



DYNAVERSITY

**Poma Culta,
apple breeding association
(Switzerland)**

Case study analysis

**DYNAmic seed networks for managing European diversity:
conserving diversity *in situ* in agriculture and in the food chain**



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PART 1: DESCRIPTION

1.1 Contextualising the case

Poma Culta was initiated by Nicklaus Bollinger, a biodynamic farmer from the Canton of Solothurn in the German-speaking part of Switzerland. In the 1990s, Nicklaus Bollinger had the opportunity to recover a plot of land a few kilometres from his home and decided to start arboriculture. The recovered land was immediately converted to organic farming with the production of apples from "modern" varieties such as Jonagold, Golden, etc. Soon, he realized how fragile these varieties were, being particularly susceptible to fungal diseases such as scab, mildew or marssonina. Several chemical treatments had to be carried out to secure an acceptable yield and quality of production. Nicklaus further reflected on his trees' phytosanitary problems when he compared them with the other crops he farmed successfully without chemical treatments. Although he managed his farm according to biodynamic principles taking special care of the soil's health, his apple varieties were still prone to fungal diseases. Therefore, he started questioning the adaptability of apple varieties to organic farming.

He decided to conduct systematic observations on different varieties, to identify the most susceptible and the most tolerant varieties. To do this, he sowed the seeds from apples obtained on the market or from local cultivars and/or varieties from Germany. With no prior information on the varieties he owed, he chose to learn by observing the trees' development and growth. In 1999, more than a thousand apple seeds were sown on his farm. After a few years of observation, Nicklaus was able to identify varieties with different degrees of vulnerability. In the beginning, he carried out this work in parallel to his farming activity; later, in order to scale up his variety selection activity to a more professional breeding work, Nicklaus decided to create a structure that would allow him to raise funds. In 2004, he founded the association Poma Culta, governed by a board of directors and with members who financially support Nicklaus' work. Each member must contribute 40 Swiss francs to be part of the association. The first funding came from close friends whom he invited to his farm. He explained the project to them and showed them the first trees and his selection work.

1.2 « Doing »

1.2.1 Properties WITHIN the initiative (closure)

Nicklaus is a farmer-breeder, so before multiplying and disseminating the varieties he selects, he undertakes all the steps of a breeding cycle: sowing; observation and characterization of the varieties in order to accumulate knowledge; breeding of the varieties which are most interesting. The first varieties sown by Nicklaus came from his own consumption. These are both so-called modern varieties and local varieties. In order to "get to know" (term used by the interviewee) the varieties; Nicklaus spends a lot of time in his orchard. He points out that the time spent with his trees allows him to observe and know each one of them. He carries out all the work himself, which allows him to develop a precise knowledge and observation of the varieties he holds.

To collect these observations, Nicklaus and his son developed a specific computer program and workflow: each tree is labelled with a barcode so that observations are directly recorded in a database. Nicklaus makes different types of observations: systematic observations are made for each tree (disease susceptibility, flowering/fruiting time, etc) and noted on a scale of one to nine; other observations which are more *ad hoc*, as they occur to Nicklaus as he walks around his orchard. The development of this program allows him to obtain data for each tree and reports from year to year. Thus, he can rigorously monitor the evolution of trees and cultivars.

Thanks to the characterization he has carried out for more than fifteen years, Nicklaus can now plan meaningful crossbreeding, which leads to disease-resistant varieties. For this, he collects pollen from the two chosen varieties and proceeds by manual cross-pollination. In a second step, the fruits resulting from this crossing are harvested and reseeded. He makes the first selections in the first years based on the resistance of the young plants to diseases. After the first three years, a new selection criterion is added, based on organoleptic characteristics. The interesting varieties that meet the desired expectations are propagated by grafting in the lower stem of non-vigorous rootstocks. This new plant material is then registered and named. Subsequently, other criteria will be evaluated, in particular agronomic traits, such as yield or the shelf life of the fruit. In 2018, Nicklaus made about twenty crosses.

Currently, Nicklaus is still in a test phase. This selection work requires a constant reflexion on the characteristics that he wishes to develop in these new varieties. The refined knowledge of these trees allows him to imagine which variety could compensate for the weaknesses of another variety (resistance vs. conservation; yields vs. resistance; etc.). Thus, some crosses are made with two varieties he has created before while others involve modern varieties. The varieties are propagated by grafting and remain within the orchard of Nicklaus' farm.

The Poma Culta association has joined forces with the Swiss Organic Agriculture Research Institute (FiBL) for this selection work. The FiBL does not carry out selection work but supports Poma Culta both on technical aspects of selection and on aspects related to plant diseases. Thanks to the laboratories of the research centre, Nicklaus' observations can be backed by a scientific analysis. Some of the crosses are also planted and tested at FiBL.

