ON VISIONS AND NEW APPROACHES

Case studies of organisational forms in organic plant breeding and seed production

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SUMMARY

This report is based on an exploratory study of the social, financial and legal organisation, and technology applied in five initiatives in the sector of biological seed production and plant breeding in the Netherlands, Germany and Switzerland[1]. The study is carried out by researchers of the Chairgroup Technologie en Agrarische Ontwikkeling (TAO) of the Wageningen University and Researchcentre (WUR), and was comissioned by Louis Bolk Institute and Platform Biologica.

The report is an exploratory study of the social, financial and legal organisation, and technology applied in five initiatives in the sector of biological seed production and plant breeding in the Netherlands, Germany and Switzerland. The experiences of the studied initiatives are relevant in a period in which interest for organic seed and plant breeding is increasing. A number of the actors in the organic sector consider organic breeding a guarantee the availability of suitable seeds and varieties for the organic sector in terms of agronomic and quality traits. An important requirement is that seeds are produced and developed with technologies that are accepted in the organic sector. In addition, the organic sector is interested in breeding strategies that aim not only at economic, but also at social sustainability.

The analysis of the five initiatives concentrates on the limitations and the choices by the involved actors made in the course of their development. The main conclusion of the study is that the social and financial organisation, and technologies used in the initiatives show functional coherence. Two circuits are distinguished in the study, i.e. the bio-dynamic circuit and the bio-classic circuit. Each of the circuits shows its own characteristics and coherence. The perspective of the actors on the mission and function of plant breeding is an important factor in their choices. Choices of sources of capital for financing the initiatives play a crucial role. Those that opt for capital from donations and legates (bio-dynamic circuit) seem to have a different development path of breeding and seed production than those that use conventional capital arrangements (bio-classic circuit). The use from the two distinctive sources of funding corresponds, respectively, to organisations that develop a network structure and a more classical organised one. Both types of organisations can be seen as initiatives that have to conform to the principles of capital providers in the use of technology and marketing strategies. At the same time, however, they are both innovative. Summarising, it is concluded that the diversity of the perspectives of the actors in the organic sector provides opportunities to explore new pathways in breeding and seed supply for the organic sector. Over time, as their improved materials become available, the viability of the different approaches will become clear.

[1] Jongerden, J., C. Almekinders & G. Ruivenkamp, 2002. Over visies en nieuwe wegen. Cases van organisatievormen in de biologische veredeling en zaadproductie. Stichting Zaadgoed/Platform Biologica/Technologie en Agrarische Ontwikkeling/Wetenschapswinkel WUR, Wageningen. pp57.

CHAPTER 1. INTRODUCTION AND ANALYTICAL FRAMEWORK

1.1 Background

The subject of seed production and plant breeding in organic agriculture has received increasing attention over the past few years as a consequence of developments in biotechnology. Traditionally, breeding and seed production were based on crossing and selection at the plant and population level. Biotechnology developed cell- and gene level technologies (e.g. anther culture, protoplast fusion, range of DNA transformation techniques) that are now common use in breeding and seed multiplication. In organic agriculture gene technology is not accepted. In addition, cell technology and hybrid varieties are much discussed in bio-dynamic agriculture. It is expected that the application of these technologies as well as the number of varieties developed with them will increase. Consequently, the availability of planting materials that can be used in organic agriculture will most likely decrease because seeds of such varieties can not be used and also because these varieties can not be used in further breeding for 'organic' varieties. To ensure the long-term availability of seed and the choice of varieties, the organic sector therefore needs to address the issue of seed production and plant breeding. In addition, the organic sector feels that the availability of suitable varieties for the organic production hinders development of this agricultural production sector. Current available varieties are developed for the conventional sector. Environmental conditions in organic production are different from those in the conventional sector and ask for other varieties. Above considerations are underpinned by the EU regulation 2092/91 which forces organic agriculture to use biologically produced seeds. In the transition period until January 2004, derogation is possible for seeds that are short in supply. After January 2004 all organic production has to use organic propagation material.

Development of organic seed production and plant breeding can expect to meet a number of constraints. In organic agriculture, the vision on sustainability includes economic and social sustainability at plant and farm level. This influences practices such as fertilisation and crop protection. As a consequence, growing conditions are different and presumable more variable than in conventional agriculture. Region-specific characteristics and adaptation of varieties play a more important role than in conventional agriculture. For that reason, a variety developed for the organic sector is likely to be planted over smaller areas than varieties for the conventional sector. In addition, the on-farm saving of seeds for next planting is likely to be more common in organic agriculture than in conventional agriculture, in particular for grain crops, vegetatively propagated crops and some annual vegetables that are easily multiplied. This further lowers the possibilities to recover costs of variety development and seed production.

1.2 Cases

To study the extent in which the above mentioned considerations are a problem and how they can be dealt with, five initiatives in organic seed production and breeding in Germany, Switzerland and the Netherlands were studied:

- The *Bingenheim Initiative,* started in 1985 as a network of mainly bio-dynamic vegetable growers with the objective to supply seed among themselves;
- *Sativa Rheinau* in Zwitserland, founded in 1999 as a vegetable seed company;
- *Vitalis Biologische Zaden* in the Nederlands, started in 1995 by Jan Velema and focusing on production and genetic improvement of vegetable seeds;
- *Getreidezüchtung Peter Kunz* in Zwitserland, started in 1982 as a one-person initiative in cereal crop breeding, concentrating on spelt and wheat;

- *Getreidezüchtungsforschung Darzau* in Germany, initiated by Karl Jozef Müller in 1987, also as a one-person activity focusing on variety improvement and research in cereal crops.

The selection of the cases was based on the conditions that the initiatives i) needed to be involved in plant breeding, ii) included both field and vegetable crop breeding initiatives, iii) involved initiatives arising from farmers-vegetable growers as well as from plant breeders, iv) produced seed for the commercial-professional market, and v) had a history of several years, in order to be able to draw lessons from their experiences.

1.3 Objective and research questions

The central objective of the study was to analyse how these initiatives have developed over the years, which factors played a role in their development and which lessons can be drawn from them. Based on this central objective, three research questions were defined.

1. *How are seed production and breeding organised, and what is the role of the various actors involved?* In the conventional sector, the roles of plant breeder, seed producer and farmer-producer are differentiated quite distinct and clearly defined. In the organic sector, the differentiation of these roles is less marked and, to a certain extent, considered undesirable on the farm level.

2. *How is production of plant material organised in financial and legal terms*? Investors are usually looking for short-term profits. Breeding programmes require long-term investments, which makes it difficult to find capital. This is even more so for breeding initiatives that follow unconventional pathways. What alternative sources of capital are used and are these sources more restricting than conventional sources? For the possibility to recover the invested capital, the use and protection of the products of breeding efforts in the market is a key issue.

3. *How are seed production and breeding organised in terms of knowledge and technology?* Organic agriculture rejects gene and cell technologies in plant breeding, and hybrids are disputed. This leads to the question of how to recombine and select from genetic diversity.

1.4 Structure of the report

The report describes the cases in Chapter 2. In Chapter 3 and 4, financial, regulatory and market elements are discussed. Chapter 5 elaborates on the technologies used in the organic initiatives, and discusses the importance of collaboration among breeders and producers. Chapter 6 describes the development paths of the five cases over the past few years. The report finishes with a chapter with concluding observations.

1.5 Delineation

With organic breeding we refer to genetic crop improvement through the development of new varieties within organic farming systems with methods and technological trajectories that are acceptable in organic agriculture production. Organic breeding is a relatively new activity. Some people consider it goes back to the 1950's when persons influenced by the ideas of Rudolf Steiner worked on crop improvement. The mid-1980's see the first organised activities in organic seed production. Among these initiatives are three cases analysed in this study: *Getreidezüchtung Peter Kunz Getreidezüchtungsforschung Darzau* and the *Bingenheim Initiative.* The other two cases in this study, *Sativa Rheinau* and *Vitalis Organic Seeds* are young organisations that work in organic seed production and genetic improvement of horticultural crops. The four initiatives in Germany and Switzerland are

bio-dynamic initiatives; Vitalis Organic Seeds is bio-dynamic and organic (the company's farm holds both certificates).

Next to seed production by organic initiatives, we see organic seed production in the conventional seed sector. Companies like *Rijk Zwaan* and *Bejo Zaden* produce seeds under organic conditions of conventional varieties that they consider specifically suited for organic production. In these cases we speak of organic seed production without organic crop improvement.

In this report we distinguish seed production and plant breeding. We speak of maintenance breeding when we consider the selection in plants and seeds that is needed to keep the variety in accordance with the description of its characteristics. With seed provision we refer to the total of organisations involved in the supply of planting material. With the market we mean the market of seeds, unless specified otherwise. In the context of this report, the user of seeds is the farmer or vegetable producer.

CHAPTER 2. THE CASES: INITIATIVES IN ORGANIC PLANT BREEDING

2.1 Bingenheim Initiative

The Bingenheim Initiative comprises three organisations*:* the *Initiativkreis für Gemüsesaatgut aus Biologisch-Dynamischer Anbau*, the seed enterprise *Bingenheimer Saatgut AG,* and *Kultursaat*.

Initiativkreis. The basis of the Bingenheim Initiative lies in the Inititiativkreis für Gemüsesaatgut aus Biologisch-Dynamischer Anbau, or shortly the Initiativkreis. The Initiativkreis is an association which was founded in 1984. It has presently around 120 members, mainly bio-dynamic vegetable growers. Members are mostly from Germany, but there are also members from Switzerland, France, Austria, Italy, Israel, Spain and the Netherlands. The purpose of the association is to produce bio-dynamic seed, for which the members also carry out maintenance breeding. The Initiativkreis has a fairly loose and informal organisation structure; the legal status of the membership is not yet clearly defined. Some members are – as a breeder – also member of the Kultuursaat.

Bingerheimer Saatgut AG is basically a seed enterprise. It was an initiative of the Initiativkreis and the antroposophic community Bingenheim. The purpose was to jointly organise and co-ordinate seed processing and distribution in a more professional manner. The decision to adapt a more professional attitude resulted in 1987 in the organisation of a seed-processing workshop within the confinements of the Bingenheim Community. Until recently, this workshop was known as the Allerleirauh-Saatguthandel. Allerleirauh contracted organic seed producers for the delivery of seeds of vegetables, herbs and flowers. It cleaned and packed seeds. Marketing of seeds occurred through a catalogue. Initially, it only sold seeds of free varieties, i.e. varieties that were not protected by plant breeders' rights and therefore freely available to the public. Later, seed was also produced under license of a number of varieties from Hild, an independent vegetable seed company. When Hild was taken over by Nunhems Zaden the license agreements were terminated. Allerleirauh also marketed seeds of varieties that were developed by members of the Bingenheim Initiative. Allerleirauh was organisationally a part of the Bingenheim Community. In November 2001 Allerleirauh was transformed into the Bingerheimer Saatgut AG.

