

The Food and Feed Value Chain of Faba bean in Switzerland

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1. THE FOOD AND FEED VALUE CHAIN OF FABA BEAN IN SWITZERLAND

1.1 Faba bean in Switzerland

In the Alps, especially in the canton of Graubünden, the first archaeological finds of faba bean date back to the Bronze Age, around 2200 BC (Jacomet, 1999). Several authors already described faba bean and its different varieties, such as Mattioli in 1563, or the Swiss doctor and botanist Johannes Bauhin in 1650-51 (Bauhin, 1650; Mattioli et al., 1563). Other descriptions followed, including one from the 18th century by an unknown author, who in 1766 lists the most diverse legumes that are cultivated. Faba bean has been used coarsely ground or boiled as fodder for livestock. Its green pods were used as a cooked vegetable, steamed, and the beans were smoked. The dried young faba beans were cooked or ground into flour. Faba bean flour was incorporated into soup, or mixed with other flours in bread and other preparations (Schilperoord, 2016).

The arrival of the common bean (*Phaseolus vulgaris*) from America, which needs more heat, slowly reduced the importance of the bean in the warmer regions of Switzerland. In the colder regions, faba beans held their own until the arrival of the potato and its acceptance in the mountainous regions in the early 1800s. The history of the faba bean is less known in the 20th century, as no books have been written and no professional breeding has been done (Schilperoord, 2016). Rudolf Koblet, a Swiss scientist specialising in plant production, described in 1965 the disappearance of faba bean as a crop in Switzerland. He mentions its replacement by potatoes and, for proteins, by meat, eggs and dairy products. In addition, low demand and cheap imports led to the disappearance of legumes in general (Koblet, 1965). Still cultivated mainly in the Alpine region, faba beans are disparagingly called "horse bean" or "pig bean". Moreover, Rudolf Koblet wrote in 1965: "The question of reintroducing this crop, which would enrich the crop rotation and provide farm-specific concentrated feed for fattening pigs, deserves careful consideration" (Koblet, 1965).

Faba beans are hence being phased out for use in human food. However, faba beans continued to be grown for animals, as they reportedly give good yields compared to other protein crops. The Swiss Federal Research Station for Agricultural Plant Production in Zurich Reckenholz (now Agroscope) carried out a variety trial on faba beans in 1963 and 1964 (Schilperoord, 2016). The purpose of the trial was to test the suitability of the bean for agricultural cultivation in Switzerland. The report shows that no suitable Swiss varieties were available, so the agronomic trials were based on foreign varieties (Schilperoord, 2016).

According to Koblet (1965), in the year 1917, out of a total area of 128 ha, 72.5 ha of faba bean cultivated surfaces was in the Wallis (alpine canton). Since the 2000s, faba beans are still cultivated marginally (see Table 1). Its cultivation area increased to around 1000 hectares in 2018, 2019 and 2020, due to growing importance of organic farming (Agristat, 2021a; Swissgranum, 2021). In 2021, its area decreased by 25.2% (-241 ha), according to first estimations (Agristat, 2021b). Yields are reportedly trending downwards. The reason for this would be seasonal and weather variations on the one hand. On the other hand, the growing number of organic farms where yields typically are lower compared to conventional farms contributes to decreasing average yields (Ramseyer, 2021).

Table 1. Area cultivated and yield of faba bean in Switzerland

Year	2000	2010	2018	2019	2020	2021
Cultivated area (ha)	275	274	1003	1002	957	716 ^a
Average yields (usable production divided by cultivated area) (kg/a)	40.9	31	26.1	31.6	31	- ^b

According to Agristat, 2021a. ^a number for 2021 is an estimation (Agristat, 2021b). ^b not available at the moment.

Thus, while the Swiss hardly consume faba bean, a few hundred hectares of faba bean continue to be planted for feed production. Faba bean would indeed be an extensive and low-input crop. However, the challenge is that the relatively low (conventional) standard prices discourage cultivation and there is little interest from the processing and market side. The potential of this crop is therefore limited and restricted to feed production and organic farms (Ramseyer, 2021).

In this report we look at two value chains, one for animal feed and one for human food. We decided to look at a feed production value chain, specifically the faba bean feed mixture value chain, in order to understand and identify the challenges and opportunities in this value chain. Regarding the food value chain, we learned about a project concerning the "revival" of old faba bean varieties grown in the Swiss mountains ("Swiss mountain faba bean"). This project is an example of the possible conservation of old varieties through the creation of a value chain. For CROPDIVA, this chain also shows the possibilities that arise when several stages of the value chain work together, in this case a producer, a mill manager and a former gastronomic chef. The rest of the report is structured as follows: first, we give an overview of the interviews conducted. After that, the results of the food value chain and then the feed value chain are separately given. At the end, we make a joint discussion, limitations and synthesis.

1.2 Overview of the interviews completed

The food and feed value chains selected were rather different in both the upstream and downstream aspects. Regarding the food value chain of the "Swiss mountain faba bean", we could find partners for interview by the mean of internet, because different articles and websites are relating about this value chain and the project linked to it. Table 1 informs about the number of interviews done. We could interview the only producer and the only mill involved in this food value chain. The mill is acting as a collection centre and to some extent, as a seller. Additionally, we interviewed one former gastronomic cook, which has an important role in the marketing of the Swiss mountain faba bean. We could interview one person from a seed conservation foundation involved and one person from a consumer information organisation.