Furthermore, some members of Poma Culta have asked for grafts of the varieties created by Nicklaus. However, he is a little sceptic about this idea, since He claims his profession is that of the breeder and not the nurseryman:

"I don't produce trees."

However, when he produces too many grafts, he accepts to distribute his varieties, but in very small quantities. The applicant members must then sign a contract in order to undertake not to re-multiply and disseminate the variety obtained. This way, Nicklaus knows where these varieties are and protects himself legally. This collaboration with the members of the association also makes it possible to create a network for observations of the varieties' performance.

1.2.2 Properties BEYOND the initiative (outreach)

Poma Culta is part of the TEMA project which involves six other European biodynamic producers. The project tests varieties resulting from biodynamic breeding under different soil and climate conditions. In the long term, the objective is identifying it a variety capable of thriving under variable conditions in order to be marketed across several regions. Thus, producers exchange information on the varieties received (fruit quality, disease resistance, tree productivity) and contribute to the robustness of the data initially produced by Nicklaus. In 2017, the six producers in the project received twenty different cultivars from Nicklaus' breeding work. If producers agree on a promising variety, the possibility of legally protecting it can be considered, since these producers are close to distributors and could introduce a new variety on the market.

The Poma Culta association has not yet achieved a real commercial diffusion for its varieties. Apples from a variety from Nicklaus' work are occasionally sold at the Solothurn market in German-speaking Switzerland. This variety is called Brigitte B and it is interesting for its resistance to disease. It is planted on many lines in the farm's orchard to continue its characterization and is marketed when the harvests are large and there is enough fruit for sale. This variety is beginning to be known by consumers in the market and seems to interest more and more people thanks to word of mouth.

While seeds still circulate little beyond the network, Nicklaus is considering many ways to ensure the protection and marketing of the varieties he creates within the association in the future. These different channels will be analysed in part two.

1.2.3 Transformative effects beyond the initiative

The creation of varieties and therefore of seeds is carried out by the process explained in section 1.2.1 (sowing, observation and characterisation of varieties, data collection, grafting). Only varieties that meet the expected criteria in terms of fruit quality, shelf life, agronomic value (yields and limited year-to-year fluctuation in production) and disease resistance are maintained in the farm's orchard. Nicklaus' objective is not to create a conservatory, but rather to select interesting varieties that can help in the development of resistant varieties. Thus, some varieties can be maintained for several years, but if their resistance is bypassed and they become very susceptible to disease, they will be removed from the orchard. In the beginning, Nicklaus' breeding work focused on monogenic resistances; however, single resistance traits are very quickly bypassed by pests, which evolve with their environment. Indeed, the first varieties created were resistant for a few years, then became sensitive again. In order to achieve long-term resistance, Nicklaus' selection work started to focus on polygenic resistance¹. However, this work requires much more time and is labour-intensive.

The knowledge associated with the varieties present in the orchard is maintained and preserved in the computer program developed by Nicklaus' son. The recorded phenotypic data are cross-referenced with tasting data gathered in the winter season, with the help of FiBL researchers. Taste criteria are also very important, such as the firmness of the fruit, its juiciness and its sugar content. These criteria are crossed with "agronomic" data in order to produce a good summary about the variety. Each variety and each tree has its own characterisation sheet, which is updated from year to year. Nicklaus has not yet performed a statistical test with his entire database because it is not large enough.

1.3 « Organizing »

1.3.1 Properties WITHIN the initiative (closure)

¹ resistance governed by several genes

The Poma Culta association is governed by a Board of Directors (BoD) which includes five people. However, Nicklaus wants to be as independent as possible in his work as a breeder. Nicklaus makes the decisions on his own as to the technical selection choices. He consults the FiBL, but the final decision rests with him.

Nicklaus consults the BoD for financial issues, so that he knows what the funds allow to be done. Nicklaus' work through Poma Culta is based on the funds raised through different actors and/or organisations. Some of them come from active members of Poma Culta itself, others from private donors, generally pomology enthusiasts. Most of its funding comes from German foundations that support the future of organic and biodynamic agriculture. Thanks to these different actors, Poma Culta is able to raise about 30,000 Swiss francs (26,800 euros) a year.

Other projects also contribute funds, particularly European projects such as LIVESEED in which Poma Culta is partner. Poma Culta is beginning to be recognized as an active breeder in the organic and biodynamic field and is involved in a number of various projects.

Poma Culta has collaborated on numerous occasions with FiBL and Agroscope². The latter has also developed breeding programs for sustainable, input-free tree growing. Agroscope has not tested the varieties developed by Poma Culta, while Poma Culta tested the varieties from Agroscope's breeding programs. FiBL has not developed a research programme but participates in it through its scientific expertise. It supports Poma Culta in the phytosanitary analyses of varieties.

