

PUBLIC AND PRIVATE BREEDING: A COLLECTIVE RESPONSIBILITY FOR A CONTINUUM

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ABSTRACT

Plant breeding and breeding research are treated as a collective responsibility of public organisations and private enterprise. Tasks and responsibilities are described and the necessity for a division of tasks and cooperation between public and private sectors is indicated. The crucial importance of a two-way continuum between research and target groups is stressed. In order to formulate the correct research policy and to attain a continuous development of cooperation, the interaction between public and private breeding should be stimulated and organised. It is concluded that the optimal approach to plant breeding in public and private organisations is a joint approach with separate tasks.

KEYWORDS

Research policy, division of tasks, interaction, co-operation.

INTRODUCTION

Governments have the responsibility to provide conditions under which the needs of the people may be satisfied and their interests cared for. Carrying out these responsibilities is generally the task of public institutions and private enterprise.

Agriculture plays a crucial role in meeting human needs. This industry is organised into relatively small-scale units which are generally private enterprises.

Plant breeding is a powerful instrument for shaping, directing, and optimising agriculture. Breeding has gradually developed from an art into an integrating science. In breeding research the knowledge from basic sciences is integrated into a system for developing more suitable genotypes. As a consequence, the research is broad and complex, multidisciplinary and not autonomous.

Using this framework for discussion on public and private breeding I would like to look at the situation of a relatively small country where primary production is extensive, the important role of plant breeding is predominantly government funded, and the development of private breeding is relatively recent. I will present some

thoughts about responsibilities, coordination, and efficiency which are based mainly on experiences in another small country with limited funds.

THE TASK AND RESPONSIBILITY OF PLANT BREEDING

Plant breeders manipulate genetic information to develop genotypes which best serve the interest of the grower, the trade, the processing industry, the consumer, and the environment. This responsibility goes far beyond the increase of yield — it requires complex research.

Plant breeders also have a long term responsibility to continually integrate and exploit relevant developments in the basic sciences. This integrating function surpasses the capacity and responsibility of individual breeders, be they employed in private or public organisations.

Breeders face many different crops and many very different problems; their task is so extensive that it must be approached from different angles. It is most important to develop effective cooperation between potential partners when funds are restricted.

Regional plant breeding activities are essential in each country because a well-developed, modern, and active breeding industry is of national interest, and genotype x environment interactions are highly variable. In addition, breeding is clearly a field of research which attracts interest from invested capital, not only for the range and diversity of improvements that can be realised, but above all because improvements are generally heritable and therefore permanent.

The crucial importance of a continuum

As plant breeding and plant breeding research develop further and international cooperation increases, the division of tasks and a continuum assumes great importance. It is thought a governmental responsibility to provide the correct conditions for development.

The correct training of breeders and research workers at different levels is critical to a developing breeding industry. It is important that this includes university training of people who are not just specialists but can overlook the whole field so that they may evaluate developments in basic disciplines for integration.

Breeding research covers fundamental risk-bearing research on the one extreme and routine application of known techniques on the other. Fundamental risk-bearing research and the more basic aspects of applied research are the responsibility of public institutes, as they are usually unattractive to private enterprise. Examples of such research are the genetic and biochemical nature of disease and pest resistance, especially durable resistance; the physiology of adaptation to stress; the introduction of alien genetic material and the study of breeding barriers; and the application of molecular and cell biology. Such research should result in exploitable knowledge, methods, or half-way breeding material.

To provide the climate for private enterprise to invest in plant breeding, governments can provide the legal protection of plant breeders' rights. This may also include the infrastructure and organisation of variety research in order to establish whether a cultivar is new, distinct, uniform, and stable.

Cultivar evaluation is preferably carried out by or under the guidance of a public institute because evaluation must be strictly objective and independent. Public institutes must also take responsibility for conveying the resulting information to the users of cultivars.

Gene banks play a basic role in safe-guarding the future food supply. The establishment and maintenance of these facilities for future plant breeding are another public responsibility.

In an ever developing society, governments have to cope with new problems all the time. To be efficient it is important to stimulate private enterprise and delegate the execution of tasks as soon as, and wherever this is possible. In plant breeding this view results in the following division of tasks.