Concerning the feed value chain, we did some online research but most of our interviews were crossed with other value chain interviews (mostly lupin). We interviewed three seed traders, and one organisation linking breeding and seed production. We interviewed two producers, as well as one collection centre. Furthermore, we interviewed a feed mill, which acts as a collection centre and has partnership with collection centres. The feed mill was also involved in the selling of the faba bean in feed mixtures.

Table 2. Overview of the number of interviews performed for each VC actor¹.

VC actor	Numbers of interview
Organisation (extension, research, etc.)	2
Organisation linking breeding and seed production	1
Seed trader	4
Producer	3 (1 for food, 2 for feed)
Collector	3
Mill	1
Feed mill	1
Seller (directly to endconsumers)	2
Caterer	1 (Gastronomic chef)

1.3 Results: food

1.3.1 Description of the faba bean food value chain

Figure 1 below depicts the value chain of the Swiss mountain faba bean (organic production). A 2011 project of a Swiss seed conservation foundation marked the start of the faba bean value chain. The Swiss seed conservation foundation was interested in faba bean because: it is a forgotten crop that used to be grown in Swiss Alps, it contains a good amount of protein, and provides ecological benefits common to legume cultivation. Collaborators of this foundation started looking at about 30 accessions of “Swiss mountain faba bean varieties” that were stored in the Swiss gene bank.

Then, together with other seed conservation organisations, they started to multiply and test those varieties. In the end, they found few usable varieties. They asked a producer they knew which was already growing special potatoes varieties, to test them. After finding the best-adapted variety and after about three to four year of seed multiplication, the producer started producing faba bean for food production. The producer is hence producing his own seeds.

¹ Please note that we counted the number of interviews for each role taken by one interviewee. For example, if one producer was processing and selling its lupin directly to consumers, one interview with this producer would count as three interviews: one producer interview, one processor interview and one seller interview.

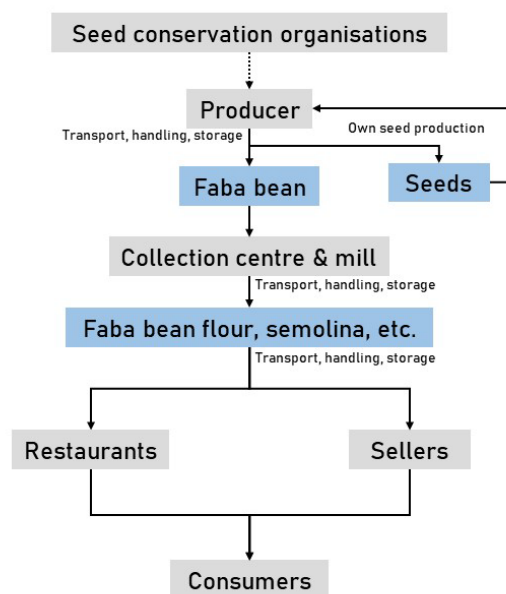


Figure 1. Swiss mountain faba bean food value chain mapping.

After harvest, the faba beans are dried on farm and transported to a mill (acting as collecting centre as well). In the mill, the faba beans are crushed to pieces or semolina, or milled to flour. A former cook, which is already working with the same producer for marketing the special potatoes, plays an important role in the marketing of the faba bean after the processing stage. This former gastronomic cook is links from the producer and the mill to different gourmet restaurants and other small and/or speciality shops. The different faba bean products are sold to about 20 gourmet restaurants. It was estimated by them² that more than two third of the faba bean products go to gourmet restaurants, the rest to other small and/or speciality shops.

Tariff protection on faba bean are very low or even zero, depending on the form of imports. Table 3 show different tariff protection on different faba bean products (Number: 0713.50XX) and for different usages retrieved on the 17.06.2022 (BAZG, 2022). Faba bean is classified under the category “Dried leguminous vegetables, shelled, whether or not skinned or split”, as there is no explicit category for grain-legumes.

Table 3. Overview of the normal tariff protection (duty rates) on faba bean (Number 0713.50XX, unprocessed and “other” and for different usages).

Usage	Tariff protection in CHF per 100 kg
Unprocessed, for animal feeding	0.00
Unprocessed, for technical purposes	0.00
Unprocessed, for making beer	0.35
Seeds	0.00
Other, for animal feeding	0.00
Other, for making beer	4.85 ^a

From BAZG (2022). ^a Tariff of 0.00 for “Least developed countries”, China and Lesotho.

² In this text, “their/them” is used as a singular gender-neutral third-person pronoun.

1.3.2 Input suppliers (Seed conservation organisations, seed producer)

The supplier of the varieties is, indirectly, one foundation for conservation of species that (re)discovered 30 old Swiss faba bean varieties in the Swiss seed bank. The old varieties were multiplied and tested for their usability. In the end, only few were interesting. The current seed supplier, which is also a food producer, tested few of the most interesting varieties. After finding the adapted one, the producer multiplied the seeds for three to four years. Currently, they remain their own seed supplier for this variety. In this part, we report only results from the seed conservation foundation and the producer as seed producer. Results generally related to production (e.g. pest control) and not specific to seed multiplication are in the next section: 1.3.3 Producer.

Except for the Swiss mountain faba bean seeds, all faba bean seeds are breed and imported from abroad. We describe this in the feed results, under 1.4.2, Input suppliers (seed traders).

VC capacities and organisation

Knowledge/technology

In the project, it was not clear if the seeds are explicitly free or have low levels of the antinutritive molecules vicine and convicine³. Varieties were not tested in this regard. The best-adapted variety would also be to some extent sensitive to chocolate spot disease (*Botytris fabae*).