Currently, Poma Culta is part of a PAN project, of the Federal Office of Agriculture in collaboration with FiBL and Agroscope. The Confederation has allocated a budget of 150,000 Swiss francs per year (133,900 euros), for the conservation and use of apple genetic resources for organic farming. The purpose of this work is to expand the range of varieties offered in organic farming. The project aims to characterize Swiss apple genetic resources in order to estimate their potential. Local cultivars are either used directly or for crossbreeding with more modern cultivars. The objective of this plan is to find disease-resistant cultivars. The PAN project also focuses on the organoleptic quality of the fruit and its storage capacity.

In parallel with this project, the three organizations also collaborate on a project on old apple varieties. Prior to this, Agroscope carried out a characterization study of more than a thousand old varieties and selected about thirty that could potentially be of interest. Since 2016, the varieties have been tested in the orchards of Poma Culta and Agroscope to test resistance to fire blight, a bacterial disease that is currently a major problem in Switzerland. Poma Culta and Agroscope are participating in the project by hosting the thirty varieties in their orchard. Agroscope has a laboratory and also participates in the scientific analyses (bacterial resistance + organoleptic quality). FiBL does not have orchards, but participates in scientific analyses.

As a federal research organization, FiBL receives funding for research programmes. Biopartener, a certifying body, has granted funds to FiBL for the improvement of organic breeding. Part of this funding is intended for arboriculture and more specifically for selection work on Nicklaus' apples.

Poma Culta is part of many research projects on a Swiss and/or European scale, in particular thanks to its relations with FiBL (LIVESEED project for example).

In addition, Poma Culta has joined forces with the Bioverita association, which has created a label for selection under organic conditions. Nicklaus sees an advantage to this collaboration in that if one day his breeding work leads to an interesting variety, it will be able to benefit from the "selection under organic conditions" certification in addition to being a variety adapted to organic farming.

1.3.2 Properties BEYOND the initiative (outreach)

In order to extend its network and reach a wider audience, the association has developed a website where it makes its activity reports available to anyone. Currently the website is in German, but Nicklaus plans to translate it into English soon. In addition, awareness days on selection work and tasting days are organised on site or at FiBL. Farm days are organized each year with about thirty participants. During these days, Nicklaus presents the work and progress of his selection program. It thus raises participants' awareness of the challenges of arboriculture, for a more sustainable orchard.

Furthermore, it participates in many events (fairs, markets) that give visibility to this work: Pomology Day in Basel, the Solothurn market, the autumn organic market.

In addition, Poma Culta's participation in numerous European projects allows it to extend its network. During these projects he works with other breeders and/or producers with whom he can exchange on breeding techniques, the

² Competence Centre for Agriculture, Food and Environment of the Confederation

efficiency of organic breeding, etc. During a meeting in the Netherlands with the biodynamic producers' group, Nicklaus met Marc Lateur of the Centre de Recherche Agronomique de Wallonie (CRA-W)³, who is a scientist recognized at the European level. This meeting allowed him to exchange views on the guiding principles of his selection, to improve his crossing techniques and to make his activity known to other networks/organizations, which have the same objectives.

1.3.3 Transformational effects beyond the initiative

Poma Culta raises awareness of arboriculture issues through open days on the farm and/or market events. Poma Culta carries the idea of a sustainable and (chemical) input-free orchard. The association has been able to collaborate with various organizations to ensure that the selection work takes on a new, more scientific dimension.

However, the creation of the association was born from Nicklaus' initiative. Although the association is governed by a board of directors, Nicklaus decides alone on the future crosses to be tested. He exchanges and discusses with partners with whom he has already collaborated, but they do not participate in the decision-making process.

PART 2: ANALYSIS

2.1 Knowing

2.1.1 Properties WITHIN the initiative (closure)

Two types of knowledge can be described within the initiative.

First, knowledge derived from scientific protocols and, second, knowledge derived from practice and observation.

Knowledge from practice and observation is created through regular monitoring of the trees in the orchards. Agroscope and Poma Culta both have orchards to study the performance of trees over several years. Phenotypic but also organoleptic aspects are evaluated. In order to validate these visual and/or sensory observations scientifically, Poma Culta has teamed up with FiBL, which has the appropriate infrastructure to evaluate the data recorded in the orchard. FiBL's analytical laboratories confirm or reject *in-situ* observations.

The confrontation of these two types of knowledge enables the creation of robust results on which future crossings can be based.

