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ORGANIZATION OF AGRICULTURAL RESEARCH IN THE NETHERLANDS WITH SPECIAL REFERENCE TO POTATO RESEARCH AND FARMERS' PARTICIPATION

D. E. van de Zaag

Research Coordinator
Wageningen, The Netherlands

INTRODUCTION

At the request of the organizers of the workshop on "Agricultural Research Policy and Organization in Small Countries," the organization of agricultural research in the Netherlands will be discussed in general and, in particular, the organization of potato research as a case study. Special attention will be paid to the participation and involvement of the various branches of the potato industry (such as growers, breeders, merchants, and processors) in potato research activities and policy, and to the application of research results in practice. Before doing this, it may be necessary to explain why, from all research activities, potato research has been especially chosen as a case study. Three reasons can be given:

1. The importance of the potato crop in the Netherlands

The potato has been an important crop in this country for many decades and in the last two decades it has become even more important. There is no other country in the world where 25% of the arable land is cropped with potatoes, and where almost 50% of the income of farmers with arable land is derived from this crop. Moreover, about two thirds of the total production (seed, food potatoes, and potatoes for starch production) is exported in fresh or processed form, so that both production and research have become somewhat internationally oriented.

Since the 1920s, research has played an important role in potato improvement by starting with the well-known research by Dr. Quanjer and Dr. Oortwijn Botjes on potato virus and on the role of aphids in virus transmission.

Although it is difficult to prove, it is my opinion that the strong position of the Dutch potato industry today is due to the well-developed potato research program in this country, and to the strong involvement of growers, breeders, merchants and processors in potato research policy.

2. The increasing importance of the potato crop in many developing countries

The increasing importance of the potato in developing countries is shown in Figure 1. During the last 15 years, total production has almost doubled due to an increase in yield per hectare and to an increase in the area cropped with potatoes. Moreover, the increase in edible energy and protein yields per hectare for potatoes was somewhat higher than that for wheat or rice (Figure 2), despite the green revolution in wheat and rice varieties.

3. Organization of potato research and the participation of the potato industry

There is no doubt that of all agricultural research activities in the Netherlands, the participation of the potato industry in potato research has been greater than that for other crops or other fields of research.

ORGANIZATION OF AGRICULTURAL RESEARCH

As there is no time to give detailed information about the organization of agricultural research in general, I will confine myself to an outline sketch of this research, accepting the risk that in some places the picture might be slightly distorted. However, this can have an advantage in that the reader may get an overall picture of the organization more readily when not distracted by details which are not important for our purpose.

Figure 3 is an attempt to give such a draft outline of the organization of agricultural research, and I would particularly draw your attention to what has been described in Figure 3 as the main characteristics of research. These characteristics emphasize perhaps too strongly the differences between some departments of the Agricultural University and the related research institutes.

Experiment Research Stations are usually situated in a main area of crop production. They are commodity or farming type oriented, and deal with aspects of a specific branch or sector of agriculture. Staff and activities are half financed by the Ministry of Agriculture and Fisheries and half by farmers' and growers' organizations. The financial contribution by farmers and growers gives them a great influence in the selection of research projects.

The station can rely on specialized research institutes for long-term projects and more specialized subjects such as plant breeding, crop protection, agricultural engineering, soil fertility, etc. The management of the institutes (and also of the stations) is governed by a board of which several members are appointed by national agricultural organizations, to promote an appropriate level of input in the selection of research projects. In some cases, organizations contribute financially to specific research projects (up to 10% of the total budget), but in general, the budget of institutions is fully financed by the Ministry of Agriculture. The staff of the stations and institutes have the status of public servants.

The Directorate for Agricultural Research of the Ministry of Agriculture and Fisheries coordinates the activities of the institutes and stations. Departments of the Agricultural University are primarily established for education and basic research, but often staff members also deal with applied research. The university is fully financed by the ministry. In all types of research establishments, research is dedicated not only to the needs of the agricultural industry, but also to the benefit and welfare of society.

In order to provide channels for liaison between departments, industries and stations, the National Council for Agricultural Research was established. All aspects of the agricultural industry, the Advisory Service, the Ministry of Agriculture and other organizations interested in research are represented in the National Council. Apart from the task of promoting contact between scientists at the bench, the council makes proposals for a national plan for all agricultural research to the ministry.

