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SOME ASPECTS OF THE PROGRAM OF THE
FRUIT BREEDING STATION OF ANGERS

J. HUET, Head of the Station.

Summary

The research Station of Angers is one of the four Research Station dealing with Fruit Breeding at the National Institute for Agronomical Researches. Other ones are Cervione in Corsica for citrus, Versailles for varieties of apple for processing (Cider and fruit juice) and Bordeaux for Stone fruits and nuts.

Our Research Station deals with breeding of apples, pears, blackcurrants, redcurrants and raspberries. We began with this breeding work in 1958. So we just achieve our "juvenile period". However, I have to mention that in 1950, J. BROSSIER had undertook an important work on a clonal selection among quinces, as pear-rootstocks. The documents which have been handed over to you, the visits and lectures to be given in the course of this symposium will excuse myself from making a full report about our programmes. I will only set forth the main aspects.

The three steps of our breeding work have been the following ones :

. Gathering in collection of numerous cultivars, record of datas and choice of the more valuable varieties.

. Selection, for a variety, of the best clone that means, selection of the mutant offering the best characteristics and in almost all cases the selection of the least virus-contaminated clone.

. Breeding of new types, using methods similar to those of all the breeders : Crosses and induction of mutations.

In fact we deal with these three steps more or less at the same time. But with the evolution of works, the importance of the selection of varieties in collections is decreasing and that of breeding is increasing, mainly for apple and pear. An important programme is always carried out for pear

rootstocks, on the contrary for apple rootstocks, we do only trials with the East Malling clones.

The major problem in Fruit breeding is to determine aims which remain stable and justified 20 or 30 years after the beginning of crosses, with all the hazards of Technical improvements and changes of customer's and Market's requirements.

As for apples, we began with different intervarietal crosses. One of them has shown a high specific combining ability. Then we have undertaken a breeding program for scab resistance and a low susceptibility to mildew and European Canker.

Our breeding program for scab resistance is quite similar to that of our american colleagues. We have used their methods and their best resistant parents. We hope to be able to propagate our first resistant selected hybrids in ten years' time so as to offer them to commercial growers.

Our environment conditions give us the opportunity of screening for susceptibility to mildew. For recent progenies we plan to do such a screening for susceptibility to mildew through records made over three years in nursery.

As for pears, our major aim is to breed a few types of late ripening varieties. We forecast an amount of 12.000 hybrids. The oldest ones will bear for the first time in 1970.

So, for these two main species, a total of 15 to 20.000 hybrids will bear fruit requiring records during the next ten years.

The induction of mutations is also an important part of our work. L. DECOURTYE will give you the full results during the last ten years. It is quite a promising one.

Now a few words about the breeding of pear rootstocks. Having studied the whole variability shown by the 350 quince clones gathered at the Station, we have decided to choose Pyrus communis clones selected among progenies issued from open or controlled pollinations. Our aim is the selection of types as vigorous as quince trees or whose vigour is intermediate between that of the quince trees and that of the presently used pear seedlings.

These breeding works have to be carried out by quite a number of people and demand extensive grounds for quite a long period of time. Their cost is relatively high. That is why very few private establishments agree to bear such expenses. Here are so many reasons to bring programs and methods into harmony and initiating material exchanges in the course of selection. It is one the aims of meetings such as this one.

To come to an end with the works of our station I will come to a short report about a few activities within and without varietal breeding.

1 - Researches aiming at perfecting our knowledge of factors controlling various reactions about trees such as temperature requirements of buds (breaking of dormancy and ulterior growth) or characteristics supplied by rootstocks (compatibility relationships, vigour). The results of these researches could allow to start early selection tests.

2 - Studies allowing improvements in some cultural techniques.

- Analysis of pear trees reactions to various prunin methods.
- A study of GOLDEN DELICIOUS fruit behaviour in relation with picking time and analysis of some factors of the organoleptic qualities.
- Use of various growth substances.
- Management of black currant and mechanical picking ability of varieties.
- Determining pollen-compatible varieties for the new types of apple-tree.

A group of five scientists deals with this program along with four engineers, seven technicians, two secretaries, a manager of the experimental farm and twenty three labourers. This work is carried out on two estates covering about 200 acres.

