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FIFTEEN YEARS ACTIVITY OF THE COMMISSION FOR THE ADVANCEMENT OF POTATO BREEDING

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CONTENTS page

1. INTRODUCTION

H. DE HAAN has pointed out in his article entitled "Potato breeding in the Netherlands" (Euphytica 2, 1953: 113–121) that a great merit of the General Seed Inspection Service has been the encouragement and effective assistance of potato breeding in our country. This aid consisted of the payment of remunerations according to a definite scheme. Since 1942 these remunerations are paid out on the strength of the so-called Breeder's Decree.

An important further step was the creation in 1938 of the Commission for the Advancement of Potato Breeding, which owed its origin to the initiative of the Inspection Service and especially to that of late Prof. C. BROEKEMA. By this measure the breeding and the testing of seedlings was placed under central leadership.

The Commission is composed of the following persons: Dr J. OORTWIJN BOTJES (ex-president of the Seed Inspection Service), Ir W. B. L. VERHOEVEN (for the Ministry of Agriculture), Dr J. C. DORST (Institute of Agricultural Plant Breeding), Ir J. K. GROENEWOLT (Institute for Research on Varieties of Field Crops), Ir J. SIEBENGA (Seed Inspection Service) and Ir J. A. HOGEN ESCH (Secretary and technical leader). Mr H. ZINGSTRA has been appointed technical officer to the Commission.

Since the Commission started its work potato breeding has expanded greatly, as may be seen from Table 1.

The number of seedlings in the years 1938–1943 are not known, but probably a gradual increase took place during these years.

Many of the new breeders are young farmers engaged in the production of seed tubers and who are at the same time good judges of the potato plant. Of course the extent of the work of these breeders varies much. Thus the number of 1st year seedlings raised varies between some 500 for the small breeders to 25,000 for the large, well-equipped establishments.

The location of the breeders in the various provinces is shown in Fig. 1.

TABLE 1. NUMBER OF POTATO BREEDERS IN THE NETHERLANDS

Year	Number of breeders	Number of 1st year seedlings
1936	18	12,500
1938	50	
1940	75	
1942	91	
1944	170	60,000
1946	179	65,000
1948	193	110,000
1950	197	224,000
1952	188	308,000

The activities of the Commission consist of giving advice and technical aid to the breeders and of directing the research on seedlings in the first years.

The further observation and testing up to the moment when it is decided whether or not a variety will be inserted in the Descriptive List of Varieties is done by Government Institutions (I.V.R.O., C.I.L.O. and Government Agricultural Advisory Service) with continued co-operation of the Commission.

2. TECHNICAL ASSISTANCE TO THE BREEDERS

The technical assistance is of the following forms:

2.1. *Visit* in summer and autumn to the breeders by the Commission's officer to examine the seedlings and get an idea of the breeding work in general.

2.2. *Advice* concerning breeding proper (crossing, raising seedlings, evaluation of seedlings, storage, etc.). New breeders receive brief notes on these subjects.

2.3. *Distribution of true seed* to the breeders (Table 2). The seed needed is obtained from special plots where the crosses are made. There is at present a close collaboration for the distribution of seed to the breeders with the Foundation for Agricultural Plant Breeding at Wageningen, which annually produces a great number of seedlings.

TABLE 2. SUMMARY OF THE NUMBER OF TRUE POTATO SEEDS SUPPLIED TO THE BREEDERS

1939	18,000 seeds	
1943	54,000 „	
1947	92,000 „	
1948	101,000 „	
1950	120,000 „	
1952	130,000 „	(in collaboration with the Foundation)

Moreover the breeders can get tubers of first year seedlings from the Foundation so that they are relieved of the necessity of raising plants from seed, which is a boon to many small breeders.

2.4. Recording data on seedlings in the "*Potato Genealogical Register*" with the object of gaining an insight into the best combinations for crosses. After ten years of observation it was possible to make the first communications to the breeders concerning this subject.