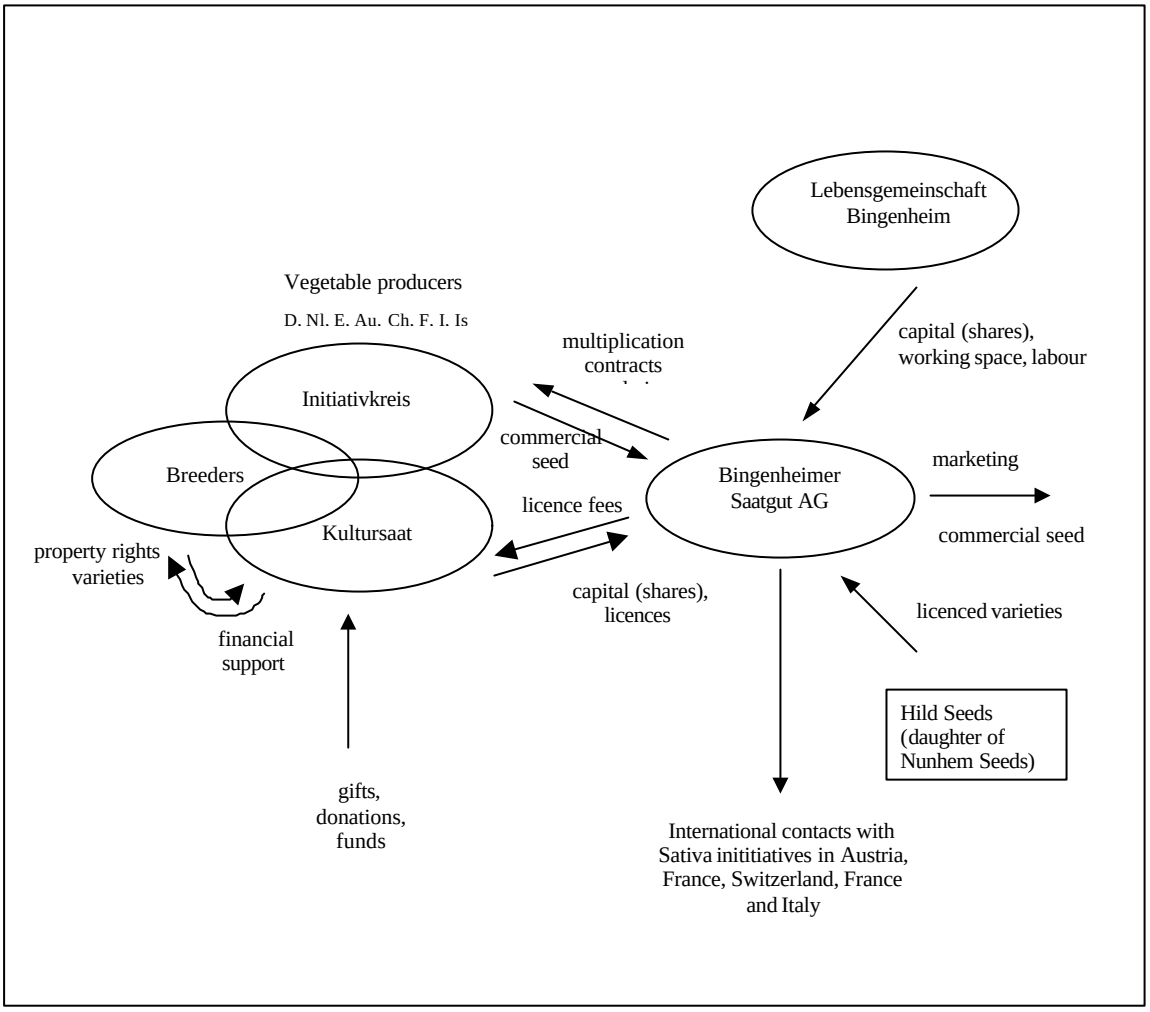


Figure 2.1 Organisation of the Bingenheim Initiative

The participants of the initiative see the transformation of Allerleirauh into Bingenheimer Saatgut AG as a logical consequence of the growth of the initiative. The organisation became too large to be able to continue within the Bingenheim Community. When the responsible co-ordinator decided to leave, the moment had arrived to discuss a new formula. Shares of Bingenheimer Saatgut are held in an AG (Aktien Gesellschaft) by the members of Kultursaat (3%), the Initiativkreis (20%), the Bingenheim Community (20%), the Software Stiftung (49%) and other known patrons. Shares can only be sold after approval of the AG. This formula allows for financial independence from Bingenheim Community while maintaining a direct relation with and the influence of the stakeholders. An additional argument for the transformation was the need to establish a formal and regular labour contract for the people working in the seed enterprise.

Kultursaat

To support and stimulate the breeding work of a number of members of the Initiativkreis, a separate organisation was created: Kultursaat. Kultursaat has ± 400 members and a total annual budget in 2000 of around € 440.000, mainly stemming from contributions and gifts – which flow in for an important

part via the Gemeinnützige Treuhandstelle (Kultursaat, 2001). Approximately € 275.000 of the Kultursaat budget is channelled to the 23 breeding initiatives that it supports. The ownership of promising materials developed by the breeders is handed over to Kultursaat. In its capacity of legal owner, Kultursaat formally presents the materials for variety registration and takes care of the costs and responsibilities involved. This situation is a reflection of the fact that the breeders consider private ownership of varieties as inappropriate. The materials may be the work of an individual breeder within the initiative, but they are considered the result of a collective effort (Zschunke, pers. comm.). So far, Bingenheimer Saatgut AG has been the only organisation that produces seed of the Kultursaat varieties under license.

The breeder-members of Kultursaat develop only lines and populations, according to the guidelines of bio-dynamic agriculture. As parental material they use free varieties and other commercially available varieties. They also evaluated a range of materials from genebank collections, but so far these have hardly been used in their crossing work.

2.2 Sativa Rheinau GmbH

Sativa Rheinau GmbH produces, processes and commercialises seed and has breeding activities in a number of vegetable crops. It is an independent organisation, but has close relations with the Swiss Sativa Genossenschaft, Peter Kunz and the Bingenheim Initiative. There is narrow collaboration with other seed producers such as De Bolster in the Netherlands. Sativa Rheinau was created in 1999, has 5 staff workers and forms part of a partnership of bio-dynamic producers who work the estate Gut Rheinau, a former monastry. Sativa Rheinau sells seeds of vegetables, herbs, flowers, grains, grasses and clover. Much of the seed production takes place on Gut Rheinau, but some seed is produced by contract farmers.

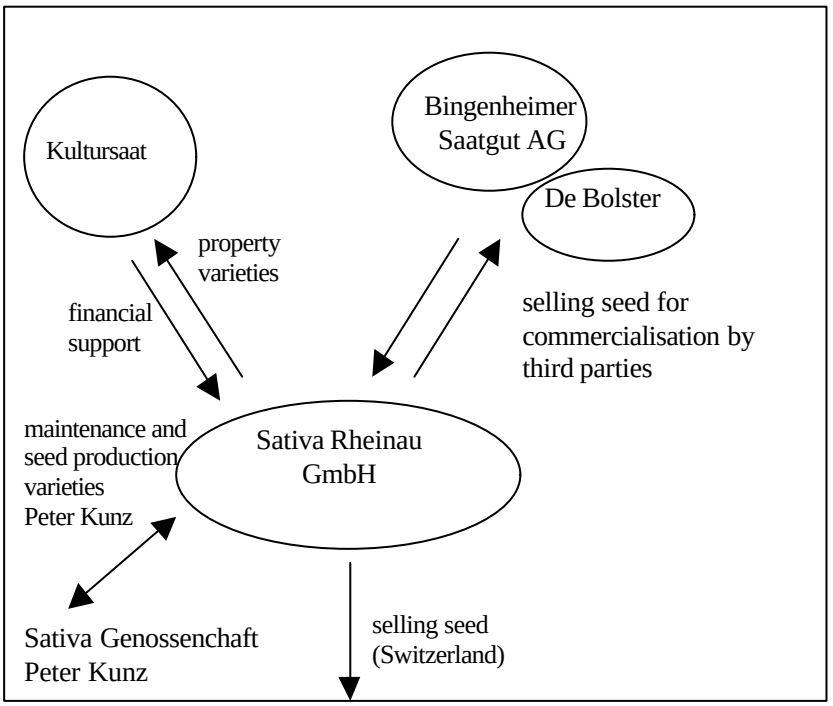


Fig. 2.3 Organisation Sativa Rheinau GmbH

Revenues of seed sales of Sativa Rheinau are flowing back into the breeding programme. Investments are made to up-grade facilities for seed production and breeding. The breeding activities of Sativa Rheinau are supported by Kultursaat. Amadeus Zschunke, who is responsible for the breeding and seed production in Rheinau, has developed 7 varieties (of 6 different vegetable crops) which have been submitted for testing to the Bundesortenamt in Germany, in order to make commercialisation of the varieties in the EU possible. Kultursaat is the owner of these varieties and Zschunke represents Kultursaat before the Bundesortenamt. In addition, Sativa Rheinau markets around 30 own selections of free varieties.

2.3 Vitalis Biologische Zaden

Vitalis Biologische Zaden produces organic seed of vegetables and herbs bearing the EKO and Demeter certificates. The size of the breeding activities is still relatively small. Vitalis works independently, but Enza holds shares of Vitalis. Vitalis Biologische Zaden started her collaboration with Enza in 1995. The collaboration enables Vitalis to use breeding materials and sales channels of Enza (see also Ch. 3).