Vertical linkages

It was reported by almost all actors of this VC that there was a good cooperation between all involved people, as they know each other from another project about special potatoes.

Entry barriers

Seed multiplication of the Swiss mountain faba bean varieties was reported fastidious. A first challenge is the cross pollination between the varieties. Because of this, all tested varieties were grown in different places, to avoid fecund each other. Another past and current issue mentioned is the inhomogeneous flowering and maturing: when some seeds are ready for harvest, a part of the same plant is flowering. Thus, it is difficult to obtain a lot of seed quantity, and the seed producer had indeed to spend some years multiplying the seeds.

Resource and infrastructure

Existing and required infrastructure

The lack of space to produce faba bean seeds is a problem for the interviewed seed producer. As a mountain farm, not all of their parcels would be ideal and, in addition, a long cultivation break required for faba bean would further restrict the cultivation of faba bean on their parcels. The producer was able, in order not to be restricted by space, to exchange a parcel for a year with a neighbouring producer. This issue further reduce seed multiplication and exchanging a parcel prevents the farm from reaping the ecological benefits provided by the faba bean.

Market conditions

Distribution channels

For now, the producers use their own seeds and do not sell them. Selling seed and working with other producers is for now very difficult. It was reported that producers in the region have low interest for faba bean cultivation. There is a beer-producing firm in the region, and it is profitable for producers to grow barley and sell it to this firm. Producers would not risk producing mountain faba bean, whose cultivation

³ Convicine and vicine are glucosides that can cause favism and lead to death in individuals that are genetically deficient in an enzyme (glucose-6-phosphate dehydrogenase). Low vicine-convicine varieties are safe for enzyme-deficient individuals. In monogastric animals, high levels of vicine and convicine can decrease feed intake (Khazaei et al. 2019).

is also not well known in mountain areas. In addition, it was reported that seed availability would be another restricting factor for value chain development and scaling up production. However, the seed producer was reporting that the slow development of the upstream part is a chance, since there is time to develop a sustainable collaboration with the downstream sector. This would give the opportunity to plan and account for future issues of the value chain.

Framework conditions

Regulatory environment

The issue of the seed availability and a possible future upscaling of production was discussed with one responsible of a seed conservation organisation. It is for now not planned, but they think about starting in another canton with another faba bean variety. Regarding this value chain, it was mentioned that there are some administrative hurdles that should be overcome before selling faba bean seeds. A first hurdle would be the registration of the variety. Another hurdle mentioned is the licensing for selling seeds (in German, “Pflanzenpass”). The requirements and the time costs were reported as high, at least for one producer alone. However, working with a seed producing and trading company could decrease costs linked to seed selling. The seed production must be to some extent profitable to the seed company, which is another challenge for expansion of the seed production.

Role of public sector

The early phases of the project were, according to the seed conservation foundation, “financed with the support of the Federal Office for Agriculture, through producers' and partner organisations' own contributions, as well as through donations”. The seed producer mentioned the financial help obtained through the Swiss “National Action Plan for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture⁴”. Different research and seed conservation organisations were also involved in the first years of the project.

1.3.3 Producer

According to fact sheet from 2009, faba beans enjoy high precipitation (>1'000 mm/year) and prefer heavy calcareous soils. Winter faba bean should only be grown in low to medium altitudes, while spring faba bean has low climatic requirements (Dierauer & Böhler, 2009). The old Swiss variety of spring faba bean used for the project is grown at an altitude of 1'500 m and are not excluded to be slightly different than imported faba bean cultivated in plains. As already mentioned, the current unique producer of Swiss mountain faba bean interviewed is also their own seed producer. They joined the project because they were asked by seed conservation foundation, for which they were already cultivating special old potatoes varieties. In addition, they recognise the benefits of legumes in crop rotation (e.g. soil nitrogen fixation) and the need to produce plant-based protein. The Swiss mountain faba beans varieties would be great for mountains. Unlike in the plain, pests such as aphids or bean beetles do not cause problems at altitude, which is a big advantage for organic production.

VC capacities and organisation

Knowledge/technology

Starting the mountain faba bean project was difficult, regarding the lack of knowledge reported by the producer and other projects' partners. It is unclear to us whether the existing cultivation experience from

⁴ The National Action Plan for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture has been running since 1999. Various measures are being taken to preserve the diversity of varieties of agriculturally important plants. These can be divided into three categories: provision of basics, conservation and sustainable use, and awareness-raising. Implementation takes place in the form of projects in cooperation with various organisations, most of which are active at regional or national level. Over 600 projects have already been supported (BLW, 1999).

feed production of faba beans could have been transferred. The producer mentioned having to learn about different aspects of the faba bean cultivation in mountain areas. The learning process was mostly done through research and trial-and-error.

One major issue was the organic weed control, which required manual weeding. In collaboration with other project partners, other solutions were approached, like using sub-seeding to suppress weeds. The producer reported less manual weeding necessary when using a subseed, even if it was first required to test the potential sub-seed mixtures. Inoculation of the seed with rhizobia, as is recommended for lupins, is not necessary for faba beans.

Another difficulty mentioned was the harvest: first 50% of harvest was lost due to lack of experience. Currently, the producer estimates the losses at harvesting stage at about 5%. One partner of the project reported the non-homogeneous maturing of the faba bean as another challenge. Choosing the best harvest time is tricky, as sometimes beans on the lower parts of the plant are already ready for harvest, whilst the top parts of the plant could still be flowering.