Résumé

La Station d'Angers est l'une des quatre Stations chargées de l'Amélioration des Arbres Fruitiers au sein de l'Institut National de la Recherche Agronomique. Les trois autres sont Cervione en Corse, pour les agrumes, Versailles pour les variétés de pommes à cidre et à jus et enfin Bordeaux pour les variétés de fruits à noyau et de fruits secs.

La Station d'Angers a la responsabilité de l'amélioration des pommiers, poiriers, cassis, groseilliers à grappes et framboisiers. Le début des programmes d'amélioration remonte à 1958. Nous achevons donc à peine notre "période juvénile". Toutefois, il faut préciser que, dès 1950, J. BROSSIER avait engagé un important travail de sélection clonale parmi les cognassiers, porte-greffe du Poirier. Les documents qui vous ont été remis, les visites et exposés prévus pendant ce Symposium, me dispensent de vous faire une présentation détaillée de nos programmes. Je me limiterai donc à en tracer les grandes lignes.

Les trois étapes de notre travail d'amélioration ont été :

- Le rassemblement en collection de nombreux cultivars, leur observation et la sélection des types les plus intéressants.

- La sélection, pour une variété, du meilleur clone (c'est-à-dire du mutant ayant les meilleures caractéristiques, soit, et c'est plus souvent le cas, de la souche la moins contaminée par les virus.).

- La création de types nouveaux par les méthodes communes à tous les sélectionneurs, que sont l'hybridation et les traitements mutagènes.

En fait ces trois phases coexistent dans nos programmes d'amélioration mais avec l'avancement des travaux, la part consacrée à l'étude des variétés en collection a tendance à régresser et celle qui est représentée par la sélection créatrice à s'accroître. Ce travail de sélection créatrice est surtout activement conduit à la Station sur Pommier et Poirier. Un programme important est toujours, pour les porte-greffe du Poirier, maintenu, alors que notre activité sur les porte-greffe du Pommier est limitée à

l'expérimentation des sélections d'East Malling.

La difficulté majeure en Amélioration Fruitière est de choisir des objectifs qui ne soient pas remis en question vingt ou trente ans après le début des croisements, par suite d'une modification des techniques ou des exigences des consommateurs et du négoce. L'avenir dira si nous avons su faire ce choix.

En Pommier, après une première série de croisements intervariétaux, dont l'un s'est révélé être une combinaison particulièrement heureuse, nous nous sommes orientés vers la création de variétés résistantes à la Tavelure et peu sensibles à l'Oïdium et au Chancre européen.

Notre programme d'Amélioration pour la résistance à la Tavelure est dans la ligne des travaux poursuivis depuis bien longtemps par nos collègues Américains auxquels nous avons emprunté les méthodes et les premiers géniteurs de résistance. Nos premières sélections pourraient être proposées aux arboriculteurs dans une dizaine d'années.

Nos conditions écologiques nous ont permis d'éliminer les types sensibles à l'Oïdium et un nouveau programme, récemment engagé, rendra cette sélection encore plus efficace par un séjour de trois années en pépinière.

En Poirier, notre objectif essentiel, que nous espérons atteindre avec un total de 12 000 hybrides, est la création d'une petite gamme de variétés de maturité tardive. Les premiers hybrides de ces programmes fructifient cette année.

Au total, pour ces deux espèces, c'est un effectif de 15 à 20 000 hybrides dont les fruits devront être observés durant la prochaine décennie.

La mutagénèse induite représente aussi une part importante de notre activité. L. DECOURTYE vous dressera le bilan des résultats obtenus au cours des dix années écoulées. Il est, à notre avis, encourageant.

Quelques mots de l'Amélioration des porte-greffe du Poirier. Ayant, nous semble-t-il, exploité toute la variabilité présentée par les 350 souches de Cognassier rassemblées à la Station, nous nous sommes orientés vers la sélection de clones de Pyrus communis, sélectionnés parmi des descendance issues de fécondations libres ou contrôlées.

Notre objectif est la sélection de types de vigueur comparable aux cognassiers ou intermédiaires entre ces derniers et les francs actuels multipliés par semis.