Initially, Vitalis Biologische Zaden maintained links to the Bingenheim Initiativ. This provided Vitalis with a channel to sell her seeds via Allerleirauh and Bingenheim. The collaboration did not, however, develop any further. The membership-based organisation and meetings in which members discussed the strategy of the Initiative did not fit with the more company-oriented organisation of Vitalis. In addition, the interest of Bingenheim Initiative for varieties did not match the type of materials that Vitalis aimed to develop. Vitalis concentrated on developing and producing seed of modern varieties, including hybrids. Most of the varieties were produced under license from a range of seed companies, some others were Vitalis' own selections. Bingenheim choose to market only populations and lines, many being older free varieties. This brought along that many professional vegetable producers that aim at meeting the needs and standards of supermarkets and their clients purchase seed from Vitalis. Bingenheim varieties have more demand from vegetable producers who focus on delivery to local

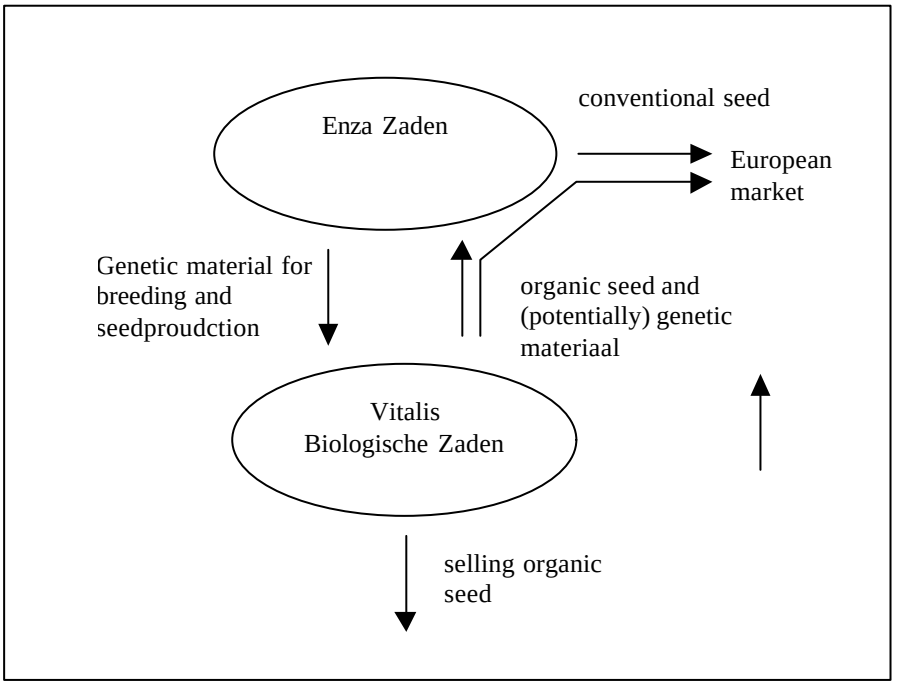
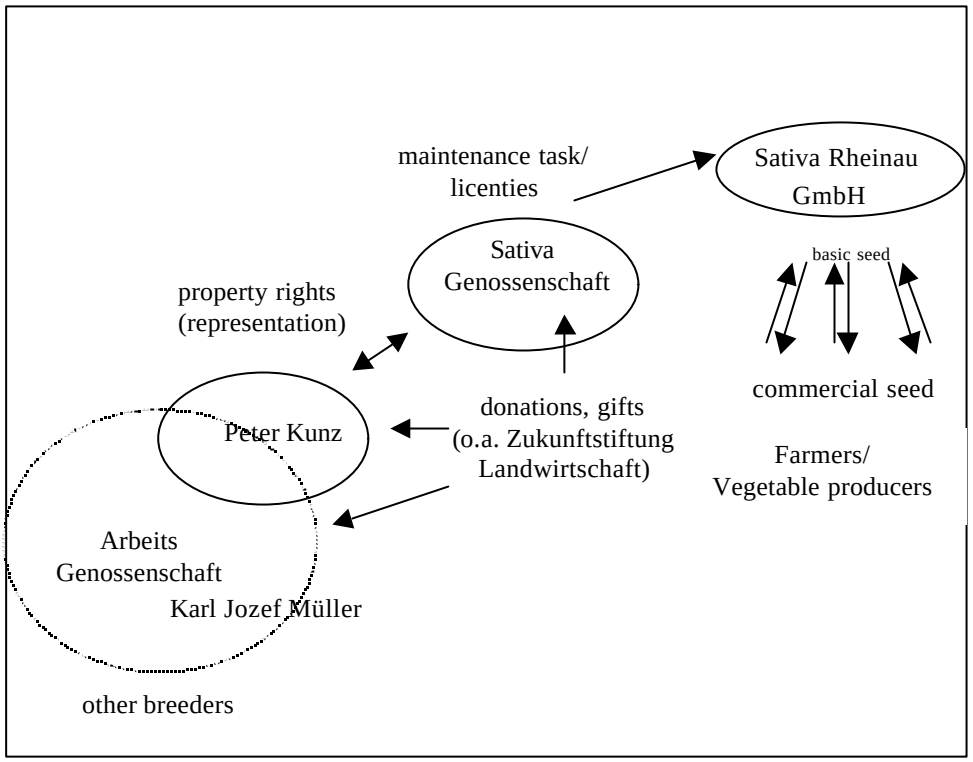


Fig. 2.3 Organisation Vitalis Biologische Zaden

Fig. 2.4 Organisation Getreidezüchtung Peter Kunz



reform shops, farmer markets and subscription services. Also, the organisation and financial structure of the two initiatives are different. Vitalis is a company with a classical organisational set-up, showing clearly distinct roles between the company's breeding and seed production activities and the clients. In Bingenheim, the roles of breeders, seed producers and clients are partly mixed.

2.4 Getreidezüchtung Peter Kunz

Peter Kunz in Switzerland did the first crossing work in 1984. In 1992 he created the one-man company Getreidezüchtung Peter Kunz which was transformed into the foundation Getreidezüchtung Peter Kunz – Verein für Kulturplanzenentwicklung – which is a more tax-favourable construction. The foundation has 4 part-time staff members and uses additional seasonal labour. Next to breeding, Peter Kunz and his group carry out training activities and research.

Peter Kunz and his people work primarily with barley, wheat, emmer and spelt. Each year, they make approximately 200 crosses of old and new conventional varieties. Baking quality and performance under low-input conditions are the main selection criteria. The initial idea to develop varieties on different farms from F3-generations turned out to be too labour intensive. Now they evaluate F6-generations on a range of farms for identification of the best materials.

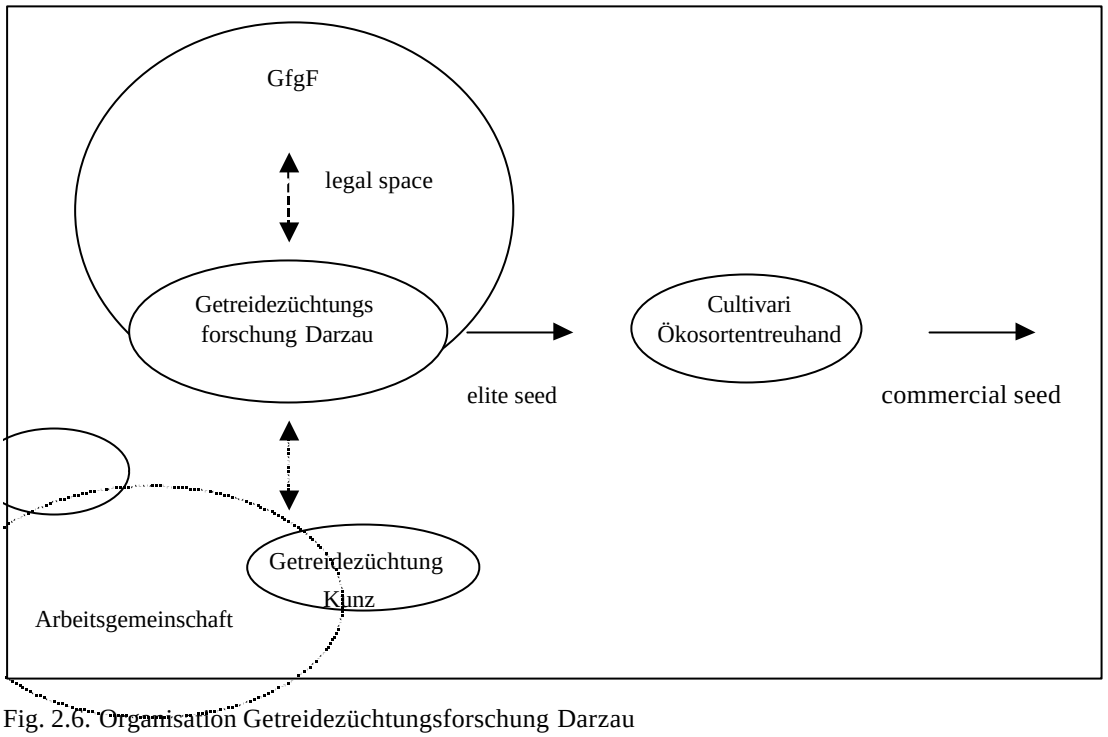


Fig. 2.6. Organisation Getreidezüchtungsforschung Darzau

Peter Kunz collaborates with 5 other bio-dynamic cereal breeders in Switzerland and Germany (among whom Karl Jozef Müller) through the Arbeitsgemeinschaft der biologisch-dynamischen Getreidezüchter. Through this collaboration, Peter Kunz evaluates materials of others while he has his material evaluated in other conditions. The Arbeitsgemeinschaft also functions as a medium for collective fund raising, such as with the Saatgutfonds. The Saatgutfonds actually requires such collaboration to make sure their funds are effectively used and that there is no overlap in the work of the various breeders it supports. The foundation of Peter Kunz is almost exclusively financed through gifts. Approximately 25 % of the funds are contributions from small yearly donations. Part of the research activities are financed from funding sources, e.g. the Rudolf Steiner Fonds.

The best materials of the breeding activities are submitted for testing and registration via the Sativa Genossenschaft für Demeter-Saatgut in Switserzland. This is a foundation of about 800 members (mainly farmers and consumers) which legally represents Peter Kunz in variety registration. It also takes charge of the costs involved in the registration and testing of the varieties. At present 4 wheat varieties and 2 rye varieties are under evaluation. The (actual) seed production of the varieties is subcontracted to Sativa Rheinau. Sativa Genossenschaft is also actively involved in the development of market-chain and price agreement with flour mills, bakers and consumers. Sativa Genossenschaft also carries out awareness and fund raising activities. For example, it has a campaign to seek ‘parenthood’ for their crop varieties. ‘Parents’ of a particular variety are expected to take care of the costs of registration and maintenance of the variety. The Sativa Genossenschafts’ involvement allows Peter Kunz to concentrate on breeding. A sister organisation of the Sativa Genossenschaft is under construction in Southern Germany.