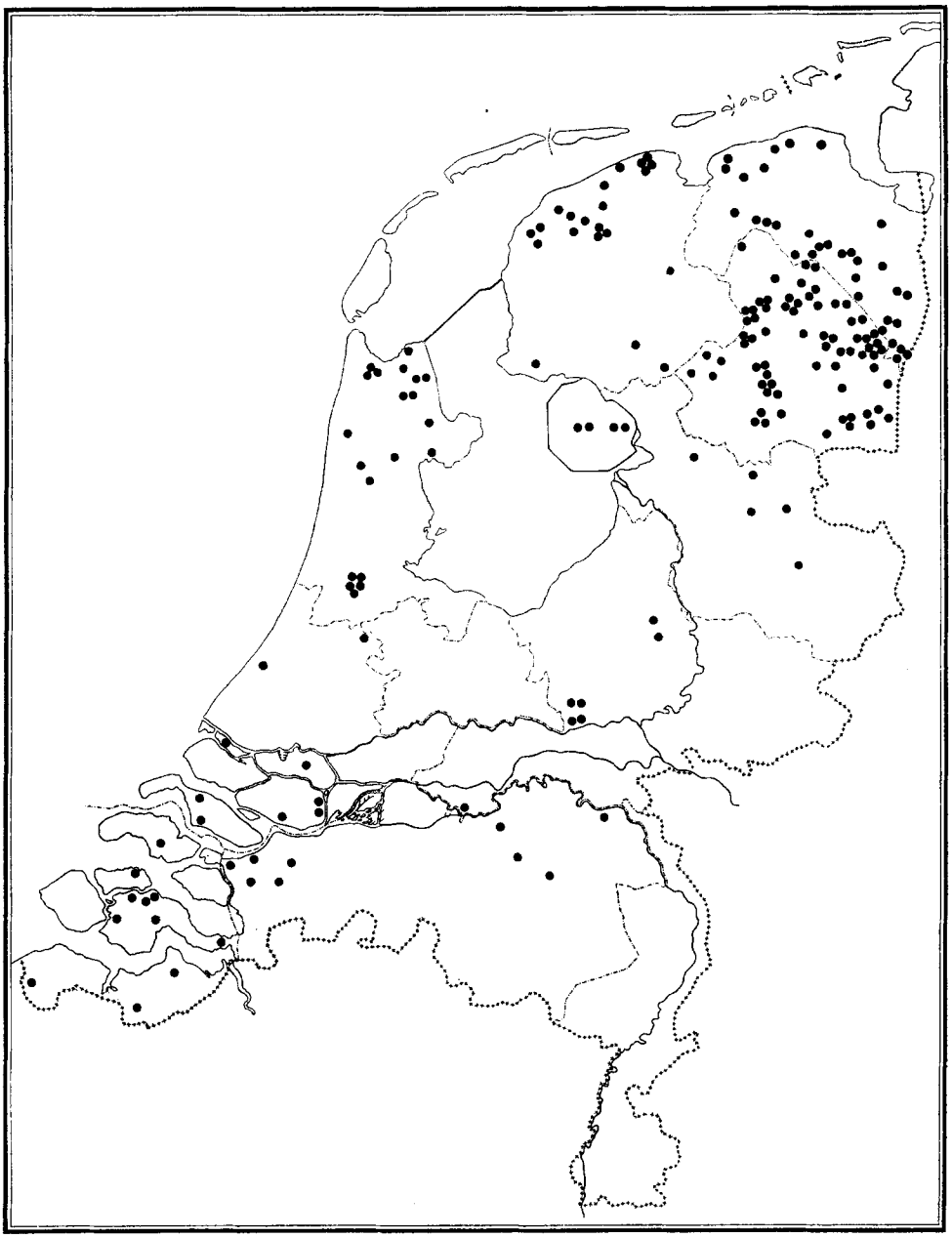

FIG. 1. LOCATION OF THE POTATO BREEDERS IN THE NETHERLANDS

2.5. *Maintaining a collection of 250 parent varieties* from which the breeders can obtain tubers of the sorts they desire for their crossing programs. At the same time they are informed about the properties of the parental material.

3. TESTING OF SEEDLINGS

From "cross to list of varieties", that is to say during the period preceding its release for general use, the seedlings have to undergo numerous tests as is shown by Fig. 2.