Public institutions may concentrate on:

- the education of breeders and other research workers
- the fundamental aspects of research, i.e. the risk-bearing aspects of integrating relevant developments in basic disciplines

- the development of breeding methods and of half-way breeding material
- the evaluation and stimulation of new research fields
- the protection of plant breeders' rights
- the evaluation of new cultivars
- the foundation of gene banks
- the execution of breeding where private enterprise is as yet inadequate.

Private companies may concentrate on:

- the applied research directly related to the development, production, maintenance, and marketing of cultivars
- the execution of some of the above public tasks under the responsibility of the government.

This division of effort may lead to a profitable specialisation of research groups each acquiring appropriate skills and concentrating on different aspects of the plant breeding continuum. In this view, public institutes are instruments of policy making. It is their responsibility to challenge private breeders by demonstrating new developments and by continuous open discussion of research programmes, based on the conviction that public and private sectors are partners in a cooperative process.

In general, the actual division of tasks depends on the state of development of plant breeding in a country and on the development of the private breeding companies. The marginal area between public and private is continuously moving: where private enterprise further develops it should take over more tasks of the public area, and public institutes should concentrate more on basic and new research. Overlap of activities results in competition between public and private and that is undesirable because it discourages cooperation.

It is the government's responsibility to coordinate the division of tasks and cooperation and to attune the public activity to the private enterprise. It is therefore crucial to create and maintain a two-way continuum in information: in one way a stream of new knowledge which originates from the fundamental research, is integrated in breeding and then applied in practice; in the reciprocal way a stream

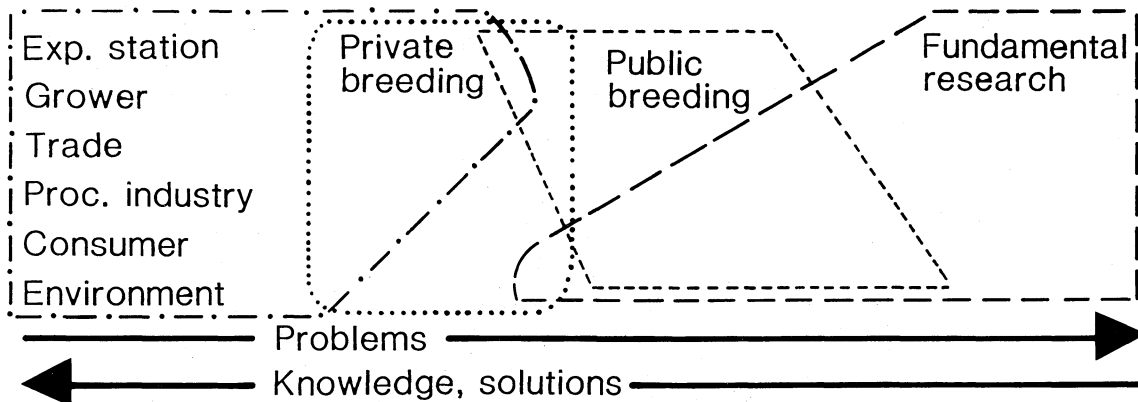


Figure 1. Partners in cooperation and division of tasks, the basis of a two-way continuum. Overlapping areas indicate direct interactions.

of problems is defined in practice for which solutions are sought in (fundamental) research (Fig. 1). Such a continuum protects against ill-balanced and disturbing developments.

In this view, public breeding — in cooperation with private breeding — acts as a bridge between the two extremes: the fundamental research and the application of knowledge in practice. This function can only be carried out in the correct way through well-developed contacts with all sectors of the agricultural industry.

A public breeder's research policy

A breeder's research policy is to a large extent determined by current and anticipated problems in agriculture. Growers form the main target group of public breeding. Private breeding companies are an essential intermediary between public research and growers.

In public breeding research institutes, setting priorities in a research programme is a problem of balancing a complex set of factors. Social as well as scientific developments should be taken into account.