2.5 Getreidezüchtungsforschung Darzau

Getreidezüchtungsforschung Darzau in Northern Germany is a cereal breeding and research initiative of Karl Jozef Müller. The underlying motivation for the scientific curiosity is to find and understand

the characteristics and methods for developing varieties for organic and regional agriculture. Karl Jozef Müller and 4-5 part-time assistants are collaborating with other cereal breeders through the Arbeitsgemeinschaft der biologisch-dynamischen Getreidezüchter. They have tested a wide range of conventional varieties and materials from gene bank collections, principally from Austria, Switzerland and southern Germany. Like Peter Kunz, the initiative is funded through gifts. The Getreidezüchtungsforschung Darzau is an independent initiative under the auspices of the Gesellschaft für goetheanistische Forschung. The Gesellschaft forms the legal home for Darzau and does the administration. Darzau carries, however, its own responsibility for seeking funds. To produce and commercialise the seed of future Darzau varieties, Karl Jozef Müller has created Ökosortentreuhand. (see also Ch. 6). As in the case of Peter Kunz and Sativa Genossenschaft, the objective is to allow Karl Jozef Müller to concentrate on his core activities, i.e. breeding and research.

2.6 Conclusions

In the cases of Bingenheim and Sativa Rheinau, the vegetable growers and seed producers play a key role. There is also a combination breeding and seed production tasks (including vegetable production in some cases). In the Bingenheim initiative, a separate organisation was created to process and commercialise the seed. Sativa Rheinau does its own commercialisation in Switzerland. In the other initiatives, breeders play the main role. In the case of Peter Kunz and Darzau, the seed production and commercialisation has been delegated to enable them to concentrate on breeding. Vitalis occupies an intermediate position: although the breeder has a central role, breeding is combined with the production and commercialisation of the seed. For the commercialisation of seed, the sales network of Enza forms a functional channel.

The similarity between the initiatives is the increase of tasks as the initiative grows. The vegetable growers' activities evolve from seed production towards seed commercialisation and marketing. Cereal breeders move from breeding into seed production and marketing. With exception for Vitalis, the increase in tasks is associated with an increase in differentiation within the initiatives, resulting in a larger number of entities. The network structure is an eye-catching feature of the vegetable growers' and cereal breeders' initiatives. The Bingenheim network and the Arbeitsgemeinschaft are network structures that have a function in the seed flows and funding of breeding activities. The Arbeitsgemeinschaft is also functional in the evaluation of breeding materials. In the case of the Bingenheim initiative, the network plays a key role in the ownership of the varieties. In contrast, the cereal breeders opt for individual ownership.

Concerning the financial organisation of the initiatives, Vitalis stands apart from the other four initiatives. Where the others rely heavily on capital from gifts, Vitalis uses market capital. This also gives rise to the question about the financial sustainability of the initiatives. Vitalis needs to demonstrate its sustainability under conventional market mechanisms. For the other initiatives, the future will tell if the sources of capital that came in as gifts can be considered starting capital or whether continuous support from donations will be required.

CHAPTER 3. FINANCIAL ORGANISATION

3.1 Introduction

Investments in crop improvement and seed production call in both sectors for a long-term commitment while profit margins are relatively low. New initiatives also require high investments in knowledge and breeding material. These points are even more important in the initiatives in organic crop improvement and seed production. The organic sector is still very small and, given the importance of specific local conditions (see also chapter 5) and on-farm saving of seeds, it is expected that also in the future the market will be relatively small and diverse. Furthermore, where organic seed production in conventional breeding and seed enterprises can build on the knowledge and materials developed over decennia, the bio-dynamic initiatives still have to build this basis. In addition, the non-conventional organisation and development path of the initiatives in the bio-dynamic sector increases the distance to conventional sources of capital for investment. Furthermore, conventional sources of capital are also conditioning the course of development (Van der Ploeg, 1999: 32) – a course that may not fit the bio-dynamic vision. The bio-dynamic sector uses funds from other sources that, though moderate, do offer opportunities to explore new pathways of development.

3.2 Sources of capital and visions

Four of the five breeding initiatives are strongly inspired by anthroposophy, i.e. Bingenheim Initiative, Sativa Rheinau, and the two cereal-crop breeding organisations. In the anthroposophic vision, plant breeding does not necessarily have to be economically profitable. Based on this consideration, funds from legacies, foundations, gifts and donations are routed to the plant breeding activities. Some of the breeders deliberately choose to use this source of funding, for others it is just an alternative and legitimate way of financing activities that are necessary in a sustainable society. Funds are also obtained from individuals and organisations that reject gene technology, but do not necessarily share the anthroposophic vision. There is some income from licences to others for producing and marketing seeds of the initiatives' varieties.

Contrasting with this vision is the one from Jan Velema of Vitalis: Vitalis obtained capital via shares of Enza in the Vitalis enterprise and 'green', subsidised, loans. This expresses a conventional market vision: after a period of time, the sales of seeds have to ensure the viability of the enterprise.

3.3 The use of capital from gifts

The breeders in the bio-dynamic initiatives receive funds from legacies and foundations in the form of gifts. The Gemeinnützige Treuhandstelle e.V. (GTS) and the organisations Kultursaat, Arbeitsgemeinschaft in Germany and Sativa Genossenschaft in Switzerland play key roles in the channelling of funds to the breeding initiatives. GTS administers legacies and other funds. Via the Zukunftsstiftung Landwirtschaft and the Saatgutfonds (two funds that fall under the GTS), the various bio-dynamic grain and vegetable crop breeding initiatives received more than € 800.000 in 2000 (Fig. 3.1). GTS defines conditions related to the use of the funds which are in accordance with the interests of those whose funds they administer. In effect, this means that GTS does not support initiatives that use gene technology or hybrids. GTS considers its role as a coordinating one and also advises third organisations that have an interest in supporting organic breeding, such as the Gerling Foundation and AG Software.

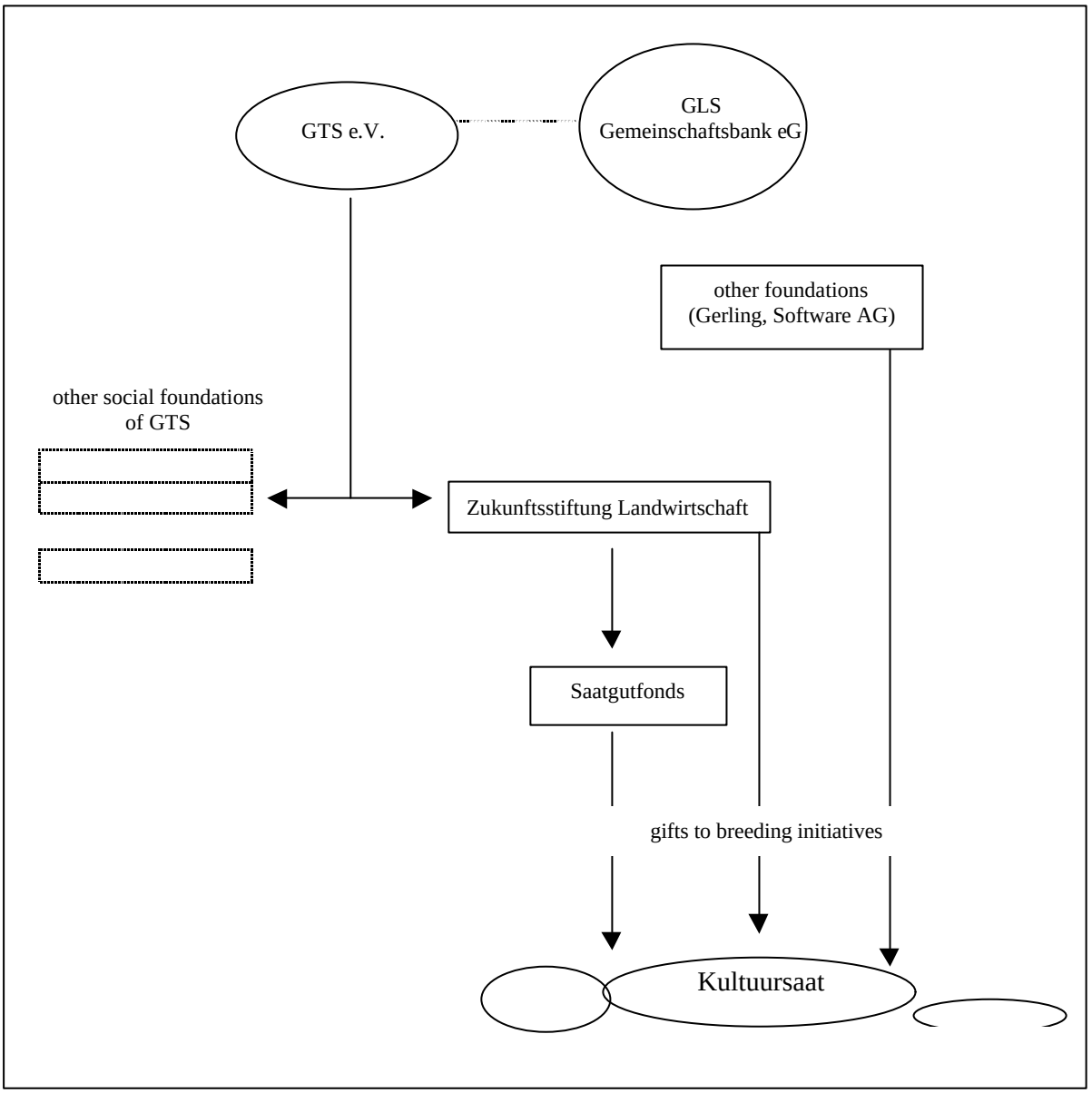


Fig. 3.1 Capital flows from various involved breeding initiatives and funding organisations

Kultursaat and the Arbeitsgemeinschaft decide themselves on the allocation of received funds over the various breeding activities of the members. In 2000, Kultuursaat had a budget of more than € 400.000 from larger and smaller gifts, and income from licences for seed production and sales. Approximately € 275.000 was used for the 23 breeding projects within Kultursaat (Kultursaat, 2001). The five grain breeders who are united in the Arbeitsgemeinschaft receive funds from a range of organisations, among which the Zukunftsstiftung and the Saatgutfonds. As an example, Peter Kunz Getreidezüchtung receives funds from the Saatgutfonds, SAMPO, Rudolf Steiner Fonds, and others. Approximately 25 % of the budget of this organisation comes from donations of around 250 individual supporters. Darzau, which has a programme of comparable size, has 1 full-time and 1 part-time employee, uses a total budget of less than € 180.000. Sativa Genossenschaft in Switzerland counts around 800 members. They provide the financial means for the variety testing of the most successful materials of Peter Kunz.

The commercialisation of vegetable seeds does not cover the costs of breeding, but they form a significant contribution. Contrarily to most of the vegetable crop breeders, the grain crop breeders do not have an income from seed sales of a current assortment of 'free' varieties. In contrast, the grain breeders have invested for more than 10 years in genetic improvement without selling any seeds. Peter Kunz calculates that, although the size of his programme and wages are modest, the total costs for his first variety are also likely to be in the range of € 200.000-450.000 (pers. comm.).