Vertical linkage + integration

There is in the entire value chain a high cooperation between all value chain actors. The producer reported good relationship with the mill collecting their beans, as well as with the gourmet scene. In addition, there is the vertical integration of seed production and faba bean production, as one producer is, for now, responsible for both value chain stages.

Entry barriers

As the only producer of the region producing Swiss mountain faba bean (and the seeds), and with limited surface for cultivation, the producer wishes to convince other producers to start faba bean cultivation. However, he mentions entry barriers such as low availability of seed and risk-aversion of neighbouring producers. Selling malt barley to a local brewery would represent for regional producers a less risky and more profitable opportunity as faba bean.

Resource and infrastructure

Existing and required infrastructure

The lack of surface available for faba bean cultivation is also a problem for production. As we mentioned above in the seed production part, the producer has limited soil suitable for faba bean production (mountain region). In addition, long cultivation break for faba bean limit the surface available. Faba bean is incompatible with itself and has little compatibility with other legumes. Thus, a cultivation break of at least 3 to 5 years should be observed (Kolbe, 2002) .

Post-harvest, the producer is drying the faba beans on-farm. However, they describe their drying infrastructure as very rudimentary. They would like to plan more professional drying by cooperating with other producers in the region.

Market conditions

Selling channels

After drying, the faba beans are given to a “niche-specialized” mill. Actual partnership is good; however, a local solution would be preferred, for transport costs and regional development reasons. The mill is located about 100 km away from the farm. After being processed in the mill, faba bean products come back to the producer shop, or are sold to gourmet chefs and other small speciality shops.

The producer mentioned that other interesting processors and sellers already approached them, but this is not their immediate focus for now and they prefer to grow the value chain slowly, in order to accommodate for a better growth.

Framework conditions

Role of public sector

Different partners financed the first phases of the project, which helped the lack of profitability during the testing and production phase. One important financing source already mentioned is the National Action Plan for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture. In addition, one organic research institute (undersowing strategy, see above), as well as one seed conservation foundation (See 1.3.2 Input suppliers (Seed conservation organisations, seed producer)) provided help in the first years of the project.

Beside this direct help, the Swiss direct payment system will be contributing to encourage legume production for food in the future. For now, producers get direct payments for growing legumes for feed purposes, which is a reason for producers to cultivate faba bean for feed. As of the first of January 2023, producers will get this direct payment also for legumes grown for food purposes. The producer thinks that, if this direct payment will not have any negative effects, it will not be a game-changer. For them, faba bean cultivation comes with high risks, because it is a very old crop and its cultivation has been “forgotten”. Thus, there is the need to gain cultivation experience and test different varieties, which is a risky phase for producers. After that, as there is for now few buyers, there is the need to know to or have time to do direct marketing of faba bean. The producer reported that neighbouring producers had no interest in direct marketing, as it would represent much effort and risk.

1.3.4 Collection centre and mill

The producer delivers the faba bean to a mill. This mill, which also acts as a collecting centre, is very specialized concerning niche crops. It used to be a feed mill taking only feed. Now, it is taking only food crops and its main source of revenue is spelt. Specialization on crops like old cereals, buckwheat or food maize is one objective of the mill. Due to this specialization, the mill works with small quantities of crops and hence does not possess any silos. Instead of silos, they work with big packs of cereal put on pallets, which can be easily moved around and stored in the mill.

Regarding faba bean, the mill is breaking the hull and processing it to faba bean chunks, semolina or flour. The mill possess a small shop where the faba bean products are sold, if the quantities are sufficient for the other distribution channels.

VC capacities and organisation

Vertical linkage

The vertical linkages with both the producer and the former gourmet chef are quite good, as we mentioned under part 1.3.3 Producer. The mill reported that they tend to search and contact producers themselves that are producing niche crops or have different certifications (see below). Now, thanks to mouth-to-mouth propaganda, other producers are aware of the mill and they could stop searching for producers. In addition, they are working closely with the same seed conservation foundation that is part of the faba bean project. The mill has a central function of collecting various niche crops and to some extent, market them.

Knowledge/technology

It was reported that there is no machine adapted for dehulling faba bean, however, the mill can use other machines that are adapted for processing faba bean. For example, the stone mill has proven its worth. Instead of dehulling, the faba bean is broken into pieces so that the hull comes off and can be filtered out. The faba bean hull was reported being very hard in the first year, which was surprisingly not the case last year. They reported learning a lot by trial and error and needed to experiment a lot. One difficulty mentioned with faba bean was related to humidity in the beans: after processing and

breaking the beans, they would dry and depending on their original water content, they shrink in different sizes that can be classified in three categories. The different sizes can represent a challenge in the marketing of the faba bean, because according to the former cook, restaurants should receive the better adapted category for their needs (see more in part 1.3.6, Gourmet restaurants).

Resource and infrastructure

Inputs availability

Generally, the mill reported that there is a good demand for the various niche crops they propose, faba bean as well. However, they reported that producers are not interested in cultivation niche crops, probably because of lack of knowledge or risk-aversion.

Existing and required infrastructure

As mentioned under “knowledge/technology”, they have machines (e.g. stone mill) that are or could be adapted for legumes processing. One objective of the mill is not to invest in further machines, but to experiment more with the ones already possessed.

Market conditions

Distribution channels

One former gourmet cook, who has good connections with other gourmet restaurants, mostly manages the faba bean products and the quantities at the mill level (see next part 1.3.5 and 1.3.6, Sellers and Gourmet restaurants). In addition, some part is given back to the producers’ own on-farm shop. Some parts go to different shops.