2.1.2 Properties BEYOND the initiative (outreach)

Nicklaus' work, which began in the 1990s, is becoming known both in Switzerland and abroad. Thanks to years of experience and practice, Poma Culta has consolidated its reputation among breeders. Its collaboration with Bioverita also gives it visibility outside the network. The knowledge and skills associated with biological selection processes are transported by this label. It allows to convey practices and a philosophy.

Furthermore, the collaboration between Poma Culta and FiBL makes it possible to reach the scientific arena. The FiBL activity reports highlight the work carried out at Poma Culta. The various results obtained are mentioned in these reports and give visibility both to actors in the scientific field and to amateurs of organic farming.

The collaboration with the various actors involved in Swiss organic farming has enabled Poma Culta's work to reach a wider audience. The media has also begun to take interest in it. Nicklaus has received journalists on several occasions. The various interviews conducted made it possible to address questions about selection, but also why it is necessary. The articles popularize Nicklaus' work and make it accessible to the general public.

2.1.3 Transformative effects beyond the initiative

The knowledge and know-how developed within the network meets current expectations for more sustainable agricultural and food systems. Poma Culta's objective is to market quality apples while meeting the expectations of organic fruit growers. The varieties developed aim at meeting a double expectation: to meet human needs in terms of quantity and quality, but also to meet the plant's environmental needs. To do this, Nicklaus operates according to biodynamic principles. Thanks to his holistic vision, he has recreated a complex and resilient ecosystem within his farm

³ See Case Study 4 – Cross-border Fruit Network

and orchard that allows him to treat his orchard in a minimal way.

2.2 Framing

2.2.1 Properties WITHIN the initiative (closure)

The association works for both consumers and producers. Indeed, Poma Culta's primary objective is to create quality fruit that meets consumers' expectations in terms of crunchiness, conservation and aroma. The increase in demand for organic products in Switzerland further legitimizes the creation of Poma Culta. The association is a way of meeting consumer expectations by offering producers resistant apple varieties.

2.2.2 Properties of the BEYOND initiative (awareness)

Thanks to its collaboration with organizations that promote organic agriculture and selection, Poma Culta has succeeded in publicizing issues surrounding organic arboriculture. This point has already been discussed in point 2.1.2. Another way of making seed issues public is currently under consideration at Poma Culta. Nicklaus is thinking about ways to market his work and the issues surrounding it. In parallel with the search of potential distributors, Poma Culta is considering a way to protect its variety development work.

Indeed, selection work is not enough and a reflection on the marketing of fruit is necessary to attract new stakeholders. Nicklaus is in discussion with the producers of the TEMA project for a possible support in commercialising the varieties they find most interesting. However, these producers are afraid that on the conventional market, new varieties will not interest distributors and consumers. Faced with the pressure of mass distribution, Nicklaus considered a possible different strategy. One of the pathways being explored is the grouping and union of small organic shops, so that together they can register one of the Nicklaus varieties in the European catalogue. Thus, they would have the exclusive right over its marketing and could stand out from mass distribution. This approach is being analysed with several partners. Biopartener has many contacts which would be able to market the fruit and Biofram, which includes many organic farmers who could store the fruit. The protection of the variety would be done with Bioverita, in order to promote the biological selection process. This legal protection will also make it possible to perpetuate a cash inflow into Poma Culta's accounts and fund the breeding activities.

However, no commercial strategy is yet in place, but their discussion has involved new stakeholders which has contributed to raise the initiative's visibility beyond the network.

2.3 Networking

With regard to the development presented above, it is not the structures or individual actors that allow the network to connect, but rather the basic philosophy underlying the initiative. The search for a resilient arboriculture that is less demanding in terms of inputs and produces quality fruit is the common objective that brings together the different actors.

PART 3: SUMMARY

The first lesson that can be learned from this case study concerns the arrangement between Poma Culta and FiBL. Collaboration between a research institute and a private actor allows giving scientific value to the data produced. Thanks to their scientific nature, these data are recognised by other actors and go beyond the network's borders.

A second learning point can be drawn from the tension between a personal project and the need to use an association for fundraising.

A third lesson learned concerns the reflections around marketing. Indeed, it is necessary to think about distribution channels simultaneously to the selection work. Market research and/or the involvement of potentially interested actors is a key step in selection programs. The implementation of an economically viable project, where supply and demand meet, ensures is long-term sustainability.

Finally, an important take-home point is about the sustainability of the project. Today, Nicklaus' selection work is entirely dependent on the subsidies collected by the Poma Culta association. These private and public funds depend on membership fees and, most importantly, on the contribution of foundations, which may stop donating overnight. This funding does not ensure the sustainability of the selection work. In order to address this fragility, Nicklaus plans to

register and protect one of these varieties in the catalogue which could ensure a more constant cash inflow.