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THE SHOWROOM AT THE INSTITUTE OF AGRICULTURAL PLANT BREEDING WAGENINGEN, 1961 (May, June, July).

With the aid of simple means an attempt has been made to give visitors an idea of some aspects of plant breeding in the Netherlands.

On a plan of Wageningen (in the hall of the institute) the location of laboratories and institutes has been indicated with small lights. The number of lights gives visitors an impression of the rapidly developing agricultural centre. Attention is drawn to the guide "Wageningen, Centre of Agricultural Science", 1961", issued by the International Agricultural Centre at Wageningen.

A plate (in the corridor to the showroom) surveys the history of agricultural plant breeding in the Netherlands. The ever growing improvement of methods is indicated by a spiral.

Starting with the rise of the breeders around 1885, the following inscriptions are successively given:

Research work supported by the government (1912 I.v.P.*);
Better varieties of Dutch breeders;
Activation of business life;
Subsidies;
More research (1948 S.V.P.**)
New responsibilities and further improvement of varieties
More prosperity.

Two plates present the development of plant breeding.

For ages mass selection was practised in local varieties, until the idea rose to compare the offspring of individual plants. Through this pedigree selection, considerable improvement has been achieved; results were obtained sooner and it had become possible to isolate good genotypes from bad ones.

In selffertilizing plants pedigree selection led to the production of lines, in crossfertilizing crops to families which became the basis for the production of new varieties.

By means of photos of pioneers it has been indicated that plant breeding in the Netherlands started about 1890 and that potatoes, sugar beet, cereals and pulses were the first to be dealt with. About that time some of these pioneers had already made crosses and through selection after crossing they had obtained good results.

After about 1930 crosses were also made after first inbreeding and selection, for the production of hybrid varieties, while the interest is now focussed on selection after mutation (e.g.: the production of polyploid varieties).

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* I.v.P. = Institute of Agricultural Plant Breeding (Director: Prof.Dr.J.C.Dorst), a division of the Agricultural University.

** S.V.P. = Foundation for Agricultural Plant Breeding (Director: Dr.F.E.Nijdam), an autonomous Institute.

The new varieties must be evaluated for independence and cultural value by the I.V.R.O.. When the breeder's right has been obtained and the variety has been included in the List of Varieties, the way is open for its introduction into commerce.

In order to have valuable starting material available it is necessary to pay much attention to the maintenance of the varieties. Seed and seed potato production is carried out under the supervision of the N.A.K..

On the same plates some landmarks of genetics have been included. In particular Mendel's experiments, the rediscovery of the Mendelian laws in 1900, the evolution of mutation, the discovery of heterosis and the induction of mutations have been pictured.

It is pointed out that breeding research and the raising of new varieties also require glasshouses. The importance of glasshouses can be described as follows:

1. They serve for material requiring special care (potato seedlings, colchicine material, graftings of potatoes on tomato root-stock, etc.)
2. Crossings can be carried out independent of unfavourable weather.
3. Two or more generations can be grown annually (e.g.: F_1 and F_2).
4. Glasshouse clones can be produced free from diseases (twice a year).
5. Isolation can be attained to prevent undesired pollination, the incidence and spread of fungi, and insects.
6. Maintenance of infection material and raising of aphids serving intentional contamination of trials.
7. Artificial contamination.
8. Experiments in winter are possible.

A new map indicates the location of 68 breeding establishments (private breeders) scattered all over the Netherlands. The varieties bred by the various establishments and placed on the official List of Varieties are indicated by coloured dots.

The slogan "What an inventor is to industry, a breeder is to agriculture" aptly expresses the importance of plant improvement.

As counterpart to the survey of Dutch breeding establishments serves a new mural plate indicating which percentage of the total area devoted to each crop is occupied by varieties bred in the Netherlands. The data presented show that in many instances the farmers chose home-bred varieties, but that on the other hand in several crops, foreign-bred varieties are preferred (e.g. in the case of winter wheat 85% of the acreage is sown with foreign varieties, spring wheat 100%, spring barley 87%, rye 96%, sugar beet 94%.

With the heading "The farmer readily accepts new varieties" a survey is given to the varieties which were widely grown within some years.

Another plate illustrates the influence spheres of plant breeding. Research of varieties, seed and seed potato production, agricultural production in the Netherlands and export are indicated with plant breeding in the centre. One influences the other.

In this diagram plant breeding is to be considered as a source of new material which (after impartial evaluation in the official research of varieties) produces the varieties which form the basis for agricultural production. Attention is drawn to the 36th List of Varieties, to the N.A.K. as promotor of the quality of seeds and seed potatoes and to the World Seed Year.