3.4 Sources of conventional capital

Vitalis makes use of conventional capital sources. Next to capital from shares that are held by Enza, the enterprise uses loans from 'green' investment schemes (see also 3.2). These schemes have lower interest costs, due to Dutch government policy regulations. Sativa Rheinau has a lower profitability than many other seed companies, but it is profitable thanks to hard working and modest wages. This allows for some investment, but additional capital is needed for the organisation to develop and become more professional. The company tries to use the conventional capital market in a creative way. They are looking for supporters who are willing to provide surety for Sativa Rheinau's bank loan.

3.5 Financial means derived from seed sales

Bingenheim and the two grain-crop initiatives aim at rewarding and maintaining the breeding efforts. They do so through seed price agreements and contracts on payment of a percentage for on-farm multiplication of purchased seed. This means that seed prices in these cases are not established through market mechanisms but are socially constructed. Payment is not seen as a way to recover the investment but as a contribution by the user to the development/breeding efforts. Such a social construction of seed prices is especially important for the grain crop initiatives as grains are more easily multiplied by the farmers on their farm. A large part of the vegetable growers buy seeds for every planting since saving vegetable seeds is more labour-intensive.

3.6 Market for seeds

Bio-dynamic producers concentrate mostly on the small-scale users. These are mostly farmers and vegetable growers who commercialise a large share of their products through local markets, house-to-house sales and subscription services. These farmers have other preferences for variety characteristics than the farmers who produce for supermarkets (Lammerts van Bueren et al., 2001). In this first market sector price agreements are normal practice. In contrast, Vitalis focuses on farmers who produce at larger scale and sell via chains of supermarkets. This market sector operates with similar price mechanisms as the conventional market.

3.7 Future funding

The financial means for the initiatives in the future are not secured. It is expected that funding will fluctuate. By building a wide network of supporters, the organisations hope to be able to cope with these fluctuations. If more financial means will become available in the near future, these are most likely used to increase the effectiveness of the present initiatives. The people involved consider that the effectiveness can be significantly increased through closer collaboration and evaluation of each others' material.

It is also important to see to what extent the attracted funds have to be considered as a starting capital or whether a permanent financial input will be necessary to keep the breeding activities going. In general it is not expected that the sales of seeds and licences to reproduce the developed varieties will

be able to cover the costs of the breeding activities. However, at present they already form a substantial contribution and it is expected that these sources of income will increase as more and better varieties will become available. In addition, opinions in the groups vary as to the extent to which the breeding should be able to function without any financial support. The organisations are therefore actively searching for additional funding mechanisms. For instance, Sativa Genossenschaft in Switzerland now looks for 'godparents' who want to carry the costs of evaluation, registration and maintenance of the cereal varieties. Also, the development of price agreements with actors in the food-production chain are seen as an alternative.

3.9 Conclusions

Although capital for the bio-dynamic breeding is limited, the initiatives have been able to generate sufficient means to start functional breeding activities. Nevertheless, the size of the activities is modest and many opportunities are still not exploited. There is a firm belief that financial means will increase over the years to come and this will provide opportunities to increase the effectiveness of the initiatives through more intense collaboration. The initiatives show that two visions and financing strategies can be distinguished: gifts in combination with price agreements with the market actors, and conventional market mechanisms. The capital in form legacies, gifts and donations are alternatives in which economic market factors are not the only or strongest drivers. This enables the initiatives to find their own path development. Giving shares like Vitalis did is another way to obtain capital, but this implies a dependency from the share-holding company. Both sources of funding can be seen as steering and conditional, in particular in technology application and marketing strategy. It means either dependency from those who provide the gifts or, alternatively, from the institutions providing the loans or capital. In both cases one could argue that these conditions exert an influence on the development path of the initiatives.

The question whether the used capital is starting capital, or whether the initiatives will need a continuous financial support is difficult to answer as long as these initiatives do not have an own portfolio of organic seeds of different varieties.

CHAPTER 4. REGULATION OF THE USE OF PLANTING MATERIALS

4.1 Introduction

With regulation of the use of planting material we refer to the conditions that apply to the market of the seeds and other propagation materials. We distinguish a number of domains that influence the admission and protection of organic planting materials: the International Convention on Protection of Varieties (UPOV) and the Dutch law on Seed and Plant Materials (Zaaizaad en Plantgoed Wet, ZPW); the EU regulation and EKO-certification of organic products; and finally the Demeter-certification (see figure 4.1). In this chapter we describe how these domains influence the organic breeding and the position of the various initiatives.

4.2 UPOV and ZPW

The International Convention on Protection of Varieties, known as UPOV (Union Internationale pour la Protection des Obtentions Végétales) is a recognition of the contribution of breeders to the development of improved varieties by providing them with the exclusive right of property and use of

new varieties. Property right for a variety can be given when the variety is new on the market and meets the DUS criteria: it is ‘Distinct’ from other varieties, ‘Uniform’ and ‘Stable’. The UPOV, first held in 1961, is the basis of the Dutch system of plant breeders’ rights. UPOV has undergone several adaptations, the last one in 1991.

The Dutch law on the use of Seed and Plant Materials (ZPW) of 1967 replaced an earlier law of 1941, and defines both the plant breeders’ rights and regulations on commercialisation of planting material. The principal objective of plant breeders’ rights is to stimulate breeding activities by granting breeders the rights of commercial exploitation of varieties. The regulation of commercialisation also aims to protect farmers and vegetable growers by allowing only seeds of good varieties to be commercialised. In addition, the law defines the control of seed quality (germination, seed health and genetic purity). In 1991, the UPOV strengthened the plant breeders’ rights by extending the exclusiveness of use: the permission to farmers and vegetable growers of using their own saved seed from last year’s harvest (farmers’ privilege) is not automatic but a possibility only: it needs to be explicitly mentioned in the national seed laws (see article 15.2 of UPOV). The Dutch seed law does not allow farmers’ seed saving of protected varieties without permission of the breeder, but it makes an exemption for small producers (see Jongerden et al, 2002). Organic breeders seem to subscribe to the compensation for on-farm reproduction of protected varieties, for reasons that are further elaborated in 4.5.

The DUS criteria defined by UPOV are a serious limitation for the varieties developed by organic breeding initiatives, in particular the condition of ‘uniformity’. The fact that organic production

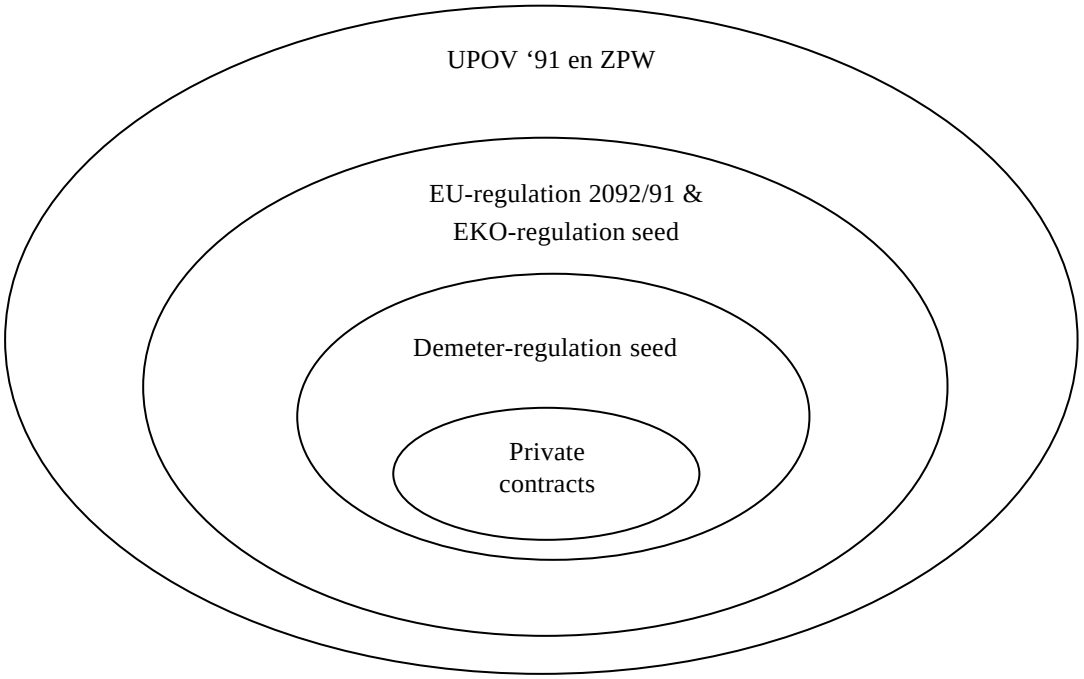


Fig 4.1. Domains of regulation within which organic seed and propagation material are being used

conditions are distinct from those in conventional production plays an important role. Firstly, the levels of fertilization are lower and, consequently, soil fertility shows more variation. In such conditions, genetic uniformity is seen as a disadvantage as it would reduce the buffering capacity of the crop. Also, the capacity to adapt to the specific farm conditions is reduced in genetically uniform varieties. Secondly, because of the difference between the conditions of testing (conventional) and the ones for which they were developed (organic), the varieties often show inferior performance in the testing. The fact that conventional bread preparation is usually different from bread preparation in the organic sector contributes to low performance for the organic wheat varieties in the bread-quality testing (see also Lammerts van Bueren et al., 1999, 2000).

4.3 EU regulation and EKO certification

On June 24, 1999, the EU approved regulation 2092/91 referring to organic productions and methods applicable to it. Among others, it stipulates that seed used in organic production should be of organic origin. In practice this means that the mother plant of seed and vegetatively propagated plant parts should be (re)produced for at least one generation under organic conditions without use of gene technology. Conditions for EKO certification comply with the EU regulations on organic production.

A transition period would apply until January 2000 during which it was permissible to use seed that was not biologically produced for those crops and varieties of which there was not sufficient organic seed available. This transition period was extended until January 2004. After that date, derogation of the regulation will not be possible anymore. From then onwards, all organic production should utilise organically produced propagation materials. Further postponement of enforcement is considered undesirable. Such postponement would be detrimental to investments in seed production and variety development so far.

Regardless of these regulations on organic production, those applicable to the conventional seed sector remain valid (plant breeders' rights, regulations for variety registration and commercialisation). The regulations for organic production can therefore be seen as an extra restriction for that sector while at the same time defining a domain and providing opportunities for organic seed production and breeding.