Ces travaux d'amélioration occupent des terrains et des hommes pendant de nombreuses années. Ils coûtent donc relativement cher. C'est d'ailleurs pourquoi très peu d'Établissements privés acceptent d'en supporter la charge. Autant de raisons pour harmoniser les programmes et les méthodes et pour procéder à des échanges de matériel en cours de sélection. C'est l'un des buts de rencontres telles que celle-ci.

Pour en terminer avec les activités de notre Station, je mentionnerai brièvement divers travaux qui sont en aval et en amont de la sélection variétale.

1. Des recherches destinées à améliorer nos connaissances sur les facteurs qui contrôlent certains comportements de nos arbres, comme les exigences thermiques des bourgeons (levée de dormance et croissance ultérieure), ou comme les caractéristiques conférées par les porte-greffe (affinité au greffage, vigueur). Les résultats de ces recherches pourraient en particulier permettre de proposer des tests de sélection précoce.

2. Des études permettant d'apporter une contribution à l'amélioration de certaines techniques culturales :

- Analyse des réactions du Poirier à différentes méthodes de taille.
- Étude du comportement des fruits de GOLDEN DELICIOUS en fonction de l'époque de cueillette et analyse de quelques facteurs de la qualité organoleptique.
- Utilisation de diverses substances de croissance.
- Conduite du Cassis et aptitude des variétés à la récolte mécanique.
- Détermination des variétés pollinisatrices pour les nouvelles variétés de Pommier.

L'exécution de ce programme est confiée à une équipe de cinq scientifiques, quatre ingénieurs, sept techniciens, deux secrétaires, un chef d'exploitation et vingt-trois ouvriers agricoles. Deux domaines sont mis à notre disposition. Leur surface totale est de quatre-vingt-dix hectares.

Zusammenfassung

Die Station in Angers ist eine der vier Stationen, die im Schosse des Institut National de la Recherche Agronomique mit der Obstzüchtung beauftrag sind. Bei den drei anderen Stationen handelt es sich um Cervione auf Korsika für Agrumen, Versailles für die Sorten für Apfelwein und -saft und als letzte Bordeaux für Kernobst- und Trockenfrüchte-Varietäten.

Die Station in Angers trägt die Verantwortung für die Züchtung von Äpfeln, Birnen, schwarzen und roten Johannisbeeren sowie Himbeeren. Der Beginn der Züchtungsprogramme geht auf das Jahr 1958 zurück. Unsere "Jugendzeit" ist damit also kaum zu Ende. Jedoch muss man darauf hinweisen, dass J. BROSSIER seit 1950 eine bedeutende Arbeit in die Klonenselektion von Quittenbäumen, den Pfropfunterlagen für Birnenbäume, investiert hat. Die Unterlagen, die Ihnen überreicht worden sind, die Besichtigungen und Exposés, die während dieses Symposiums vorgesehen sind, erübrigen eine detaillierte Vorstellung unserer Programme. Ich beschränke mich also darauf, Ihnen die grossen Linien aufzuzeichnen.

Die 3 Abschnitte unserer Züchtungsarbeit waren :

- Das Zusammenbringen in Kollektionen zahlreicher Sorten, ihre Beobachtung und die Auslese der interessantesten Typen.
- Die Selektion - für eine Varietät - des besten Klons (d. h. sei es des Mutanten mit den besten Charaktereigenschaften, sei es - und das ist viel häufiger der Fall - des Zweiges, der am wenigsten von den Viren angegriffen ist).
- Die Schöpfung neuer Typen durch Methoden, die allen Züchtern gemeinsam sind, d. h. durch Erzeugung von Hybriden und durch mutagene Behandlungen.

In Wirklichkeit finden sich diese 3 Phasen gleichzeitig in unseren Züchtungsprogrammen, aber mit dem Voranschreiten der Arbeiten, hat der Teil, der dem Studium der Varietäten in der Kollektion gewidmet ist, die Tendenz, abzunehmen, und jener, der von der schöpferischer Selektion eingenommen wird, anzuwachsen. Diese schöpferische Selektionsarbeit wird vor allem aktiv auf der Station bei Apfel- und Birnenbäumen geleistet. Ein bedeutendes Programm wird noch immer für die Pfropfunterlagen für Birnenbäume aufrecht erhalten, wohingegen sich unsere Tätigkeit bei den Pfropfunterlagen für Apfel-

bäume auf die Versuche der East-Malling-Selektionen beschränkt.