The national plan is implemented by means of programs in which new perspectives for research and the possibilities for, and problems of, agriculture are kept in balance. When planning programs, those who lead research and those who use it are always kept in close contact. In the following section, this mutual influence of practice and science in regard to the potato will be discussed in more detail.

POTATO RESEARCH

Potato research institutes, where most of the potato

research of a country is concentrated, do not exist in Western Europe or in North America. This is in contrast to most countries in Eastern Europe, where such research institutes do exist, e.g. DDR, Poland, USSR, and CSSR. The Central Potato Research Institute in Simla, India is also well known. In the Netherlands, there are some 30-35 scientists, mainly concentrating on potato research, who are employed in 3-4 departments of the University, 8-10 research institutes and one experimental station. The advantage of this system is that they can do their research in close cooperation with their colleagues working in the same field of research or discipline, such as crop protection, breeding, physiology, etc., and that they can use sophisticated equipment that has been developed for specific research disciplines.

The disadvantage of the system is that because the potato research workers are divided over many research institutions, close cooperation between them is hampered and the essential cross-disciplinary research is not stimulated, even when the majority of the research institutions are located in the same place, Wageningen. Moreover, the participation and involvement of the various branches of the potato industry in potato research are much more difficult to organize when the research is divided over so many institutes.

In what way can the disadvantages of a system without a central potato research institute be removed? I believe that we have been successful in this respect by establishing two institutions in the Netherlands:

- A committee (Dutch Potato Association - DPA) in which the various branches of the potato industry are represented. The DPA advises the National Council for Agricultural Research and the board and directors of the research institutions on potato research;
 - A staff member of the Directorate of Agricultural Research, who is responsible for the coordination of all potato research.
4. To advise special funding agencies of the potato industry about financing special potato research projects.

DUTCH POTATO ASSOCIATION

The DPA consists of:

- Four representatives of the growers (seed, food potatoes, potatoes for the starch production, and growers' organization);

Fig 1. Development of the total production of (1) wheat (•), (2) rice (x) and (3) maize (o) in developing countries with market economies.

1) $\hat{y} = 45.89 + 4.2206x - 0.0546x^2$
 (100 = 48.2×10^6 t)
 $r = 0.96$

2) $\hat{y} = 139.45 + 4.48x$
 (100 = 133.7×10^6 t)
 $r = 0.92$

3) $\hat{y} = 59.13 + 1.39x$
 (100 = 60.4×10^6 t)
 $r = 0.95$

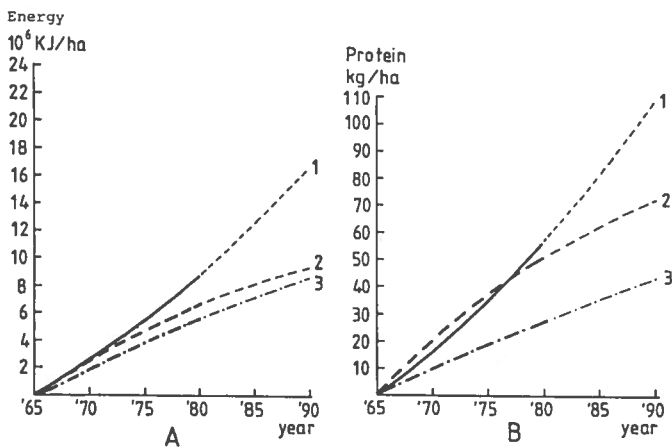
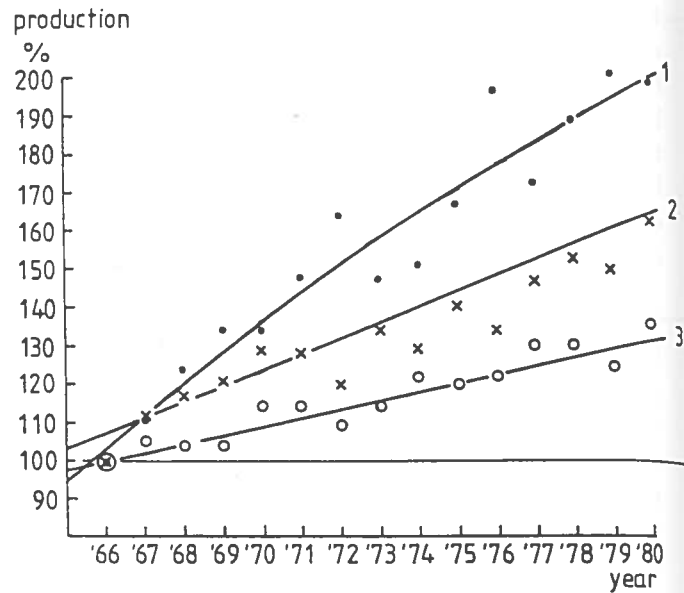