Social developments that influence the breeder's programme are:

- changes in the development of different branches of industry
- developments in the relevance of crops and problems, their current and potential economic and social importance, the international market position, development in production costs, production systems and production periods
- development in the capabilities and interest of private breeding companies
- consumer's interest in quality and food safety
- the need for product diversification
- concern for the environment, e.g. the effect of heritable resistance to chemical pesticides
- genetic erosion
- problems of developing countries.

Scientific developments influencing a breeder's programme include:

- development of knowledge on host-parasite and other intimate partner relationships
- possibilities of computer-aided simulation techniques
- developments in biochemistry and physiology
- developments in molecular and cell biology.

In general, the degree of knowledge is increasing and a more fundamental approach to breeding research is necessary. Continuous changes in its environment mean a public institute needs a receptive, flexible and self-critical attitude to realise the importance of a continuous test of its programme. The programme should continually change and reflect, or rather anticipate changes in practice.

A research project is started, changed, or stopped after considering the:

- expected perspective of (further) breeding research
- relative potential of achieving improvements by research other than breeding
- costs of a project
- the expected gain in knowledge from the project.

Interactions between public and private breeding

To have a vigorous public research programme information about developments in agriculture and other sectors of society should be available. This information can only partly be gathered from literature. Both a broad knowledge of the industry and direct communication with the target groups is needed. To this end, public institutes need an organisation which guarantees their programme is continuously and critically discussed by a wide range of interested parties. A system of a board and advisory committees for each area of research is suggested. In each group room is given for the direct influence of the private sector and a full evaluation of views, opinions, and interests should take place before deciding on research priorities.

Once a decision has been made and a project is running, periodic discussions between research workers and private breeders on progress, the value of the material developed, and the moment of transfer to the private companies are very useful. Extension meetings also play an important role. It should be stressed that all these discussions allow the public institute to influence developments and programmes of private breeding companies. In this way a situation is created for a flexible development of the division of tasks, a cooperation based on mutual trust and interest, and shared responsibilities.

A crucial aspect of the division of tasks is the moment when a breeding project is transferred from a public institute to private breeders. The products of public research may be knowledge and/or new material. In the Netherlands new knowledge and methods are published and are free of charge. If material is produced this may in some cases be in the form of cultivars (in asexually propagated plants) but it is mostly half-way breeding material. Cultivars are distributed by plant propagators who pay the public institute a license fee. Half-way breeding material is released to the registered Dutch breeding companies. This release of breeding material logically results from continuous discussion on a research project. A hearing is organised to discuss the release procedure and the price of the material and the board of the institute eventually decides on the release. The price of the material is based on the costs of the project, the prospects of the material, and the feasibility of the price. In general the aim is to recover 10-15% of the financial input involved in developing the released material.

A very direct influence on a public research programme can be exercised by the private sector through contract research. This interaction may increase the national research capacity by efficient use of the existing infrastructure. It can stimulate cooperation between research organisations, strengthen multidisciplinary research and it may even lead to new structures for making policy. In order to prevent disturbance of a public research programme and to restrict potential conflicts of interest, regulation is needed regarding organisation, financial and legal aspects as well as regulation regarding openness of information. Contract research projects must be compatible with the policy of the institute and must not disturb its infrastructure (management, assistance,

equipment). Such projects must not be at the cost of the running programme and the normal responsibility of the institute.

Another possibility for the private sector of making use of the existing infra-structure is the creation of funds to stimulate certain research fields at public institutes. Recently this was done in the Netherlands with the integration of developments of molecular and cell biology into breeding research. This approach gives public institutes extra room for the exploration of new research areas without too much risk to the existing programme.

Separate or joint approach

Part of a government's responsibility regarding agricultural production is to see to it that plant breeding is efficient. It should also provide the correct conditions for development. But in the absence of any private enterprise in some areas of plant breeding, the initiative must be taken by public institutes.

Once private breeding companies exist, public institutes should aim for maximum development. Then, as the private companies are evolving, the division of tasks, as discussed above, may be revised. This will lead to specialisation and increased efficiency.

In the above view, public and private breeding each have their specific place and task in the necessary continuum, i.e. a joint approach with separate tasks. Generally, a public institute should concentrate on those aspects of breeding and research that cannot (yet) be taken care of by private enterprise, i.e. the more experimental and unexplored areas of research, and the removal of bottlenecks in breeding. Further activities should be delegated.