Die Hauptschwierigkeit bei der Obstzüchtung besteht darin, Kriterien zu wählen, die nicht 20 oder 30 Jahre nach Beginn der Kreuzungen in Frage gestellt werden in Folge einer Veränderung der Techniken oder der Ansprüche der Verbraucher und des Handels. Die Zukunft wird zeigen, ob wir die richtige Wahl getroffen haben.

Beim Apfel haben wir uns, nach einer ersten Serie von intervrietas Kreuzungen, von denen eine Kreuzung eine besonders glückliche Kombination zeigt, der Schöpfung von Sorten, die schorfresistent und wenig anfällig gegen Mehltau und Kancker Nutria sind, zugewandt.

Unser Schorfresistenz-Züchtungsprogramm befindet sich in Richtung der Arbeiten, die seit langem von unseren amerikanischen Kollegen verfolgt werden, von denen wir die Methoden und die ersten resistenten Eltern übernommen haben. Unsere ersten Selektionen können den Obstanbauern in ungefähr 10 Jahren angeboten werden.

Unsere ökologischen Bedingungen haben uns erlaubt, die für Mehltau anfälligen Sorten zu eliminieren, und ein neues erst kürzlich begonnenes Programm wird diese Selektion noch wirksamer durch einen dreijährigen Aufenthalt in der Baumschule machen.

Bei den-Birnen ist unser Hauptkriterium, das wir mit einer Gesamtheit von 12 000 Hybriden zu erreichen hoffen, die Schöpfung einer kleinen Skala von Varietäten mit Spätreife. Die ersten Hybriden dieser Programme tragen in diesem Jahr zum ersten Male Früchte.

Insgesamt handelt es sich für diese beiden Sorten um einen Gesamtbestand von 15 000 bis 20 000 Hybriden, deren Früchte während des kommenden Jahrzehnts beobachtet werden müssen.

Die induktive Mutagenese nimmt ebenfalls einen bedeutenden Teil unserer Tätigkeit ein. L. DECOURTYE wird Ihnen die Bilanz der im Laufe der vergangenen 10 Jahre erhaltenen Resultate ziehen. Sie ist unseres Erachtens ermutigend.

Einige Bemerkungen zur Züchtung von Pfropfunterlagen für Birnenbäume : Nachdem wir, so scheint es uns, die gesamte Veränderlichkeit, präsentiert durch 350 Quittenbaum-Stämme

die auf der Station zusammengebracht sind, ausgebeutet hatten, wandten wir uns der Klonen-Selektion von Pyrus communis, ausgelesen aus Nachkommenschaften, die von freien und kontrollierten Befruchtungen abstammen. Unser Ziel ist die Selektion von Typen, deren Kräftigkeit mit der von Quittenbäumen verglichen werden kann ; oder intermediär ist zu letzteren und den augenblicklich frei durch Sämlinge vermehrten Birnenbäumen.

Diese Züchtungsarbeiten beanspruchen Land und Menschen während langer Jahre. Sie sind deshalb relativ teuer. Aus diesem Grunde akzeptieren Übrigens nur sehr wenige private Institute, sich damit zu belasten. Das sind Gründe, um die Programme und Methoden aufeinander abzustimmen und den Austausch von Material im Verlaufe der Selektion vorzunehmen. Dieses ist ebenfalls eines der Ziele von Zusammenkünften wie dieser.

Um den Bericht über die Tätigkeiten der Station abzuschliessen, werde ich kurz über verschiedene Arbeiten berichten, die vor und nach der Sortenauslese vorgenommen werden :

1. Forschungen, die dazu bestimmt sind, unsere Kenntnisse über Faktoren, die gewisse Verhaltensweisen bei unseren Bäumen kontrollieren, zu erweitern, wie z. B. die Wärmeansprüche der Knospen (Aufhebung der Ruhepause und späteres Wachstum) oder wie die Charakteristika, die von den Pfropfunterlagen übertragen werden (Affinität mit dem Pfropffreis, Kräftigkeit). Die Resultate dieser Forschungen würden im besonderen gestatten, vorzeitige Selektionstests vorschlagen zu können.