4.4 Demeter

Demeter represents the certification of the Bio-dynamic Foundation in the Netherlands. Bio-dynamic production, including seed production, has to meet Demeter conditions and has to take place on farms that carry the Demeter certification. As of now, hybrid varieties can be used in bio-dynamic production. In the 2nd Green Seed Catalogue a number of Demeter hybrids are offered by Vitalis Biologische Zaden.

4.5 Positioning of the domains

The studied initiatives are positioned differently in the domains of regulation of property, commercialisation and the definition of what is organic seed. What can be called organic seed (EU-regulation 2092/91) is still not fully clarified: the debate on the compliance of particular cell and tissue technologies with organic production is still on-going at the moment of writing this report. It is also possible that hybrid seeds will ultimately not be accepted in the bio-dynamic domain. If hybrid seeds are not acceptable in the bio-dynamic domain, then, logically, the initiatives in bio-dynamic breeding will not develop hybrid varieties. This would particularly affect the availability of organic seeds from those crops in which hybrid varieties dominate. At present, conventional hybrids are used in the

organic sector in two ways. The conventional companies identify hybrid varieties in their conventional assortment of which organic seeds can be produced and commercialised. In the bio-dynamic initiatives, conventional hybrids are used to introduce new genetic variation in their breeding. Both ways of using hybrids form a (genetic) linkage between the conventional and organic sector (see also 5.4). Rejection of hybrids by the bio-dynamic sector will weaken this linkage. This can increase the difference in the portfolio of available varieties in the conventional and organic sector.

4.6 Protection and regulation in the bio-dynamic domain

Organic breeding also struggles with the regulation of the utilisation of their products, i.e. seeds, especially in the cereal crops. The first problem is the registration of the varieties. The cereal varieties developed by Peter Kunz, for example, are not considered sufficiently uniform and thus do not meet the standards of use as defined in the variety testing procedures. These standards are associated with grain yield and bread quality under conventional production conditions and bread preparation practices, respectively. Secondly, the compensation for the breeding efforts via seed sales is problematic. In this respect, cereal breeders seem to mimic the UPOV 91 regulation by requesting buyers of their seeds to sign a contract for on-farm reproduction of the seed. According to the contract, the farmers pay 60 % of the breeders' fee for every year they reproduce the seed, for a maximum period of 10 years. For a number of farmers this has been a serious drawback, giving reason to renounce to the use of the materials of Darzau. Kunz and the Sativa Genossenschaft aim at price agreements between the various actors in the bread-chain to be able to cover part of the costs of variety development. The price of seed of bread wheat is 50% higher than the price of conventional seed. It has been agreed that the breeders' fee is 9% percent of the seed price; this flows back into the breeding efforts, which is double of what happens in the conventional sector, i.e. 2-4%.

In the horticultural sector the situation of variety protection is different. Applying for variety protection is less common for vegetable crops. Although it is common practice that varieties from other companies are used in further breeding, commercialising each others' varieties is considered bad practice. This is supported by the fact that company and variety name recognition are important reasons for producers to use a given variety. Also, a competing company wishing to commercialise a successful variety of a competitor needs time to multiply sufficient seed in order to be able to commercialise it. In addition, applying for variety protection takes a long time and is expensive, whereas the turnover of vegetable varieties tends to be high and, consequently, life time of the varieties is short. Finally, on-farm reproduction of seeds is less common in the horticultural sector. The larger part of the vegetable growers buys seed yearly, also in the case of non-hybrid varieties of self-pollinating crops. This is explained by the fact that seed production of vegetable crops is a more specialised activity than for many agricultural crops. It is, for example, relatively easy to separate part of the grain harvest for seed for next planting. In contrast, for most vegetable crops, seed production does not coincide with the marketable product: selected plants need to be left in the field to mature in order to produce seeds. In addition, many vegetable crops are bi-annuals: carrot and cabbage seed, for instance, need a two-year production season.

4.7 Property and variety protection in the studied cases

All studied initiatives have varieties registered or in the process of evaluation for registration. The construction of property varies between the initiatives. Breeders-producers of *Kultursaat* have developed promising varieties of which they transferred the property (rights) to Kultursaat. Kultursaat has registered approximately 30 varieties of different vegetables. Kultursaat, as the owner, is also the

organisation with the responsibility to maintain the varieties and to give licences to third parties for seed multiplication, use and commercialisation. So far, only Bingenheimer Saatgut AG has licences for varieties registered to the name of Kultursaat. Selling price of seed of Kultursaat varieties to hobby gardeners includes € 0.20 per bag which flows back into the breeding efforts of Kultursaat. *Sativa Rheinau* has approximately 30 own selections of different crops, 7 of which are registered as Kultursaat variety. Sativa Rheinau also does the maintenance breeding of a number of free varieties that are sold via Bingenheimer Saatgut AG. Sativa Genossenschaft represents *Getreidezüchtung Peter Kunz* in the variety registration. Peter Kunz remains the owner of the varieties, but Sativa Genossenschaft is the organisation that carries the costs of the testing and maintenance of varieties and is responsible for the licences and money flowing back into the breeding activities of Peter Kunz. *Getreidezüchtungsforschung Darzau* has the ownership of its materials, but Cultivari Ökosortentreuhand is is responsible for registration, multiplying the seed and its commercialisation. *Vitalis Biologische Zaden* has a number of own selections of free varieties and has licences for a number of Enza hybrid varieties of which it produces and commercialises organic seeds.

4.8 Conclusions

The studied initiatives use different constructions for protection and property rights of the varieties. Kultursaat's construction is based on the argument that varieties developed with gift money cannot serve the income of individual breeders. This has resulted in the choice for collective property. The other initiatives use more conventional regulations, with Kunz and Darzau delegating the representation to other organisations. The decision to choose for individual or collective property is based on principles, but does not constitute a functional or practical restriction in the regulation of protection or commercialisation. Like in the conventional breeding, the pursuit of compensation and contribution to the breeding efforts is also important in the organic initiatives, to guarantee recognition and continuation of the activities. The main limitation is still the registration of the varieties – in particular of cereal crops, in which uniformity and use-value form the crucial criteria. As long as these criteria remain those of the conventional sector, the registration is likely to remain the principal bottleneck. Even so, this bottleneck is not linked to the acceptance or rejection of hybrids and other technologies, nor to the social and financial organisation of the initiatives.

CHAPTER 5 TECHNOLOGY AND BREEDING STRATEGIES

5.1 Introduction

Just as organic agriculture has been described as an agriculture without chemicals, organic plant breeding is often described as breeding without gene-technology. This description does not, however, render justice to the considerations and visions on which bio-dynamic initiatives are based nor to the way in which the initiatives translate these visions in the strategy and technology applied in breeding. To illustrate this, we elaborate in this chapter on the breeding objectives and methods of Getreidezüchtungsforschung Darzau, with complementary references to the other initiatives.

5.2 Problem definition and mandate

Development of knowledge and technology presumes a defined problem (Van der Ploeg, 1991). Problems in organic agriculture differ from those in conventional agriculture. This is reflected in the priorities and selection criteria of breeding programmes. One type of difference has to do with

production conditions. For example, aphids are an important problem in conventional lettuce production. The damaging type of aphid is, however, only a minor problem in organic lettuce production. Consequently, aphid resistance is a less important selection criterion in organic lettuce breeding. There are also differences associated with the market and consumer preferences for the organic vs. the conventional products.

Apart from the problem definition, organic breeding differs from conventional breeding in the perception of the mandate and role of plant breeding. Organic agriculture can be described as management of agro-ecosystems with the objective of sustainable supply of the regional market with safe and healthy food and non-food products, while maintaining a largely closed system (based on Goewie, 1995). Central are the agro-ecological sustainability at plant and farm level, the socio-economic sustainability, and the interaction between these (Lammerts van Buren et al., 1999). Diversity within and between varieties and crops, and the management thereof play an important role in the sustainability of agro-ecosystems (Almekinders et al., 1995). Whereas in conventional agriculture the genetic basis of crop production has narrowed considerably, organic agriculture aims at maintaining a genetically diverse production. This objective fits the perception that breeding has to play a role in maintaining the availability of diversity and in keeping this diversity in 'good condition'. This is in contrast with conventional breeding where the continuous introduction and replacement of varieties seems a necessity for breeding companies and farmers to survive.

5.3 Strategy

In the organic sector, farmers and vegetable growers are not only considered end-users of breeding products: they also form the environment in which breeding is integrated, as is the situation in most of our studied the cases. In some cases, the breeders work in a partnership, with the other partners being engaged in vegetable production, fruit production or animal husbandry. In others, the activities are more clearly separated in economically independent operating units. The land for trials can for instance be rented, but at the same time adjusting to the farms' rotation, as in the case of Darzau. The organisation of breeding activities on farm does not necessarily imply direct participation of farmers in the breeding activities.

An important element in organic agriculture is the recognition of the specific character of the farm and the region. In breeding terminology this can be translated as the objective of aiming at specific adaptation to farm and environment. Darzau, for example, develops cereal varieties that particularly suit the conditions of the region that is characterised by early drought in spring and the occurrence of mildew. Selection for rust resistance in the cereals is not important as it does not occur in the area. Aiming at a wider adaptation of the varieties would mean, on the one hand, a larger group of users, but, on the other, counting with more selection criteria, which would result in larger, more expensive breeding programmes. In any case, the Bingenheim objective of aiming at location specific adaptation seems also difficult to realise as it asks various breeders to work in and for different environments.

5.4 Methodology and technology

Plant breeders distinguish 4 phases in the development of varieties: i) the recombination of genetic variation, ii) selection, iii) variety maintenance and iv) production of foundation seed. The different technologies used in plant breeding are most relevant in i) and ii). They are applied at plant or population level, cell and meristem level, and DNA level (FiBL Dossier, 2001). At DNA level, the

distinction can be made between gene technology and marker technology. In bio-dynamic agriculture the technologies at DNA and cell levels are not acceptable. If, like now, the majority of the organic breeding activities are taking place in the bio-dynamic domain, these technologies are likely to remain irrelevant for breeding in the organic sector. Another discussion is the acceptability of hybrid varieties. On this point the opinions among bio-dynamic practitioners are variable. It is possible that in future hybrids will not be acceptable anymore in the bio-dynamic sector. At present, hybrids are widely used in the organic sector, including the bio-dynamic sector. Vitalis Zaden sells seeds of bio-dynamic hybrid varieties. In the view of the Saatgutfonds, development of hybrid varieties is not acceptable and is therefore not financially supported.