Demand

The former gourmet cook reported having a list of interested people for cooking or selling the Swiss mountain faba beans. In addition, through our interview with the feed sector, we could notice some interest for faba bean (not Swiss mountain one, but the regular varieties for feed, see part 1.4 Results – feed value chain). One feed mill reported that one big food company had interest in faba bean. This company took some faba beans (produced in the plain for feed), in order to experiment and eventually create products based on faba bean. We were reported that two other companies (one start-up and one subsidiary company of an important one) are currently experimenting with faba bean processing and product development.

Framework conditions

Certifications

The mill possess three main certifications: organic, biodynamic and a mountain label, which are helpful for adding value to their products and makes it more attractive for their clients. The faba beans carry the organic label and the label of the seed conservation foundation.

1.3.5 Sellers

This part is about the selling of faba bean products through different the shops, but not through the gastronomy. The next section 1.3.6, Gourmet restaurants, is about gastronomy. The selling of faba bean through the shops is estimated to represent less than one third of the amount of Swiss mountain faba bean sold. Our information arises first hand from the mill, which we interviewed, as they have a small shop. The former gourmet cook, who is managing the distribution to shops and restaurants, as well as other project’s partners, gave us some information as well.

VC capacities and organisation



Vertical linkage

There is a form of vertical linkage between the other shops and the former gourmet cook. One objective of the former cook is to develop a network with partners that are interesting in faba bean. The former cook is looking to have a sustainable development of the marketing of the faba bean. Hence, selecting passionate shops and cooks that are interesting in stable and long-term partnership is the main objective of the downstream part development.

Market conditions

Selling channels

Selling faba bean in small shops is great to promote the faba bean, and explain its benefits. We were reported that shops had interest for having Swiss legumes in their assortment. In addition, due to the interesting story behind the Swiss mountain faba bean, there is the possibility to promote it and inform the consumers even better. The story behind the faba beans is great for adding value in the eyes of the consumers and would be possible in big supermarkets, according to one interviewee.

Consumers were in general not well informed about faba bean and its origin or possible utilisation. However, even if faba bean is in Switzerland currently used almost only as feed, no negative reaction linked to feed aspects were reported.

Product marketing

Having different types of product (chunks, semolina, flour) allows to cook faba bean in different ways, which is also important. One interviewee mentioned that faba bean flour was the most tangible product for consumers cooking at home, as it would be better-known and used than chunks or semolina.

Other gourmet cooks developed different recipes that are published on different websites and this might help for promoting the faba bean consumption.

Demand

It was reported that the demand was high, at least at the mill small shop. Because of clients' proximity, it was possible to promote it well enough and interest was reported high. However, due to lack of quantities, the small shop had to stop selling faba bean to reserve it for the gastronomy. In other shops, one interviewee reported that no large volumes were really sold for now.

1.3.6 Gourmet restaurants

One former gourmet cook is coordinating the faba bean marketing at the mill level. The former cook is now a "Genustrainer" (Savour/pleasure coach). Their business activities are advising and promoting producers, co-selling products, organising cooking classes, workshops, caterings, training and consulting, recipe developing, etc., with a focus on sustainability and savour. They estimated that about 20 restaurants across Switzerland would offer meal with faba bean. Often the faba bean was prepared as hummus or as falafel. Other cooks prepared it in a similar way like a risotto or a polenta.

VC capacities and organisation

Vertical linkage

There is a vertical linkage between the value chain actors of the upstream process and the former cook. In addition, there is a strong link between the former cook and the restaurants. The former cook reported searching for cooks that are passionate and would understand the story behind the faba bean and sell them the faba beans. The objective for the former cook is to build sustainable and long-term partnerships.

As mentioned under 1.3.4, Collection centre and mill, three different sizes of chunks are actually produced, due to the drying of the beans at different maturity stages and humidity levels. Consequently,

the former cook reported the need to give advice to other cooks, in order to give them the best product they would need. For them, advice is crucial to ensure that the cooks are satisfied with the product.

Knowledge/technology

Knowledge about preparation and cooking of faba bean was not very widespread. The former cook mentioned the development of different recipes with some other cooks. In addition, the former cook mentioned taking time to organise workshops or visit cooks and experiment with them. Overall, the former cook reported that feedbacks from cooks and clients were positive. The taste was appreciated and the possible uses in the gastronomy as well.

Resource and infrastructure

Inputs availability

It seems that the demand is outweighing the offer, at least at the gastronomy level. The interest is big, however, it is unclear to which extent. There is an “interest list” from gourmet cooks.

Market conditions

Advertising

There is the possibility to tell about the story of the Swiss mountain faba bean to consumers. However, this requires informing the restaurant service staff about Swiss mountain faba bean and their ecological benefits, and the staff should inform clients.

Framework conditions

Certification

According to two interviewees, certifications (organic, rare species, mountain) are not as important in gourmet restaurants. The storytelling would be more important than certifications, since consumers can be directly informed about faba bean.