2. Studien, die gestatten, einen Beitrag zur Verbesserung einiger Kulturtechniken zu leisten.

- Analyse der Reaktionen der Birne auf verschiedene Schnitt-techniken.

- Studium des Verhaltens von GOLDEN DELICIOUS-Früchten in Abhängigkeit von Pflückzeit und Analyse einiger Faktoren von organoleptischer Eigenschaft.

- Verwendung verschiedener Wachstumssubstanzen

- Verhalten der schwarzen Johannisbeeren und Anlage der Varietäten in Bezug auf die maschinelle Ernte

- Bestimmung der Bestäuber-Varietäten für die neuen Apfelvarietäten.

Die Ausführung dieses Programms ist einem Team von 5 Wissenschaftlern, 4 Ingenieuren, 7 Technikern, 2 Sekretä-

rinnen, 1 Betriebsleiter und 23 Landwirtschaftsarbeitern. Zwei Domänen stehen uns zur Verfügung. Ihre Gesamtfläche beträgt 90 Hektar.

TEXT OF THE LECTURE

We have thought that it would be interesting for you to have this morning a general view on the Breeding works on Fruit trees in France. So Mr BERNHARD, Director of the Stone Fruit Breeding Station of Bordeaux and Iself for Pome fruits, we will give you some informations on the programs of our two Research Stations.

In France the National Institute for Agricultural Researches is concerned with almost all the Researches on agricultural problems. This Institute depends of the Agriculture Minister.

The organisation of the Researches is on a "vertical" model, that is to say by Scientific branches. So each Laboratory depends of a Research Department. In many cases, several laboratories are gathered in one place and constitute a "Research Center". As far as possible, general Researches aims are given to the different Laboratories of such Centers.

As you can see on this slide 4 Stations deal with Fruit Breeding :

- BORDEAUX
- VERSAILLES
- ANGERS
- CERVIONE

Our Station deals with breeding of apples, pears, blackcurrants, redcurrants and raspberries, and the rootstocks for the two first species. We are concerned with all the problems of the French fruit growing districts and not only with the Loire Valley.

D E P A R T E M E N T : GENETIQUE ET AMELIORATION DES PLANTES.

(Chef de Département : Mr MAYER)

25 STATIONS DE RECHERCHES + DOMAINES EXPERIMENTAUX

ARBORICULTURE (Coordination : J. SOUTY)

- . Station d'Amélioration des Arbres Fruitiers à Pépins - ANGERS (Dir. : J. HUET)
- . Station d'Amélioration des Arbres Fruitiers à Noyaux -BORDEAUX (Dir. : R. BERNHARD)
(et des fruits secs)
- . Station d'Agrumiculture - CERVIONE (Corse) (Dir. : R. BLONDEL)
- . Laboratoire d'Amélioration des pommes à cidre
et à jus -VERSAILLES (Dir. : J. FLECKINGER)
- . Laboratoire de l'Ecole Supérieure d'Agronomie - MONTPELLIER (Dir. : J. HUGARD)

As it is mentioned in the summary, beginning this breeding work some 12 years ago, we just achieve our "juvenile Period".

The Staff of the Station is the following one :

- 5 Scientists
- 4 Engineers
- 7 Technicians
- 2 Secretaries
- A manager with 24 workers
- 2 experimental farms covering about 200 acres.

Three points to mention in our programm :

- . Breeding of good varieties and rootstocks, free of virulent viruses diseases.
- . Perfecting our knowledge on some physiological features of the fruit-trees.
- . Studies allowing improvements in some cultural techniques.

The three steps of our breeding work are classical ones :

- . Gathering in collections of numerous cultivars and choice of the more valuable varieties.
- . Selection, for a variety of the best clone, that means, selection of the mutant offering best characteristics and in almost all cases, the selection of the least virus - contaminated clones.
- . And at last, the breeding of new types.