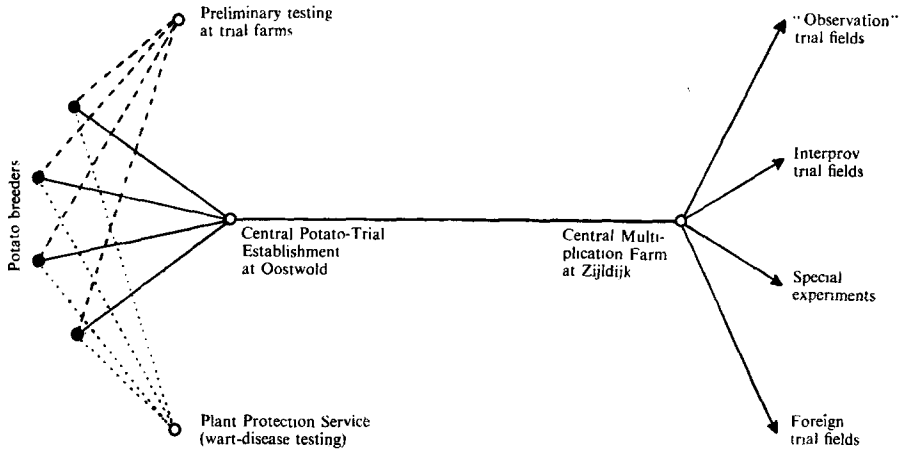

FIG. 2. DIAGRAM OF SEEDLING TESTING

Since only varieties immune to wart disease are entered on the Descriptive List o Varieties, testing for this disease is undertaken at the outset of the trials.

3.1. *Wart-disease testing*

In September the breeders send some tubers of second year seedlings that are intended for further trial in the third year to the Plant Protection Service at Wageningen, where testing for wart-disease resistance is done by means of laboratory methods. In March the results of this examination are made known, so that the susceptible seedlings can be discarded by the breeder before the start of the third year's planting. The seedlings that were not attacked in the laboratory are then tested during two years on infested fields of the Central Potato-Trial Establishment at Oostwold. If no attack is observed a certificate for wart-disease immunity is delivered.

3.2. *Preliminary testing at three trial farms*

Since 1950 the breeders have the opportunity of sending their fourth year or older seedlings to three trial farms located on clay, sand and sandy-peat soils. Many avail themselves of this opportunity.

TABLE 3. NUMBER OF POTATO SEEDLINGS IN PRELIMINARY TESTS

1950	90 seedlings
1951	211 „
1952	218 „
1953	256 „

FIG. 3. PRELIMINARY TESTING OF SEEDLINGS

This preliminary testing has proved to be of great use to the breeders for the sifting of their material and at the same time it has prevented the overburdening of the establishment at Oostwold with too many seedlings.

3.3. *Research done at the Central Potato-Trial Establishment at Oostwold (Province of Groningen)*

Since 1922 this establishment has been placed free of charge at the disposal of the breeders. During almost 25 years Dr J. OORTWIJN BOTJES, a well-known research worker in the field of virus diseases, has performed various investigations for the benefit of the breeder. In 1945 the work was taken over by his son-in-law, Mr A. H. MUNTINGA, under the general direction of the Commission.

FIG. 4. Dr J. OORTWIJN BOTJES

The research program on this farm covers various points.

3.3.1. *Wart-disease testing*

As mentioned under 3.1 this testing is done during two years on a field heavily infested with *Synchytrium endobioticum.*

3.3.2. *First investigations concerning the agricultural value*

These investigations are carried out during at least two years. During the growth period notes are taken concerning development, virus diseases, *Phytophthora* and time of maturity.

At harvesting the appearance of the tubers is judged, and yield and starch content are determined. Later the consumption quality is assessed. On the strength of these findings the breeders are advised by the Commission to retain or discard their seedlings.

TABLE 4. NUMBER OF SEEDLINGS TESTED AT THE ESTABLISHMENT OF OOSTWOLD

1940	82 seedlings
1945	104 „
1947	114 „
1949	130 „
1951	176 „
1952	185 „

3.3.3. *Testing for resistance to virus diseases*

By means of natural and artificial infection (tuber grafting) a preliminary assessment is made of the susceptibility to virus diseases. Moreover for the best seedlings there is determined the reduction in yield from using leaf-roll infected seed tubers as compared with healthy ones.

3.3.4. *Multiplication of disease-free seed*

On the farm at Oostwold a large collection (more than 250 varieties) of Dutch and foreign varieties are maintained free from disease. This is also done for seedlings still being tested. In this collection are many varieties that are only used as parents in crossing programs. Every year this establishment supplies disease free material of given varieties to various Government Institutions at Wageningen for scientific research on virus diseases.

The multiplication plots are laid out separately in straw crops in order to avoid as much as possible the risk of contamination.