Fig. 2. Accumulated calculated increase in yield expressed in terms of energy (a) and protein (b) for (1) potatoes, (2) wheat, and (3) rice (70% edible) in developing countries with market economies (Van der Zaag & Horton, Potato Research 26 (1983): 323-362).

Fig. 3. Sketchy outline of agricultural research in the Netherlands

	Research institutions		
Type:	Agricultural University	Research Institutes	Experimental Research Stations
Number:	1	22	10
Basis of the organization:	Research disciplines	Research disciplines	Farming types
Place:	Wageningen	Mainly Wageningen	Production regions
Main characteristics of research	<ol style="list-style-type: none"> 1. More basic than applied research. 2. Determined by training students. 	<ol style="list-style-type: none"> 1. More applied than basic research. 2. Participation of government and interested organizations. 	<ol style="list-style-type: none"> 1. Applied, adapted and on-farm research. 2. Strong participation of growers.

- One representative of the breeders (in the Netherlands there are many private breeders);
- Four representatives of the merchants (seed and ware, export and inland, wholesale and retail);
- Two representatives of the processors (starch and derivatives, and processed products for human consumption);
- Two representatives of the Potato Marketing Board (Produktschap voor Aardappelen);
- One Director of the Inspection Service (NAK);
- One Director of the Plant Protection Service (PD);
- One representative of the Ministry.

The chairman of the DPA is the coordinator for potato research, and the secretary is the senior potato specialist of the Research Station for Arable Farming and Field Production of Vegetables.

The main tasks of the DPA are:

1. To advise the National Council for Agricultural Research about potato research;
2. To advise the boards and directors of the research institutions about potato research in their institutes or stations;
3. To draw the attention of the Advisory Service or of the potato industry to specific developments in the crop;

This task is executed by:

1. One annual meeting to discuss all aspects of potato research, including the appointment of the money spent on the various fields of research (see Table 1);
2. One annual meeting (1 or 2 days) where one of the four fields of research (breeding and varietal assessment; plant protection; crop husbandry including physiology, etc.; storage, quality, and processing) are discussed in extenso with the Directors and senior research workers of the institutions concerned (including departments of the University);
3. Discussion of relevant topics in special meetings;
4. Preparation every five years of a report about developments expected in the potato crop which may need special research attention.

To execute these activities, it has been shown to be extremely important that the secretary be a senior potato specialist well informed about potato research, about the Advisory Service and about practical developments. The DPA has the advantage that the chairman, who is also coordinator of potato research, is also well informed about what is going on in research.

In the activities of the DPA, the translocation or the formulation of wishes of the potato industry into research projects have never been a problem. We are aware that this is also due to the choice of the right secretary and chairman.

COORDINATOR OF POTATO RESEARCH

One of the staff members of the Directorate Agricultural Research is responsible for the coordination of potato research acts through:

- The DPA, of which he is the chairman;
- Contacts with the directors and research workers of the research institution where potato research is done;
- The establishing of working groups, in which potato research workers usually of different disciplines work together on specific topics such as "Growth vigor of seed potatoes," "Effect of water supply on yield and quality," and "Use of true potato seed." There are in total eight such working groups of which the coordinator is the chairman. He can only do this work as long as he is recognized as a potato specialist.

Is potato research in the Netherlands in balance with, or adjusted to, the problems and possibilities which exist in the field of the potato crop?

It will be difficult for me, so closely connected with this work, to give an unbiased answer to this question. Nevertheless, I dare say that in general the potato research program in this country is well balanced, and by this I mean that the research projects reflect reasonably well the problems and possibilities of the potato industry.