The study of numerous varieties in collection has given the opportunity to estimate the variability of the species, to define breeding aims, to choice parents for crosses and some good varieties for fruit growing. Unfortunately this last point was disappointing. As for pear, we have to recognize that the empirical, non scientific, breeding undertaken in the West of Europe, at the end of the last Century and at the beginning of the 20th Century has been very valuable. So, for a given time of ripening, it is difficult to find better varieties than these were are grown in the World.

For apple, on the contrary, the collections include some good varieties. But in France, the large increasing production

of GOLDEN DELICIOUS has until now reduced the chances of propagation of new varieties.

Breeding of new varieties is undertaken for apple and pear. It is a very important part of our work.

As for apple, we began with crosses between some American and French varieties, 13 years ago. One of the progenies has shown a very high specific combining ability the parents were GOLDEN DELICIOUS and a French local variety, REINETTE CLOCHARD. About 20 hybrids have been planted in a trial. One of them seems specially valuable. It is a triploid, late ripening. We plan to call it "CHARDEN".

But breeding for scab resistance and low susceptibility to mildew is our major aim. Male parents, carrying resistance genes come from hybrids of the American staff of breeders dealing with this problem since many years. Using the best scab resistant hybrids we have obtained a new generation, the size of which being 5.800 hybrids. Most of them have achieved their juvenile period and bear fruits since 2 or 3 years.

An additionnal generation was recently obtained with a size of 10.000 resistant hybrids. These hybrids will be cultivated in nursery and we shall record their susceptibility to mildew during 3 years. Then the less susceptible progenies will be budded on a dwarf clonal rootstock, in order to breed for characteristics of the fruits.

We have added to this classical program, a secondary way : the screening of triploid seedlings due to the fertilization of unreduced ovules. We have now a dozen of such triploids hybrids and we hope they will look like female parents, plus scab resistance. Another way could be the introgression. So we could hope to avoid the infection by new virulent strains of Venturia inaequalis, it has been recorded in England and in France these last years with the gene of Malus micromalus.

As for pear now, our major breeding aim is the obtention of a small number of late ripening varieties, for marketing from january to April. At this time customers find only on the markets fruits of PASSE CRASSANE and the taste quality is very variable with the ecological condition of the orchards. 13 parents were choiced for diallel crosses. This method gives us 78 progenies. The size of each progeny

was limited to 200 hybrids. The hybrids will crop for the first time from 1970 to 1975.

Two other secondary aims, with a small number of hybrids, have to be mentioned.

- Breeding of very early ripening varieties
- Breeding of late blooming varieties

So for these two main species, a total of 15 to 20.000 hybrids will bear fruits requiring records during the next ten years.

A few words on Rootstock.

As for apple, we only experiment on the behaviour of the Malling and Malling Merton rootstocks, in the main fruit growing areas. Our results are similar to the results obtained by East Malling. On the contrary, we have an important breeding work on pear rootstocks. It began 15 years ago with the prospection and the introduction of about 350 clones of quinces. The genetic variability offered to BROSSIER the opportunity for a classification of these clones in several groups and for breeding the best after trials in nurseries and orchards. So a clone of Provence quince, BA 29, is now propagated.

Unfortunately, at the end of a 15 years period research work, it seems impossible to find among quinces, rootstocks having a good affinity with varieties unable to form a successful graft union on this species.

For this reason, a new breeding program is undertaken among Pyrus communis species. Grafting or budding pear varieties on this species is always successful, except the cases when incompatibility is induced by viruses.

Two means of propagation are available : they provide two types of rootstocks :

- Seedlings
- Clonal rootstocks

We know that seedling rootstocks from Pyrus communis induced a high vigour to varieties. But it is interesting to improve the homogeneity of seedlings in nursery and of the trees in orchard.

A new seedling rootstocks has been bred recently with these quality and a low susceptibility to mildew. Seeds are obtained from interpollination between two perry pears : Fieudiere n°1 X Fieudiere n°2.

On the other side, some progenies, from open pollination, show a large variability for the vigour induced to a variety. Such a variation involve two components : an environmental one and a genetic one. We have postulated that the genetic component was important. So, the vegetative propagation for rootstocks taken as samples of the different classes of vigor, may give several clonal rootstocks inducing different levels of vigour to varieties, and we hope mainly low or medium vigour similar to that induced by quinces.