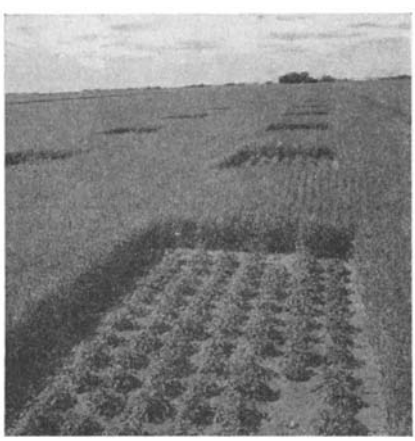

FIG. 5. DISEASE FREE MULTIPLICATION AT OOSTWOLD

3.4. *Central Multiplication Farm at Zijldijk (Province of Groningen)*

The seedlings that have given a favorable impression on the breeder's plots, on the

establishment at Oostwold and on the three trial farms, are sent to the multiplication farm of Mr J. KAPENGA at Zijldijk, where they are increased for further investigations concerning their agricultural value on the "observation" and "interprovincial" trial fields in order to determine whether they are worthy of being placed on the List of Varieties.

The importance of this multiplication lies in the fact that all varieties under investigation come from virus-free seed tubers of the same size, grown, harvested and stored under the same conditions.

FIG. 6. MULTIPLICATION FARM AT ZIJLDIJK

In 1952 28 seedlings, 56 varieties figuring on the List and 9 foreign varieties (not yet on the List) were multiplied on an area of 4.27 ha.

3.5. *"Observation" trial fields*

All over the country the Institute for Research on Varieties maintains trial fields on farms, private breeding establishments, agricultural schools and experiment stations. In 1952 a total of 120 observation plots were laid out.

The trial-field holders undertake to mark the characters of the plants in figures on special forms supplied to that effect, while at the same time a short description of the agricultural behavior of the varieties is requested. To the breeder those trial fields are of particular importance because they afford the opportunity of comparing his own varieties to those of other breeders.

During summer these fields are inspected once or more.

3.6. *Interprovincial trial fields*

In contradistinction to the observation trial fields the interprovincial fields are laid out in triplicate. These trials are undertaken cooperatively by the Central Institute for Agricultural Research and by the Institute for Research on Varieties of Field Crops, both at Wageningen, under the supervision of agricultural advisory officers in t he various provinces. The yield data are analyzed mathematically by the latter Institute.

FIG. 7. INTERPROVINCIAL TRIAL FIELD

Table 5 shows the number of seedlings tested on the observation and interprovincial trial fields and the number of new varieties put on the List.

TABLE 5. SEEDLINGS TESTED AND VARIETIES PUT ON THE LIST

Year	Seedlings on observation fields	Seedlings on interprovincial trial fields	Varieties put on the List
1948	19	13	3
1949	15	11	3
1950	19	8	2
1951	21	11	1
1952	23	8	5

The observation fields as well as the interprovincial trial fields are grouped in series. The number of series looked after by any one worker varies.

3.7. *Trial fields abroad*

On behalf of the Foundation for the Propaganda Abroad of Seed Potatoes samples of seed tubers are sent out each year by the I.V.R.O. for trial under various conditions of climate and soil. In 1952 samples were sent to 133 experimenters in 33 countries (Europe, Asia, Africa, Latin America).

FIG. 8. TRIAL FIELD ABROAD

3.8. *Special experiments*

In addition to the general investigations to assess their agricultural value the seedlings are tested for resistance to various diseases, for which purpose special trial fields are designed. The quality for human consumption and the value for the industry is also determined.

These special trials bear on the following points:

3.8.1. *Scab*

The trials are performed on clay, sand and sandy-peat soils and in the newly reclaimed North-East Polder.

3.8.2. *Spraing*

In 1952 two trials were made on sandy soil and two on sandy-peat soil.

3.8.3. *Stem eelworm (Ditylenchus destructor).*

Two fields on sandy-peat soils.

3.8.4. *Drought*

In 1952 six trial fields were laid out on very dry sandy soil in the provinces of Limburg and North-Brabant. Some of these trials offered the opportunity of investigating also the susceptibility of the varieties to magnesium deficiency.

3.8.5. *Reproduction without roguing and selection*

The speed of degeneration of the varieties is tested on plots planted with tubers coming from fields that have not been rogued.

3.8.6. *Virus research*

At the Laboratory of Phytopathology at Wageningen the seedlings under investigation on the various trial fields are tested for their susceptibility to virus diseases by means of tuber graftings.

3.8.7. *Late Blight research*

Observations bearing on the susceptibility to blight are performed at the potato-trial establishment at Oostwold and on the various trial fields.

In addition the breeders can have their seedlings tested for *Phytophthora* resistance by means of laboratory methods at the Institute for Phytopathological Research at Wageningen. This Institute also furnishes inoculation material of various physiologic races of *Phytophthora* to the breeders.