Rejection of various gene technologies has important repercussions for the flow of genes between organic and conventional breeding. At present, organic breeding can tap from the conventional sector. Vitalis Zaden uses materials from the conventional Enza breeding programmes to further develop them for use in the organic sector. Also other bio-dynamic breeders are using genetic material from the conventional sector (see 4.2 and 5.5). If in the future varieties developed with gene technology will dominate in the conventional sector, then the materials from this sector will be largely unusable as source material for organic bio-dynamic breeding.

5.5 Technologies used in bio-dynamic breeding

Bio-dynamic breeding generates diversity in the breeding process in different ways:

Crossing

Darzau makes crosses in cereals to develop new lines which can be used as varieties in bio-dynamic agriculture. Sativa Rheinau makes crosses to develop new vegetable varieties. The company uses conventional varieties as sources of new genes, including hybrid varieties. The segregation of hybrid varieties in following generations is also used to develop new lines through selection (in self-pollinators such a tomato). It is important to realise that this forms a genetic link between the breeding programmes of the conventional and organic sector.

Variation in selection

Crossing and segregation can be considered as the means to generate genetic variation (recombination) at plant level. Selection can be seen as the way to generate a diverse portfolio of varieties. This means that selection should not only be seen as an activity that reduces available variation. Bio-dynamic breeding initiatives use selection in variable environments and by different selectors as a way to select diversity.

Exploitation of variation in environment and time. Variations in climate, mineral supply, planetary constellation represent forms of variation in environmental conditions. They are the result of variation in time and place. Variation in environmental conditions leads to different materials being selected. Variation in selection environment is achieved by the biologic-dynamic breeders mainly through variation in sowing time and testing each others' materials.

Variation in selectors. Involving more selectors implies more variation in selection preferences. This means that variation can be better evaluated and exploited, which may result in more variation being selected.

One way to have more selectors is by involving farmers and vegetable growers. In a number of cases in the Bingenheim initiative, the role of the breeder and producer are combined in the same person. When the breeder is also producer, it is assumed that the breeder selects 'with the eyes' (preferences) of a producer. In Darzau, the farmer and breeder are different persons. The evaluation trials are on the farmers' fields, but it is the breeder, Karl Jozef Müller and his assistants, who make the selections. In both cases, additional information is obtained through evaluation of materials by colleagues.

Other techniques

The ear-bed method is a method used organic breeding in which the grains of an ear are sown in a row pattern, according to the position of the grains on the ear (FiBL dossier, 2001). The pattern of plants that grow from these grains represents the quality of the original ear. Cristallisation technique serves to determine the quality of the product. Research of Darzau, Peter Kunz and Sativa Rheinau is currently investigating the possibility to use this method to study differences between hybrid varieties and pure lines. Others study the possibility to use the interpretation of leaf-series as a quality criterion for varieties.

Exploiting location-specific adaptation

Selection under different conditions and by a larger number of people contributes to a larger portfolio of varieties with region-specific adaptation. In breeding this is also referred to as 'exploitation of location-specific adaptation' (see Jongerden et al., 2002). In addition to identifying the best variety for different conditions, this strategy contributes to a broad genetic base in agricultural crop production. It has, however, disadvantages, too. For example, varieties that were selected on the sandy soils of Darzau usually perform less well on the clayey soils of Kunz, and vice versa. This also explains varieties developed for specific conditions are often low-producing in the variety trials when presented for registration.

5.6 Results

Despite the relatively young age of the breeding initiatives studied, the first results of organic plant breeding already exist. The best beet root varieties in a taste evaluation test (Heine, H., 2000, in Gemüse) were the varieties Rodelika and Robila which are products of organic breeding. From the cereal breeding resulted some varieties that perform well under organic conditions. They have not been approved, however, for registration. They fail to perform well under testing conditions; the specific adaptation seems to be a crucial limitation. So far, Vitalis Biologische Zaden only markets some own selections from free varieties. In addition, it commercialises organic seeds from a number of Enza varieties, but no new ones resulting from its crossing programme.

5.7 Conclusions

In comparison with the breeding activities in the conventional sector, the collaboration between the breeders in the Bingenheim Initiative (vegetables) and the Arbeitsgemeinschaft (cereals) draws the attention. The collaboration in the form of a network allows for a decentralised approach. Such a decentralised approach is considered to be particularly suitable for variable environments – such as is thought to be the case under organic as compared to conventional production conditions (see Jongerden et al., 2002). This situation in the organic agricultural sector shows parallels with the small-scale agricultural conditions where participatory plant breeding is considered an appropriate strategy (see Almekinders & Elings, 2001). A decentralised breeding approach and participation of producers are however not necessarily linked. This is also a point of discussion in relation to participatory plant breeding in developing countries. In the cases we studied, the participation of producers-end users in

the selection is actually nil. The network structure of the organisations and the collaboration between the breeders does offer, however, an interesting opportunity to intensify the exploitation location-specific adaptation through increased involvement of end-users.

CHAPTER 6. DEVELOPMENT MODELS OF THE ORGANIC INITIATIVES

6.1 Introduction

This chapter describes the development of the organic breeding initiatives over time. We use a basic organisation model of the seed sector that considers genebanks - breeding programmes – seed production – seed users as the sequential steps in germplasm development and movement of seed. With the model we aim to show how some initiatives developed from seed production backwards into breeding. In other cases, the development was into a forward direction, i.e. from breeding into seed production and marketing. The chapter will elaborate on the different forms of horizontal and vertical collaboration that have given the initiatives their characteristic present shape.

6.2 Individual and collective experiences with seed production

With the development of modern plant breeding at the end of the 19th and the beginning of the 20th century, seed production and crop development became separate activities. Plant breeders' rights gave breeders the ownership of the varieties, which further strengthened the separation of breeding and seed production. In practice, however, this separation is not complete in all situations. For instance, in potato breeding in the Netherlands, the so-called hobby breeders, i.e. farmer-breeders, continue to play an important role in the pre-selection for the professional company breeder.

As far as seed production is concerned, it is important to realise that a significant number of farmers continue to save their own seed for next year's planting. For the Netherlands, an estimated average of 25 % of the seed used is farmer-saved seed (Ghijsen, 1995). On-farm seed saving is most common in cereals and (industrial starch) potato. In crops for which the harvested product is not the propagation material, like in many vegetables, seed saving is less common. According to plant breeders' rights as described in UPOV 78, on-farm saving of seed for one's own use was a so-called 'farmers' privilege'. Especially in the organic sector, seed production and use are in many situations not fully separated. On-farm saving of seed is considered desirable in bio-dynamic farming as it contributes to a closed cycle and adaptation to the specific farm conditions. However, since producing and saving good quality seed is laborious in most vegetable crops, the majority of the growers buy new seed. Breeding initiatives of organic-vegetable growers mostly originate from individual experiences with on-farm seed production. These experiences aimed at maintaining a closed production cycle for at least one or two crops on the farm. In addition to these individual farm-oriented initiatives, there are exchange-oriented initiatives. These mainly concern old, local and regional varieties of agricultural and vegetable crops that attract interest because of their special (culinary) characteristics or cultural significance (Mulvany, 2000). Exchange among members – as organised by the Henry Doubleday Foundation in Great Britain - avoids the problem that these varieties can not be commercialised because they are not registered (see Jongerden, 1999). The Dutch foundation 'De Oerakker' functions in a similar way: in turn for a membership fee, members can each year order seeds of a number of varieties.

Individual experiences with on-farm saving of seed and collective experiences with exchange of seed mainly concern existing free varieties or older varieties that have no commercial value anymore.

However, organic production also needs new, improved varieties that meet the requirements of the organic production systems and that are developed with accepted breeding technologies (FiBL, 2001; Lammerts van Bueren et al., 1999; Jongerden & Ruivenkamp, 1996). The emergence of organic breeding initiatives is an expression of this need.

6.3 Development direction of organic initiatives

From seed production to market and breeding

The study shows that development of professional breeding in organic agriculture can be carried by producers, i.e. seed users. This development model starts with seed production by the producers. From this, moving in backward direction, breeding activities are developed to feed the seed production with improved materials, and in a forward direction towards marketing activities (see fig. 6.1).

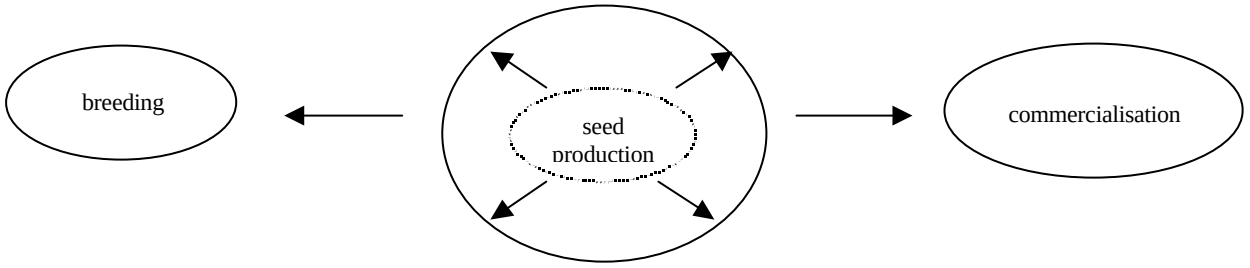


Fig 6.1 Development of breeding from seed production activities

This development model is seen in the Initiativ Bingenheim and Sativa Rheinau. Development of these two initiatives is associated in the first place by the growth of the assortment of varieties and crops of which seed is sold. This represents horizontal collaboration, i.e. among seed producers who aim at co-ordinated supply of a broad portfolio of seeds. A member of the Initiativ Bingenheim says:

> *'In the first years, the members of the Initiativkreis indicated what seed they wanted to produce. This was principally based on individual interests. This interest bears little relationship to the difficulty of the seed production of a particular crop: the affinity of the producer with the crop was determining. In addition, the suitability of the conditions of the location for a particular seed crop plays a role. After that, growers were specifically invited to produce seeds of those crops and varieties for which nobody had volunteered.'*

Crop knowledge of the producer is the basis for the seed production. The 'interest' and 'affinity' refer to this knowledge. The Initiativkreis stimulates further development of this knowledge by organising study days. As a consequence, crop study groups have developed and some of the growers moved into variety improvement. Through the Initiativkreis, growers and breeders co-ordinate among themselves the responsibilities for seed production and variety improvement of the various crops. The Intiativkreis increased from 15 members in 1984 to 40 in 1993, 100 in 1999 and ± 120 members in 2001. Most of them work according bio-dynamic principles, some of them work on an organic basis. The number of varieties of which the Initiativkreis produces seed increased from 97 in 1987 to 187 in 1993 and 320 in

2001, spread over a total of 57 crops (excluding herbs and flowers). The network development is associated with a significant increase in variety and crop portfolio.