Vegetative propagation is now achieved. Budding also the first trial will be planted the next year.

In our breeding work, the induction of mutations, mainly by gamma rays radiations, play a large part. The effect of such a radiation is a double one :

- A new distribution of layers in varieties which are chimeras, and so the formation of new phenotypes.
- The induction of true mutations.

The papers to be given by DECOURTYE on this subject, will excuse myself from given you more details on the method and the results.

I will said only that dealing with a total of about 5.000 trees since 8 years, it seems to us that this method of breeding is a promising one.

To come to an end with the works of our Station I will mention two other activities.

- Studies allowing improvements in some cultural techniques.
You will find a list of such studies in the summary. If you are interested by some of these studies, I will give you some details after this paper. You will be able also to have a talk with the different workers.
- Physiological researches on growth and development on fruit trees.
The results of many of this physiological researches could allow to improve our breeding work, in

three fields :

- The analysis of large breeding criterious (as vigour, cropping ability and so on) in several elementary components.
- Screening methods in the seedling stage in order to apply early selection tests.
- Evaluation of ecological requirements of varieties. I will illustrate these researches only by two examples : the first, deal with the temperature requirements of apple buds.

BIDABE began with a statistical and an experimental analysis of the effect of different temperature treatments, before and after breaking dormancy, on the pattern of bud opening of the population of buds on shoots of different variety.

Beside other points of interests the results allow a best interpretation of the records of times of flowering. With the different climates, the major factor controlling the relative times of flowering of varieties is cold temperatures for breaking rest, or high temperatures for subsequent growth of apple bud after dormancy has been broken. A simple experimental study on a variety give the opportunity to forecast the time of flowering of this variety in a given place.

Another point is the narrow interaction between the temperature conditions during winter and the level of apical dominance. If cold requirements are not completely satisfied for a high cold requirement variety. The effect of apical dominance is increased, inducing barren shoots and a severe competition between buds. This competition can increase fruit drop and reduce fruit set. We have confirmed this fact on black currants.

So, in places where winter is not very cold (like in this district) the best varieties are probably among low cold requirements ones, when the spring frosts are not too dangerous.

Crosses have been done to analyse the genetic control of these reactions to temperature and to see if it is possible to screen young hybrids for these temperature requirements. For instance, it would be interesting to record a good correlation between the pattern of bud bursting on young see-

dlings and the temperature requirements and level of apical dominance on mature trees.

An other example of the interest of such researches for breedings. It is the study of factors controlling the level of vigour induced by rootstocks.

As you know, nobody is able to give a clear explanation for the differences of vigour induced by the different clonal rootstocks.

In a first step we have recorded different reactions of quince seedlings to growth retardants (B9 and CCC). In two annual replications, a disjunction has appeared. Some genotypes were definitively stopped by this spray. The growth of others ceased, and then they have grown again. At last, for a third class, the spray had no effect on the growth.

An analysis of control seedlings shows the same disjunction, but spraying growth retardants increase widely the differences between genotypes. We can do two hypothesis :

- The differences in the responses of seedlings to growth retardants can be explained on the basis of different natural gibberellins, the biosynthesis of them being controlled by a small number of genes.

- These juvenile pattern of growth are correlated with the vigour induced as rootstocks after budding.

We try to verify these hypothesis and we began with analysis of the root gibberellines of East Malling and Malling Merton apple rootstocks.

This growth substance shows a large variation in chemical structure and the genetic control of each small chemical differences may involve a small number of genes. So we can hope to find gibberellic spectra different from one rootstock to another, and may be, some correlation between these spectra and the level of vigour. We are just beginning with these researches. But every breeder of rootstocks would appreciate any improvement for a less empirical an earliest screening of seedlings.

Such breeding works demand large area of land, numerous hours of labour for Scientists, Technicians and Workers. The first results are obtained in a minimum of 20 years.

So in this field of researches it is necessary to coordinate the aims, the methods and to increase the exchanges of ideas and of material. It is one of the aims of meetings such as this one and I am sure that it will be successful on this point.

Editions S . E . I .

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