3.8.8. *Quality assessment*

The section of Human Nutrition of the Central Institute of Agricultural Research at Wageningen tests seedling material from the trial fields for cooking quality (color, flavor, texture).

FIG. 9. COOKING TESTS.

The Central Institute of Nutrition Research at Utrecht determines the vitamin C and protein content, the Institute of National Nutrition at Amsterdam the vitamin B^1 content.

3.8.9. *Industrial use*

The seedlings are examined for their suitability for industrial purposes by the Experiment Station for the Technology of Potatoes at Groningen. Starch and protein content and the size of the starch grains are determined.

3.8.10. *Botanical research*

In behalf of the Registration of Varieties for obtaining breeder's rights the I.V.R.O. conducts a botanical study of new varieties with respect to the characters of the tuber, the plant and the sprout. Reports on these subjects are sent in to the Board for the Breeder's Right. Results of these investigations are used for descriptions in the list of varieties. They also furnish desirable information for the determination of varieties on the basis of the characteristics of tuber and sprout.

4. DESCRIPTIVE LIST OF VARIETIES OF FIELD CROPS

When a new variety (seedling) has successfully passed the above-mentioned tests a Government Committee decides about its entry to the Descriptive List of Varieties of Field Crops.

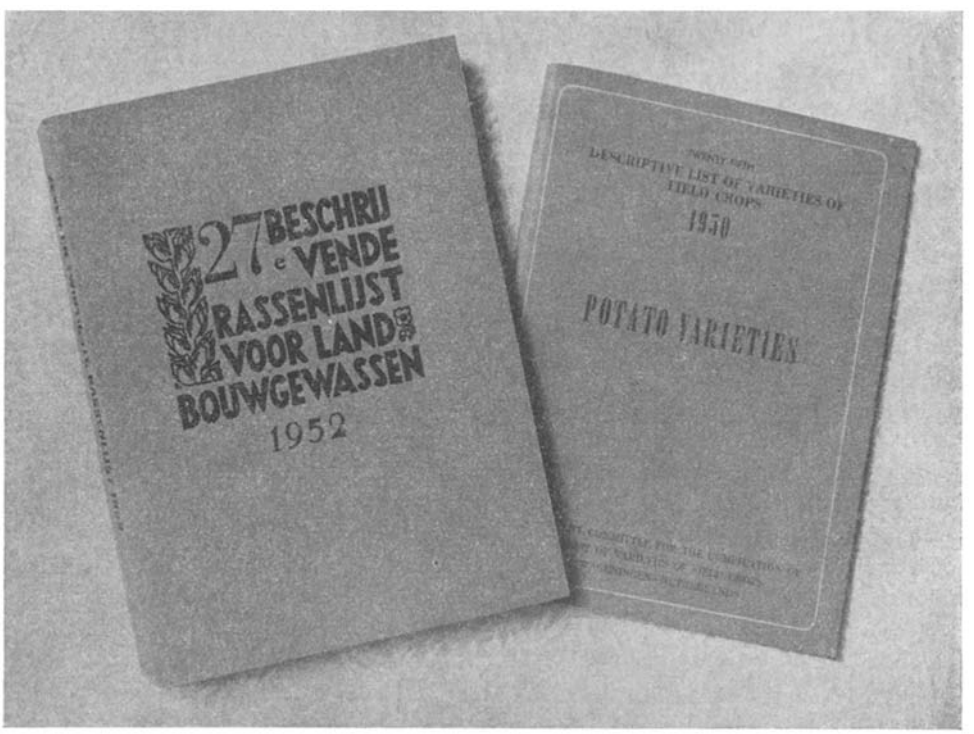

FIG. 10. DESCRIPTIVE LIST OF VARIETIES

Though every year thousands of seedlings are raised, the number of new varieties placed annually on the List of Varieties is small (see Table 5). This demonstrates clearly that seedlings undergo very strict tests. When finally a breeder has the good fortune that after 10 years of testing (from making the cross to release of the variety) a seedling is entered on the List and introduced to the growers it may be that the variety meets little favor or even disappears.

If, however, a variety proves to be a good one the originator is guaranteed an adequate remuneration thanks to the Breeder's Decree.

5. Results obtained

As the Commission started its activities in 1938 the first results could not be secured before 1947 at the earliest. In that year two varieties from new breeders were put on the List. From 1947 to 1953, 8 varieties from new breeders against 9 varieties from 5 older breeders were entered.