Other approaches may lead to competition between public and private breeding which could impede the necessary development of private companies (especially when private breeding is still in its infancy). Non-cooperative approaches will only accentuate the different priorities of public and private enterprise and further distract public institutes from the continually required new research. If public institutes fail on the latter point, private companies may have to seek information elsewhere.

The desired continuum should also include an organisation which controls the health, identity, and vitality of plant material supplied to the grower. Monopolies and their unfavourable consequences should be prevented. Within certain limits sound competition between private breeding companies may be a major factor for progress.

In order to have maximal productivity the joint approach — which prevents overlap and competition, is stimulating and thus makes one plus one more than two — is preferred. Flexibility, thorough discussion and broader criticism should be strived after. One of the advantages of a small country, i.e. the relative ease of organising interaction and coordination, should be exploited.

A recent example of the need for cooperation in breeding research is the integration of some developments

in molecular and cell biology. At first not many plant breeders were aware of the relevance of the new possibilities and only some took the initiative of critically evaluating them in relation to plant breeding objectives. On the other hand most molecular biologists have insufficient insight in plant breeding and problems involved in the science. In this situation coordination is indispensable.

CONCLUSION

Plant breeding, a broad and complex multidisciplinary field of research with a great potential for optimising agriculture, must be approached from different angles. If public and private activities are both carried out the partners should, for efficiency, divide tasks and cooperate. Public activities are preferably concentrated on education, fundamental research, protection of breeders' rights, and cultivar evaluation. Private enterprise may cover all applied research related to the development, production, maintenance, and marketing of cultivars.

To have a continuous development of this system of division of tasks and attunement of activities, interactions between public and private sectors are to be stimulated and organised. A two-way continuum in information (problems v. knowledge) should be strived after. Reciprocal, open criticism and confrontation of views should be encouraged. The research programme and further activities of public institutes must aim at stimulating an optimal development of private enterprise.

The above means that public and private sectors should have a joint approach with separate tasks. Overlap and competition between public and private activities should be prevented.

Small countries may be big in taking advantage of an intimate public-private cooperation, avoiding waste of resources, and expressing the collective responsibility for a continuum.

SYMPOSIUM DISCUSSION

Dr A. Rathjen, University of Adelaide

I would like to take issue with the fundamental parts of the address. It seems to me that the fundamental problem is that you said the private breeders are an essential intermediary. I disagree. Public institutions have suffered for a very long time from government funding cuts. One of the underlying problems throughout this conference is the various cuts — at PBI, DSIR, universities. One of the things that we have to be very careful about indeed is that our public institutions survive. They do have to produce things which are useful to consumers. Private breeders moving into the profitable area of plant breeding is very damaging to public institutions and I submit that really the very expensive part of breeding is done at public institutions. There are only three important bodies, the consumers, the producers and the plant breeders. I don't see the need for private industry in the area.

Hogenboom

I was talking about the responsibilities of target groups and government as seen from the point of view of responsibility. And when you have the responsibility of making sure everything goes well with the population then I think it is not too difficult to give private breeders a very important intermediate function. It is not impossible for me to see that public institutes may no longer be needed after 20 or 30 years. That depends on the capacity of private breeding companies. Some of them are doing very well and are doing their own rather basic research. I think for at least basic sciences there will always be a place for government institutes to do the basic developing new research. But we can not deny that private enterprise has a very nice field of activity in doing applied research and selling varieties.

Rathjen

In the ideal world it would work but the governments

do not really see themselves as having any responsibilities. They do in the social areas but not in long term development.

Hogenboom

I think the important thing is to have communication and movement, everything else will develop according to the type of society you are in.

Sir James Stewart, N.Z. Wheat Board

Is there any government pressure on you in the Netherlands to commercialise your operations?

Hogenboom

Yes, there is pressure, even more pressure than here. We have two pressures, first commercialise and the second is go into the direction of more fundamental research. This is acting like scissors because the two pressures are opposing or accumulating. It is not bad to be under pressure.