1.4 Results – feed value chain

1.4.1 Description of the faba bean feed value chain

Regarding the feed value chain, which can be seen in figure 2, all varieties handled by seed traders are imported from abroad. In particular, Germany, France and the United Kingdom were cited as most important seed breeders. Germany was mentioned as an important seed production country.⁵ Producers, which are in the plain regions, will buy faba bean from Swiss seed traders. Post-harvest, the faba bean is collected by collection centres and brought to a feed mill. The feed mill produce feed mixtures, which contain faba bean. Faba bean could, of course, be directly feed to animals on-farm. Here we decided to focus on feed mixtures. In Switzerland, it is allowed not to write the percent of components included in the feed mixture: hence, we could not know how much faba bean was included in the different mixtures. Our interviews were touching both the organic and conventional sector. However, we were told that faba bean is much more relevant for the organic sector, because of new organic sector directives, as we will explain in part 1.4.5, Feed mill (Processor and seller). Regarding tariff protection, please refer to part 1.3.1, Description of the faba bean food value chain.

⁵ In Germany, faba bean is the second most produced grain legume (behind peas). The production between 2013 and 2017 tripled (from 60'000 to 190'000 t) because of greening measures the common agricultural policy. The offer of supplementary subsidies (e.g. for a diverse crop rotation) even further increase interest in legume cultivation (Ketzey Sepngang et al., 2018).

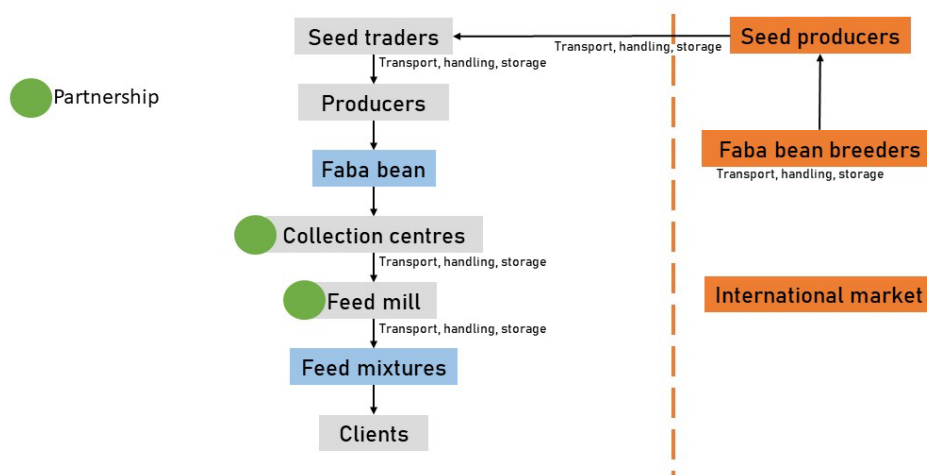


Figure 2. Faba bean feed value chain mapping.

1.4.2 Input suppliers (seed traders)

In contrast with the food value chain, the seeds are not from Swiss origin and are imported. One interviewee reported failed attempts of producing faba bean seeds in Switzerland. The reasons for failing are given below. We conducted mostly cross-interviews with seed trading from both the organic and conventional sector.

VC capacities and organisation

Entry barrier

As mentioned, it was already attempted to multiply faba bean in the plain regions of Switzerland. However, insect pressure, in particular the broad bean beetle *Bruchus rufimanus*, would hinder the production of high quality seeds.

In addition, there is no tariff protection on imported faba bean seeds, which makes its production less or not profitable and hence less interesting for Swiss seed producers. Production attempts were abandoned.

Resource and infrastructure

Inputs availability

One seed trader reported that the reliability of faba bean import was challenging. No certain explanation has been given, but the interviewee only assumed that the COVID-19 pandemic and the small Swiss market (hence not interesting as economic partner) could be reasons for challenging reliability. Another seed trader mentioned the interest for faba bean for seed production and agronomic trials, however, they do not have any capacity and surface available.

Market conditions

Demand and trend

Seed traders reported that there is a demand existing for faba bean. One seed trader mentioned that faba bean was at the moment highly demanded in green manure sowing mixtures. Some mentioned that producers requested information about food usage instead of feed. Feed varieties are adapted for food consumption as well, if they are adapted to monogastric animals, according to one interviewee. However, the food value chain we looked at in part 1.3 (Results: food), used a different variety, adapted for mountain cultivation and traditionally cultivated in Switzerland.

1.4.3 Producers

We interviewed two producers, and one conventional produces it for feed because they had bad experience with soybean and lupin and was looking for a protein alternative to them. The other organic producer stopped faba bean production, as they cultivated for feed and wish producing for food now. Both were of the opinion that faba bean is good in crop rotation, and very beneficial to the soil, thanks to nitrogen fixation. Other interviewees from cross-interviews gave some opinions about faba bean cultivation.

VC capacities and organisation

Knowledge and technology

Interviewees mentioned having better knowledge than for example soybean or lupin. The conventional producer was even making it in a no-till system and had solid knowledge of plant protection methods against faba bean pests. However, faba bean yields were said very much depending on weather. A lack of precipitations or drought would be extremely damageable to faba bean yields.

Entry barriers

The conventional producer mentioned that the prices for faba bean seed are very high. It was reported that faba bean cultivation is not profitable, however, for this same producer; faba bean is an added crop that allows him to obtain a regional direct payment linked to the diversity of their crop rotation (see below).

Resource and infrastructure

Inputs availability

The conventional producer reported not always getting the requested variety. As we have seen for seed traders, it was reported that indeed seed reliability is sometimes an issue.