In the course of time the Institute has placed numerous hybrid populations at the disposal of breeders. This is now done on an even larger scale by the newly created Foundation for Agricultural Plant Breeding, the aim of which is to perform research on behalf of the breeders, to advice them and to supply them with parental material for crosses and with hybrid populations. Large quantities of hybrid potato seed and tubers from young clones have also been distributed to breeders.

It is not surprising that attention is drawn to the centres of genetic diversity of cultivated plants, which are an important source of parental material.

Wild plants from the centres of diversity, local races and cultivated and newly developed varieties must be examined for disease resistance or other desirable features. Various diagrams show the inoculation experiments performed to this end, as well as freezing trials.

In a purposeful way a search is made for plant material that presents promising features for use in breeding programs.

Schematic illustrations demonstrate the crossing of plants having only one or a few valuable characters with commercially grown plants and the narrowing of hybrid populations by means of artificial infection, cold testing (for autumn sown crops) and so on. These narrowed populations supply the material for the research work of the Foundation for Agricultural Plant Breeding, and seed samples are also put at the disposal of Dutch breeders.

Ir.J.G.Th.Hermsen has pictured the inheritance of semi-lethality and dwarfness in wheat crosses.

Dr.G.Dantuma (who in 1958/59 worked for a year at the Exp.Farm Lethbridge, Canada) and Ir.J.Mesdag illustrate the research on the breeding of cereals. On a world map variety collections of wheat, barley and oats are indicated. Special attention has been given to disease resistance (rust, mildew and loose smut), winter hardiness and first development. The breeding work and the treatment of the populations has been worked out in a diagram.

Photographs demonstrate the trial fields with ear selections (sown according to the clump-method) in the 1st, 2nd and 3rd year, while another diagram shows that the populations are narrowed by means of selection for disease resistance in order to obtain material valuable for the Dutch breeders.

Ir.H.T.Wiersema provided the show with a diagram surveying the breeding for disease resistance in flax. It denotes selection for rust resistance, followed in the ensuing years by selection for scorch, for browning, for foot rot, selection for yield, fibre content and quality.

Attention is drawn to the distribution of starting material to the Dutch breeders. The diagram is illustrated with photographs.

Dr.H.J.Toxopeus made a tour to South-America in the beginning of 1955 to collect potatoes.

A world-map shows that Southern- and Central-America are important centres of diversity. From there much parental material has reached the research institutes. (W.A.C.=Wageningen Potato Collection).

Private breeders start each year with 500,000 seedlings. On their way from 1st year seedling they pass a number of sieves, the ones falling through the holes being discarded. Only very few seedlings reach the "Rassenlijst" (List of Varieties) in the end.

In a map of the Netherlands the location of 225 potato breeders has been indicated by means of orange coloured dots. The Commission for the Advancement of Potato Breeding (COA) stimulates the breeders in their arduous task.

The backcross procedure for the breeding of resistance against potato blight (Phytophthora infestans) and against potato sickness (Heterodera rostochiensis) are shown. Dr.C.A.Huijsman established that the first generation of crosses between parents resistant to Heterodera rostochiensis and susceptible potato varieties for 50 or 80% consist of resistant plants. These resistant hybrids are often crossed again with potato varieties. An attempt is made to combine Heterodera and Phytophthora resistance.

Very probably interspecific crosses can be used not only to obtain disease-resistant commercial varieties, but they may also serve to increase the yielding ability.

Ir.B.Maris among other things investigates the inheritance of maturity in potatoes and of the resistance to the wart disease.

Ir.H.T.Wiersema performs research on the resistance against virus disease in potatoes (leaf roll, virus X, Y and S).

The Potato Breeding Farm of the Foundation for Agricultural Plant Breeding at Marknesse (under the direction of Ir.G.A.Thijn) has assumed great importance. The Dutch potato breeders (225 in number) derive much profit from the hybrid seedling material that is grown there. By developing new methods it is now possible to supply the breeders in summer with clones that were raised the year before from seed in aphid-free greenhouses.

The working programme of the potato breeding farm of the Foundation for Agricultural Plant Breeding at Marknesse has been presented as follows:

1. Building up a collection of parental material.
2. Crossing programme.
4. Advice and distribution of seed produced by crossing and virus free greenhouse clones.

This establishment is a necessary link between the scientific research at Wageningen and the practical breeders. Tens of thousands of true seeds and glasshouse clones are distributed to breeders annually. The farm has its own breeding programme so that from experience gained at the premises directions can be given to breeders.