On the 28th Descriptive List, which appeared in January 1953 figure 5 new varieties, three of which came from new breeders.

It is satisfying to note that the number of conscientious young breeders is constantly increasing. Thanks to the assistance rendered by the Foundation for Agricultural Plant Breeding, which specializes on delicate tasks (working with various *Solanum* species possessing resistance genes), the potato improvement in the Netherlands can look forward to a promising future.

6. Samenvatting

Vijftien jaar werkzaamheid van de Commissie ter Bevordering van het Kweken en het Onderzoek van Nieuwe Aardappelrassen

Het is de verdienste van wijlen Prof. Ir C. Broekema geweest bij voortduring de aandacht gevestigd te hebben op de noodzakelijkheid om de aardappelveredeling op groter schaal ter hand te nemen.

Dit heeft er toe geleid, dat in 1938 door de N.A.K., de Commissie ter Bevordering van het Kweken en het Onderzoek van Nieuwe Aardappelrassen werd ingesteld. Voorzitter is Dr J. Oortwijn Botjes (oud-voorzitter van de N.A.K.), terwijl schr. secretaris en technisch leider is. Hierdoor werd het kweken en het onderzoek van zaailingen onder centrale leiding geplaatst. Sindsdien heeft het aardappelkweken een grote vlucht genomen, hetgeen moge blijken uit de toename van het aantal kwekers (1936: 18; 1952: 188) en het aantal 1e jaars zaailingen (1936: 12.500; 1952: 308.000).

De werkzaamheden der Commissie bestaan in het geven van voorlichting aan de kwekers en in het leiding geven aan het onderzoek van de zaailingen in de eerste jaren.

Het verdere onderzoek op de observatie- en interprovinciale proefvelden tot het moment, waarop over opneming in de Beschrijvende Rassenlijst voor Landbouwgewassen wordt beslist, geschiedt door de daartoe aangewezen Rijksinstanties (I,V.R.O., C.I.L.O. en Rijkslandbouw-voorlichtingsdienst) onder blijvende medewerking van de Commissie.

De technische voorlichting omvat het bezoek aan de kwekers door de technische ambtenaar H. Zingstra in de zomer, het distribueren van aardappelzaad, het samen-

stellen van een aardappelstamboek en het bijhouden van een geniteurscollectie. In fig 1. is het schema van onderzoek der zaailingen vanaf kruising tot rassenlijst weergegeven.

Aan de hand van dit schema worden de verschillende onderzoekingen behandeld, t.w. wratziekte-onderzoek, voorbeproeving op een 3-tal proefboerderijen, het Aardappelproefbedrijf van de heer A. H. MUNTINGA (v.h. van Dr OORTWIJN BOTJES) te Oostwold (prov. Groningen), het centrale vermeerderingsbedrijf van de heer J. KAPENGA te Zijldijk (prov. Groningen), de observatie-, de interprovinciale-, de buitenlandse proefvelden en de bijzondere proefnemingen. Op bijzondere proefvelden worden de zaailingen getest op resistentie tegen verschillende knolziekten (schurft, kringerigheid, knollenaaltje, droogte). Tot het bijzondere onderzoek kan verder worden gerekend het virusonderzoek, de nateeltproeven, het *Phytophthora*-onderzoek, het consumptiekwaliteitsonderzoek, de fabriekmatige verwerking en het botanisch-onderzoek. Indien een zaailing dit uitgebreide examen (een onderzoek van ongeveer 10 jaar) met gunstig gevolg heeft volbracht, dan wordt door een Rijkscommissie beslist omtrent opname in de Beschrijvende Rassenlijst.

In de periode van 1947 tot 1953 werden in totaal 8 nieuwe rassen van 7 jonge kwekers in de Rassenlijst opgenomen tegenover 9 nieuwe rassen van 5 oude kwekers. In de in Januari verschenen 28e Beschrijvende Rassenlijst voor Landbouwgewassen 1953 werden 5 nieuwe rassen opgenomen, waarvan 3 afkomstig zijn van jonge kwekers.

Met voldoening kan worden geconstateerd, dat het aantal serieus werkende nieuwe kwekers nog steeds groeiende is. Verwacht mag worden dat, in het bijzonder ook met de hulp van de S.v.P., die zich speciaal met het moeilijke kweekwerk (wilde *Solanum*-soorten met resistentiefactoren) bezig houdt, verdere successen bij de aardappelveredeling in Nederland stellig niet zullen uitblijven.