This is achieved by:

1. The interest of the directors and research workers in what is going on in the potato industry. The fact that several research workers have been born on farms may affect their attitude;
2. The influence of the members of the board of those research institutes where potato research is a substantial part of their whole research program;

Table 1: Budget of Potato Research by the Ministry of Agriculture and Fisheries, in Millions of Guilders.

Year	1974	1975	1976	1977	1978	1980
Total	11.2	12.1	13.1	14.6	15.4	18.0
Percentages						
Breeding and varietal research	26	29	30	28	29	33
Soils and fertilization	3	4	6	6	6	6
Crop husbandry and physiology	11	9	10	12	12	12
Mechanization, labor and economy	4	4	2	4	6	4
Diseases and pests	17	18	16	14	15	16
Storage and processing	39	36	36	36	32	29

3. The influence of the DPA and the potato research coordinator on the research program.

It is extremely difficult to weigh these three effects. In my opinion, the influence of the DPA in combination with the research coordinator can be rather strong, because of the interest of the research workers in solving problems which exist in practice, and of the interest of several board members of the research institutes in potato research. Two examples will be given to demonstrate the influence of the DPA on potato research.

1. The distribution of funding from the Ministry of Agriculture and Fisheries for the various fields of research is given in Table 1. In 1977, after long discussions, the DPA decided that research on special aspects of diseases and pests and on breeding should be extended and that research on storage and processing could possibly be slightly decreased. Table 1 shows the effect of this advice to the National Council for Agricultural Research.
2. About five years ago, the DPA discussed all aspects of the research on the potato cyst-nematodes. The conclusion was that the chairman/research coordinator should establish a working group of scientists working on this pest. The first task was to prepare a survey of, and recommendations for, urgent research on potato cyst-nematode. The recommendations were accepted by the DPA and resulted in an extension of this research with two research workers and four technicians, of which the two scientists and three technicians are paid by funds provided by the potato industry.

The adaptation of research results before introduction into practice, and the introduction and application of these results into practice

Research results which are important for growers and which can be applied without further experiments on farms are introduced into practice by:

- the National Advisory Officers via the regional Advisory Service;
- the potato specialists of the Research Station for Arable Farming and Field Production of Vegetables via the regional Advisory Service.

If the research results of the University or of the research institutes need further research on farm level and/or need some adaptation before introduction on farms, this is done by the potato specialists of the respective research stations. It is done on the experimental farms of the research station, or on the regional experimental farms, or in commercial farms, depending on the nature of the problem. Research results to be applied by merchants and processors are usually introduced to these branches by the Institute for Research on Storage and Processing of Agricultural Produce (IBVL).

The introduction or adaptation of research results do not present problems. In general, we are more afraid of a too rapid than of a too slow introduction of new findings into practice. Of course, there are exceptions. Years ago, the

DPA stimulated research on the control of groundkeeper potato plants. Research institutes found it difficult to develop techniques for controlling groundkeepers. But in the end, the techniques which were developed proved too difficult to introduce into practice on a large scale, mainly because the growers were insufficiently conscious of the danger of groundkeepers in transmitting diseases or pests from one season to another.

Comparison of the participation of the potato industry in the Netherlands with that of other countries

It is risky to compare the participation and involvement of the potato industry in potato research in the Netherlands with some other European countries without any special study. What is said here must be considered therefore as a personal opinion based on few observations. Potato research in the UK is in general of a high standard, but I believe that the link with the potato industry is far less developed in UK than in the Netherlands. This may be due to the organization and possibly also to the tradition of the research workers to be scientists first and foremost.

In the Federal Republic of Germany and in France, the participation and involvement of the potato industry is also less developed than in the Netherlands.

In Italy, Spain, and Portugal, the importance of potato research is so small, despite a large potato production, that it is difficult to talk about farmers' participation in potato research in these countries.

In the USA, especially at the land grant universities, potato research is strongly adjusted to the problems and potential of the potato crop in the relevant state. So far as I have seen, this is not due to an intensive participation of the various branches of the potato industry in the potato research policy but more to:

1. Financing special research projects (State Potato Committees);
2. Extension officers working usually in the same university and even the same departments as the research workers. The combination of research and extension is gratifying.