It is interesting to mention that it is attempted to stimulate flowering and fertility in potato varieties by suppressing tuber formation. This is demonstrated by a drawing representing a potato shoot grafted on to a tomato root stock.

Another plate demonstrates studies on bud variation in the potato. There were indications that mutants consisted of genetically different layers. To ascertain this, tubers were cut longitudinally. One half was planted untreated, while of the other half all eyes were removed. The untreated part again produced the mutant type; whereas the part without eyes developed adventitious buds from the inner layers of the tuber. This gave rise to plants corresponding to the original type from which the bud sport arose. The mutated individuals were periclinal chimeras, the outside layer differing genetically from the inner tissues, which have kept the original constitution. One can compare this with the combination hand and glove, both elements differing in nature. The periclinal structure was confirmed by examining the generative offspring.

Dr.H.Lamberts illustrates the improvement of lupins on a plate. Production is given a prominent place. Other breeding objectives are non-hardcoated seeds, rapid early development, disease resistance, non-shattering pods and non-dropping pods. Much attention is paid to types that even give a good yield of green matter when sown about 15 August.

The material collected during his study tour to Portugal in 1955 is now being studied.

Other leguminous plants that Dr.Lamberts is investigating are serradella and vetches.

The breeding of turnips takes an important place in the research programme of the S.V.P.. New and interesting possibilities can be mentioned in this stage already.

The diagram indicates that inbred lines are made which are crossed in many possible ways. Some graphs demonstrate details on clubroot resistance and the breeding for a high dry matter content. A paper chromatogram demonstrates that the problem of mustard oil is also being investigated and shows that there are great differences in this respect.

In addition to the search for suitable parents the induction of mutations occupies an important place in the program of the Institute and the Foundation. Interesting results have been obtained by colchicine treatment, the technique of which has been improved. In June and July 1961 Dr.F.P.Ferwerda and Dr.H.Lamberts will visit the U.S.A. to study mutation research there.

Mrs.Dr.D.E.Bremer-Reinders illustrates the colchicine experiments with rye.

The photos indicate that the treatment produces abnormal seedlings. Cell division is arrested so that the split chromosomes remain united in one nucleus and cells are formed with a double number of chromosomes (28 instead of 14 in the case of rye). The seedlings will consist of a mosaic of normal (diploïd) cells and cells with a double number of chromosomes (tetraploïd). The offspring of such mixoploïd plants are examined individually and the tetraploid plants are kept for further breeding. These plants will produce tetraploid progeny if they fertilize each other.

The creation of polyploid beets is shown by Ir.D.Kloen and G.J.Speckmann. The working method is explained with reference to a large scale experiment started in 1950. Photographs illustrate the procedure. Many breeders have received tetraploid material.

A plate illustrates the research work in yellows in beet by Ir.G.Cleij.

Dr.F.P.Ferwerda demonstrates a diagram of recurrent selection for rye breeding. The procedure starts with two completely unrelated populations, designed "red" and "blue". A large number of clones from the populations "red" are subjected to pollination by the population "blue" and vice versa. A comparative test of the progeny obtained in this way discloses which "red" clones show a particular good combining ability in regard to the population "blue" and vice versa.

These well-combining partners are taken as a basis for the breeding of a narrowed "red" and "blue" population. The narrowed populations serve a dual purpose:

1. They constitute the basic material for a new breeding cycle.
2. By crossing them "en masse" there is a chance that a progeny be obtained which - provided it performs well in the severe comparative tests to which it is submitted - ultimately may constitute the basic material for a new variety.

Inbred lines of maize and their F_1 obtained by mutual crossing demonstrate the heterosis effect which is utilized to produce hybrid maize. A maize hybrid is obtained by crossing 4 carefully chosen inbred lines in a given way. The breeder ascertains by test crossings which combinations are best matched.

Increasingly attention is given to new methods which have been studied by Dr.Ferwerda during a journey to the U.S.A. in 1953.

Dr.F.Wit and his fellow-workers Ir.G.E.van Dijk and Ir.J.Dijkstra have designed a plate to illustrate some details of the breeding work in grasses and clovers.

Joh.Dros and Th.Meindersma are in charge of the work involved in the maintenance of varieties bred by the I.v.P.: Vinesco winter barley, Minerva spring barley and Vada spring barley.

From the descendancy of the mildew-resistant Minerva and Vada spring barleys it appears that the resistance has been obtained from a species cross.

It is worth mentioning that the scientific periodical Euphytica (written in English) arouses interest abroad. "What the gene centres are for the cultivated plants, Euphytica is for the breeder".

Wageningen, May 1961.

H.de Haan

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