Market conditions

Distribution channels

After harvest, faba bean are collected by a collection centre and delivered to a feed mill. In general, there was no big issues regarding the finding of a collection centre. However, the conventional producer reported that its oat-faba bean mixture was accepted once in a collection centre, but that they were asked not to produce it again. Both producers were very open to sell faba bean for food, as this could also mean higher sales. The conventional producer, as well as other value chain actors, mentioned that faba bean would be not interesting, in particular in the conventional sector.⁶

Framework conditions

Regulatory environment

For now, producers receive a direct payment if they cultivate legume for feed purposes. This is of course a good motivation to produce faba bean. In addition, as mentioned above, the conventional producer get the so-called “contribution to a diverse crop rotation”. This direct payment depends directly on the number of crop included in the rotation and is not federal, but part of a cantonal or regional project.

⁶ The standard price for conventional faba bean in 2020 is 34.5 CHF/dt (the lowest among pulses), whereas it is 77 CHF/dt in the organic sector, plus an additional payment of 3 CHF/dt. The profitability in organic farming is difficult to match that of lupin and soybeans, whose prices in organic farming are 99 CHF/dt and 110 CHF/dt respectively, plus an additional payment of 32 CHF/dt for both (total 131 CHF/dt and 142 CHF/dt, compared to in total 80 CHF/dt for faba beans) (SBV, 2020).

1.4.4 Collection centre

We interviewed one collection centre that used to collect faba bean from producers (for feed). Although not collecting it anymore, the collection centre mentioned being open to collect it, if it becomes more important. Beside this collection centre, we interviewed one feed mill, collecting harvested products, which has a partnership with collection centres. Both the feed mill and some partner collection centres are collecting as well faba bean.

VC capacities and organisation

Horizontal linkage

One form of horizontal partnership could be identified. Indeed, one collection centre mentioned having redirected producers of niche crops (which this centre did not collect) to a collection centre that specifically collected these niche crops. The reverse was also the case, with this collection centre being recommended to niche crop producers by a collection centre not collecting certain niche crops. The head of the collection centre mentioned that, in a way, collection centres sometimes cooperated together.

Vertical linkage

There is some level of vertical integration, because of the partnership between collection centres and mill. Producers can bring their faba bean to collection centres that are partners of the feed mill. The feed mill is responsible to pay the producers directly, and the collection centres charge the feed mill with the handling and storage costs. However, the feed mill reported that not all their partner collection centres were taking faba bean, because of the elements mentioned above and in part 1.3.4, “collection centres” of the food value chain.

Resource and infrastructure

Volume and capacity of facilities

The low production volume of faba bean in Switzerland is accompanied by challenges for the collection points: minimum quantities of 3-8 t are required to fill drying machines (in general, for bigger collection centres). With small batches, there is also the risk of mixing with other products during collection, storage and processing. This is not dramatic when working with large quantities, but when a small batch of lupin is mixed with larger batches of other crops, the faba beans might be too “diluted” with the other crops.

In addition, one producer reported that one collection centre accepted only once an oat-faba bean mixture. No explanation was given, but separating mixture might probably requires a specific machine.

Market conditions

Distribution channels

After bringing faba bean to collection centres, the faba bean products are transported to the feed mill. It was reported than one producer would take the given faba bean back, after cleaning and sorting. The producer took it from the collection centre to use it raw for feed on farm, without letting it being processed by a feed mill.

1.4.5 Feed mill (Processor and seller)

The feed mill interviewed functions as a collection centre (see previous part), as processor and as seller. The feed mill processes the collected faba bean into both conventional and organic feed mixture

and sells it to clients. BioSuisse⁷ directives generally restrict import of organic feed. Therefore, on the organic market there is a great demand for Swiss protein crops, like faba bean. The feed mill has a higher importance in the organic market than the conventional one.

VC capacities and organisation

Vertical integration

As mentioned in part 1.4.4 (Collection centres), the feed mill has a partnership with collection centres. This is, according to the interviewee, a win-win situation: collection centres perform handling and storage and are paid for their services by the feed mill. For the feed mill, this allows for a better distribution of collection centres across Switzerland, and a higher capacity of collection as well.

Knowledge/technology

Faba bean is well known for processing and use in feed mixture. According to one interviewee, they are well suited for pig rations because faba beans will not rise the polyunsaturated fatty acids content of the pork⁸. However, we found that feed intake, especially for monogastric animals like pigs and poultry, is limited because of tannins, vicine and convicine contents of the faba bean (Crépon et al., 2010).

Regarding ruminants, anti-nutritive contents (tannins, vicine and convicine) do not cause such problems. Proteins in faba bean would be very quickly degraded in the rumen, hence amino acid supply would be low (low absorption through small intestines since degradation in the rumen) (Crépon et al., 2010; Guevara Oquendo et al., 2021). Due to low methionine content and lower protein content (high carb content), and lower feed intake, faba bean can only replace soybean to a certain extent in a feed ration.

Feed intake reportedly increases with processing of faba bean in mixture when compared to raw faba beans. If it is possible to feed raw faba bean, one big advantage of the feed mixture is the reduction of the limitation of faba bean in the ration. In addition, feed mixture are better for storing than raw faba beans.

Resource and infrastructure

Inputs availability

In general, this feed mill gets enough faba bean. Sometimes, they do not get enough and need to buy feed stuffs from other feed mills. In 2021 it was difficult to get faba bean from producers (bad yields, less interest) and imports on the European market as well. The feed mill hypothesised that the year was bad for yields, but also that soybean and lupin might have been preferred to faba bean. Therefore, they needed to replace faba bean by other products.

Required and existing infrastructure

No special machines are needed for processing and milling faba bean. Machines and knowledge on processing faba beans are typically similar than for legume processing and well known. The feed mill interviewee reported that, in order to even further increase feed intake, there is the possibility to thermically treat faba bean. This requires investments and energy costs. In Switzerland, according to this interviewee, soybean would be more interesting and profitable than thermically treated faba bean.

