only in order to save space. For a variety of Belgian origin, its disappearance from a collection means its irretrievable loss in many cases, as many of these varieties are represented in one Belgian collection only and do not exist in the large foreign collections, as fig. 5 shows. A measure of the reductions suffered by Belgian collections is afforded by comparison of the 557 distinct varieties of pear trees that we recorded in all the present Belgian collections with the number existing in 1920 at the Ecole d'Horticulture de l'Etat at Vilvorde alone, which was more than 1,600.

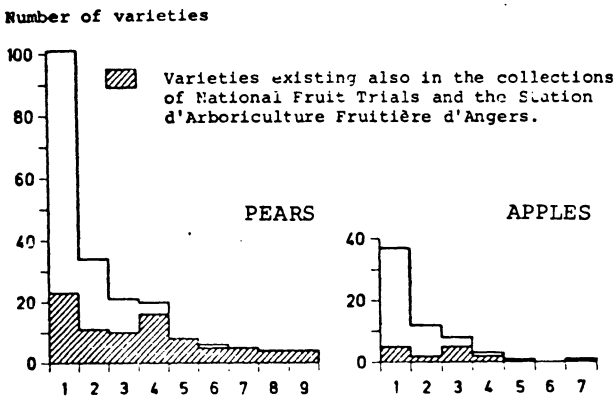

Fig. 5

Distribution of Belgian varieties represented at the Station de Phytopathologie that are also represented in Belgian and foreign collections. The Station is not included among the collections represented by the horizontal axis.

In the face of this frightening erosion of fruit tree material in the country and even in collections, the work of finding, identifying and preserving our old varieties has proved to be the essential basis of our evaluation program. Our heritage of varieties has to be safeguarded and evaluated, because it is a source of genetic variation and because the genetic variation determines the future of improvement programs, which in turn should produce varieties suited to tomorrow's patterns of production and consumption.

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CALENDAR

UPOV Meetings

1980

October 14 Geneva	Consultative Committee
October 15 to 17 Geneva	Council
November 10 to 12 Geneva	Technical Committee
November 13 and 14 Geneva	Administrative and Legal Committee

1981

May 6 Geneva	Consultative Committee
May 6 to 8 Geneva	Administrative and Legal Committee
June 23 to 25 Edinburgh (United Kingdom)	Technical Working Party for Agricultural Crops
September 22 to 25 Wageningen (Netherlands)	Technical Working Party for Fruit Crops
October 6 to 8 Antibes (France)	Technical Working Party for Ornamental Plants
October 13 Geneva	Consultative Committee
October 14 to 16 Geneva	Council
November 9 to 11 Geneva	Technical Committee
November 11 to 13 Geneva	Administrative and Legal Committee

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