With the creation of Allerleihrauh in 1987, the Initiativkreis created an intermediary organisation, developing into the direction of the (seed)market. Growers of the Initiativkreis produced seed by contract for Allerleihrauh while also being the shareholders of the seed intermediary. This way, the chain to the market remains in control of the Initiativkreis. With the establishment of Kultursaat in 1994, Bingenheim bundled the breeding activities in a special organisation. Kultursaat, most of all, functions as a catalyst in the area of financial matters (attracting and taking care of allocating the funds), generation and exchange of knowledge, lobbying, representation and strategy formulation. The backward step into breeding and the forward step into seed handling and marketing can be seen as the development of vertical collaboration in the seed chain. In other words, the Initiative develops as a network of horizontal and vertical collaboration.

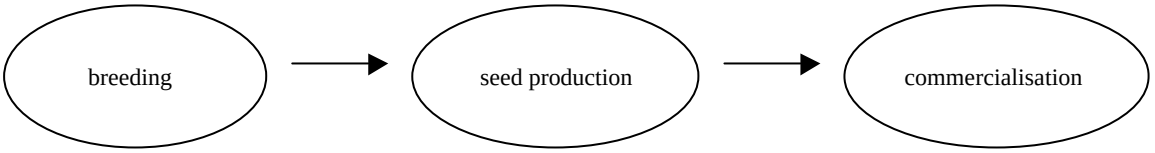
The move from seed production to breeding by the 19 vegetable growers that started Kultursaat – of whom 1 in the Netherlands, 2 in Switzerland, and 16 in Germany – was a logical development of their work. For seed production they practiced 'maintenance breeding': careful selection of the mother plants with the objective to maintain the variety characteristics as described in the variety registers. The selection becomes breeding when it aims to change the characteristics of the variety. This can be combined with the recombination of genetic diversity through crossing. The knowledge of the growers in selection forms the basis for the move into breeding. One of the members comments:

> *'The idea prevails that scientific knowledge is needed for breeding. We see this differently. Vegetable growers and farmers are in the field day and night, year after year. As a result they know the crops and are able to generate diversity and select from it'.*

In bio-dynamic agriculture the mixed farming is a common production organisation and a partnership is a common legal organisational form. We find that specialised vegetable seed production and breeding are often partner in such a partnership. An example: the Dutch member of the Initiativkreis and Kultursaat belongs to a partnership that runs a mixed farm. He is responsible for the seed and breeding activities, while the other partners are taking care of the production of fruit, agricultural crops, dairy and animals. The Swiss vegetable breeder in Kultursaat has bundled his seed and breeding activities in Sativa Rheinau GmbH. This company is administratively and financially separated from the rest of the farm activities, but partly run by the same people and on the same farm. At farm level we thus see specialisation within the mixed farming as a logical consequence of farmer-based breeding.

From breeding to seed production and marketing

Next to the network model, there is also a more linear development model that follows the step-wise development from breeding to seed production and marketing.



Figuur 6.2 Development of seed production and marketing from breeding activities

We see this model in the development of Kunz Getreidezüchtung, Darzau Getreidezüchtungsforschung and Vitalis Biologische Zaden. Since 1999, Kunz and Darzau, both established in the mid 80s, have several varieties in the variety testing for registration and admission. To supply and market seed of their varieties, they use separate organisations. Darzau created Ökosortentreuhand for production and marketing of the seed, with the objective to make it an independent organisation. Likewise, Kunz concentrates on breeding and has given Sativa Genossenschaft the representation of his varieties. In contrast with the situation of the Ökosortentreuhand, Sativa Genossenschaft is not an organisation that was especially and uniquely created for this purpose. Sativa Genossenschaft is an existing lobby organisation with ± 800 member-shareholders (see also 2.7).

The cereal initiatives are more individually based and organised than the vegetable initiatives, but the cereal breeders also have a horizontal collaboration. This collaboration is brought together in the Arbeitsgemeinschaft. Like Kultursaat for the vegetable growers, Arbeitsgemeinschaft is instrumental in the mutual evaluation of different breeders' materials, as well as raising and distribution of funds.

In contrast to the other initiatives, Vitalis Biologische Zaden can be characterised as a classically organised breeding company. With Enza Zaden holding shares of Vitalis, the two companies have created mutual access to different breeders' genetic materials. By this approach, Vitalis has chosen to build the organisation on the basis of collaboration with the conventional sector, rather than developing it from a organic basis.

6.4 Conclusions

In the studied cases we found three development models. Firstly, the vegetable growers' network – in which the number of participating growers determines the size of the portfolio of varieties and volume of seed production – with intermediate organisations for breeding and seed marketing controlled by the growers. Secondly, two more linear, classical organisational forms. There is the specialised organic breeding company with links to fellow-breeders and relations with market-partners that allow for social price formation. It develops intermediaries and linkages into the direction of seed production and marketing as products of breeding become available. One can consider this as chain-formation within the own sector. The third one is the classically organised breeding company having links with the conventional sector, and functioning on the basis of market mechanisms.

CHAPTER 7 CONCLUSIONS

7.1 Introduction

In this explorative study we used the concept of 'circuit'. We defined the *breeding circuit* as the specific way in which production, including the used technology, financing and regulation of use of seeds, are organised, emphasising their interrelationships. In our view, the studied cases are part of two different organic circuits, between which there is relatively little contact.

The *bio-dynamic* circuit consists of various initiatives of seed production and breeding that emerged in the middle of the 80s, some as a network, like the Initiativkreis, others as one-man initiatives, like the Kunz Getreidezüchtung and Darzau Getreideforschung.

The *bio-classic* circuit consists principally of (former) family-owned companies that are strong in conventional vegetable breeding. Some of these companies, like Bejo and Rijk Zwaan, have developed organic seed production as a specialised activity within their company. Others have developed, to this end, a collaboration with other breeding companies that concentrate on the organic market. Enza Zaden and Vitalis are examples of such a collaboration, and also Nunhems Zaden and Hild Samen.

We arrive at the following observations:

7.2 Seed production and marketing

1. The bio-dynamic circuit aims at developing a portfolio of lines and populations; the bio-classic circuit has a portfolio of hybrids, lines and populations. In those crops where hybrid varieties dominate – and where profits are potentially higher -, the bio-classic circuit dominates.
2. The bio-dynamic circuit builds its own marketing channels. The bio-classic circuit uses the well-developed marketing channels of the conventional breeding companies with which they closely collaborate.
3. The market of the bio-dynamic circuit is characterised by users that appreciate diversity of crops and varieties, i.e. small-scale vegetable grower and farmers who sell the produce via farmers' markets and subscriptions. Price agreements are normal in these markets. The bio-classic circuit aims at larger-scale producers, including supermarket chains. Prices are based on regular market mechanisms.

7.3 Breeding

4. Modest breeding activities are taking place in the bio-dynamic circuit, principally carried out by a network of breeders. In the bio-classic circuit, breeding is taken up by organic breeders, not by the conventional companies. The example in this study is Vitalis Biologische Zaden.
5. The breeding initiatives in the bio-dynamic circuit are autonomous breeding programmes. Breeding is based on the use of free varieties and varieties from the conventional sector.
6. For both circuits the possibility to use of varieties from the conventional sector as a source of genes decreases with the rejection of gene technologies. The limitations of using varieties from the conventional sector will further decrease as more technologies are rejected and varieties developed with such technologies are rejected for parental material.
7. The structure of decentralised breeding and centralised seed distribution, as it is found in the bio-dynamic sector, offers opportunities to exploit region-specific adaptation. In line with this opportunity is the possibility to intensify interaction with the end-users.

8. Depending on the regulation of the market (i.e. certification norms of the organic and bio-dynamic domain), the biggest opportunities for the bio-dynamic sector seem to lie in the segment of the market in which hybrid varieties do not play an important role, i.e. lettuce, pumpkins and beet root. If hybrids will be allowed, then the bio-classic circuit has a strong position as it can tap from the genetic sources in the conventional sector.

7.3 Financing

9. The bio-classical circuit works along the lines of conventional market mechanisms: seed sales finally have to finance breeding. This can account for the small scale of present breeding activities in this circuit. The bio-dynamic circuit does not depend on this market mechanism: the financial means available through gifts and other donations allow this circuit to start breeding initiatives at a modest scale, parallel to developing the seed marketing structure. Future will show the extend to which breeding can be sustained by revenues from seed sales or whether continuous financial support will be necessary.

7.4 Legal

10. The bio-dynamic circuit experiments with new collective ownership of varieties. Property rights of the varieties lie with a foundation or else the breeder is represented by a foundation. This emphasises their perception that the availability of the varieties is a public interest.

7.5 Technical

11. In the bio-classic and bio-dynamic circuit, GMO's are not allowed. In addition, the bio-dynamic circuit also rejects hybrids of cereal crops (of importance in rye), except for maize, and will possibly reject hybrids in vegetable crops when alternatives are available. The rejection of some of the 'conventional sector technologies' is associated with the development of appropriate organic technology trajectory. Rather than focusing on breeding technologies, it focuses on technologies to assess quality, such as crystallisation technique. Exploitation of the network structure of breeders' initiatives in terms of technology may further shape its organisation (i.e. through intensification of collaboration and decentralisation)

12. The acceptance or rejection of hybrids will influence the position in the seed market of the initiatives. If hybrids are accepted, the bio-classic circuit will be a strong competitor for the initiatives in the bio-dynamic circuit. If hybrids are rejected by the bio-dynamic sector, the bio-classic circuit will not be able to sell its hybrids in this domain.

7.6 Conclusions

The study shows that the social organisation of the breeding and seed initiatives, the applied and rejected technologies, and the financial-legal constructions are inter-related. In the various initiatives, breeders and seed producers make financial choices that are based on specific visions. These visions also define choices regarding the rejection of technologies. Also the social organisation is associated with the visions on the place and function of crop breeding in society. The mission statement of the Bingenheim initiative, for example, is to aim for an organisation with broad participation and transparency. The result is an organisation with a network-structure.

It is difficult to compare the various initiatives on each the separate aspects of social organisation, financing and technologies because of the diversity of forms, structures and visions. Some of the

obvious differences have been summarised under the differences between the two distinguished circuits, i.e. bio-dynamic and bio-classic. From these differences we conclude that each of the initiatives has a unique place in the total spectrum of organic breeding and seed production initiatives, each has its strengths and weaknesses, and each significantly contributes to a organic seed supply. All initiatives share the 'biological' element, which is a limitation as well as a challenge and opportunity.

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