In developing countries, the success of national potato program depends largely on the degree to which these programs are adjusted to the problems and possibilities existing in potato production and consumption. In most of these countries, it is difficult to attract the attention of potato growers to research programs. It is then the task of the leader of the program and its research workers to be

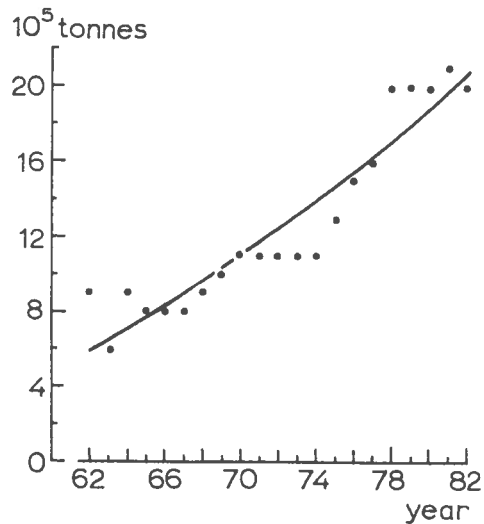


Fig. 4. Development of potato production in Colombia.

$$\hat{y} = 0.397x - 0.00791x^2$$

$$r = 0.992$$

well informed about what is going on in practice. This is often insufficiently understood, which is one of the reasons why the results of so many programs are rather poor. However, Colombia is a country with a very successful potato program. During the last two decades, potato production in Colombia has tripled (Figure 4) and consumption per capita doubled (Figure 5). It may be

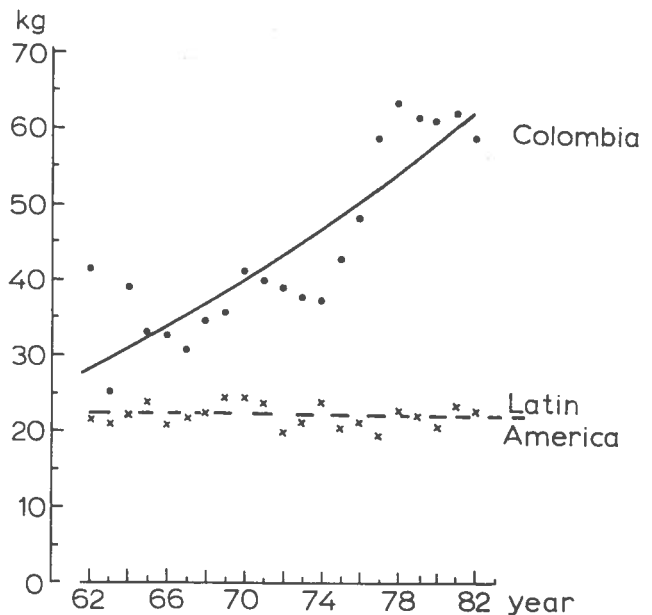


Fig. 5. Calculated consumption per head in Latin America and in Colombia.

Latin America:
not significant.

Colombia:
 $\hat{y} = -0.5x + 0.01539x^2$
 $r = 0.99$

assumed that the National Potato Program, which started in 1952, has everything to do with this success. At the moment, 12 research workers belong to the program, and about 26 research workers, who have as their main task potato research, are located at various institutes, but their potato research is coordinated by the program. Varieties which have been bred by the program are grown on 80% of the area cropped with potatoes. It is my opinion that the well-balanced research program, which is well adjusted to the problems of practice, and the well-established links with the Advisory Service (in the same organization), are the secret of the success of potato production in Colombia.

CONCLUSIONS

1. The success of potato production in a country is determined by the degree to which a well-balanced research program can be established and executed.
2. The participation and involvement of growers, breeders, merchants, and processors is important to achieve such a well-balanced program.
3. If this participation of the potato industry is not possible, it is extremely important to incorporate one or two potato specialists in research management, who are well informed about potato research and about what is going on in the potato industry.
4. In the Netherlands, it has been proven that the special committee, in which the various branches of the potato industry are represented, can play an important role in increasing the participation and involvement of the potato industry in research.

The success of such a committee depends largely on:

- The interest and capability of the members of the committee;
- The capability of the secretary and chairman to act as liaison officers between science and practice;
- The degree to which the directors and research workers are interested in solving practical problems.