⁷ Bio Suisse is the leading private organic organisation in Switzerland and established the national organic brand Knospe (German word for bud).

⁸ Consumers might find high content of polyunsaturated fatty acids (PUFA) in pork less appealing, because of potential development of off-flavours and greasy appearance (Rosenvold and Andersen 2003). In Switzerland, a payment deduction of minimum 0.10 CHF/kg carcass weight is applied, whenever the back fat contains a higher share of 15.5% of PUFA (Meier et al. 2021).

Market conditions

Distribution channels

As a feed mill, they deliver themselves almost all order from clients. This delivery is important and allows for more contact between the mill and the clients. This contact was said to be necessary to keep clients and to stay competitive. However, for the organic sector, organic producers density is quite low, hence, they have higher transport costs when delivering to their clients. According to the interviewee, distribution costs in the organic sector are a general challenge. As a feed mill specialised in organic agriculture, this is challenging for them.

Demand and trend

Regarding faba bean, the surface cultivated could be expanded for the interviewee. However, soybean and lupin were mentioned as more interesting than faba bean because prices are higher for producers. Prices are indeed higher for lupin and soybean, and in the organic market, there is even a contribution paid for lupin and soybean. A report from the Swiss producer organisation mentions the low standard price for faba bean as reason for low interest from producers (Ramseyer, 2021). Lupin and soybean would be more versatile than faba bean for feed. Unbalanced amino acid patterns and the presence of tannins make faba bean as well less interesting than lupin and soybean. According to the interviewee, faba bean is more important in the organic market (see below under “Certification”).

The interviewee mentioned that a big international company bought some faba bean to have them for testing new food products. They would be open to the selling of faba bean for food purposes.

Framework conditions

Certification

Faba bean, grown together with oats, has much better chance in the organic market. Reasons are the standard for organic feed. BioSuisse standards requires high percentages of Swiss organic feed (depending on the animal) in their feed ration. As a consequence, there is demand for Swiss organic faba bean. In addition, the organic certification allows this feed mill to position a specific market segment in the Swiss feed market, since they have become organic specialists.

1.5 Discussion

Due to our choices of value chain, we discovered very different feed and food value chain through to the interview. On the one hand, the faba bean food value chain analysed is still a small chain, nevertheless very tightly knit between the partners. In addition, this chain brings back old, traditionally used mountain Swiss faba bean varieties, representing a chance for storytelling-based marketing. On the other hand, there is the value chain for animal feed. Faba beans seem to be well known and traditional in Switzerland as well. However, it seems to be limited to the organic farming sector or own feed production, according to Ramseyer (2021), because standard (conventional) prices are low and there is little interest on the processing and market sides.

Some challenges concern the two value chains feed and food, as well as niche crops in general, others are very specific to one of the two chains. General challenges and opportunities of both value chains and of niche crops identified are the low profitability, the lack of seed reliability, the lack of knowledge of different actors, the ecological benefits of crop diversification and the apparent interest of food companies. Specific opportunities and challenges for the food value chain are the strong network of actors, the interesting storytelling-based marketing, the slow growth and seed production limitation. Regarding the feed value chain, specific opportunities and challenges are the organic market possibilities and the competition with other proteins crops. All the challenges can be found in Table 1.

1.5.1 Past challenges & successes of the value chains

Farming knowledge

Producers' knowledge varies according to the value chain (feed or food). While the production of faba bean for animal feed, mostly done in the plain, does not seem to be challenging, this is less the case for the cultivation of Swiss mountain faba bean. For organic production in the mountains, the main challenge was first weeds and harvesting. These two aspects are now less challenging, as we reported in the results (part 1.3.3, Producer), thanks to research on subseed for controlling weed and experience gain with harvesting. In the plain, the use of plant protection methods goes smoothly, as does harvesting. A common feature of faba bean cultivation mentioned by the producers is the strong dependence of faba bean on weather, mainly rainfall, making it a crop with variable yields.

Food value chain: seed multiplication and varieties testing

A very important aspect of the Swiss mountain faba bean project is to find usable and interesting old varieties. Actors involved in the project had to work intensively to produce enough seeds in the first place. As faba bean pollinates the other varieties, it was necessary to grow the varieties in separate places. Faba bean produces few seeds compared to other plants, which constrains seed production. If the producer has found an ideal variety, they have to continue to use part of his field for seed production, which remains a challenge to increase faba bean production.

1.5.2 Current and foreseen challenges and chances of the value chains

Food value chain: expansion and upscaling

Different aspects currently prevent the enlargement of the Swiss mountain faba bean chain, even if the actors explicitly mentioned that they are not bothered by the slow development of the food value chain. In the first place, the producer interviewed is the only producer. His area is limited by the quality of the plots and by a break in the rotation of cultures, and he has to devote part of his harvest to seed production. Moreover, the producers he knows in the area have little interest in faba bean production. The reasons for this are lower profitability compared to other crop (opportunity costs), risk aversion (yield risk and lack of experience) and the possible need to deal with direct marketing. In addition, there is not enough seed to go around. Increasing seed production is a challenge, because of the limitations of the area. In addition, selling seed would be a heavy administrative burden for a producer. Upscaling production therefore requires proper planning and probably working with a seed producing and trading company. However, producing faba beans should be interesting for any seed company, which is another challenge to account for. For these actors, it seems that the slow development of the value chain would allow them to plan adequately.

Food value chain: public sector interest

This value chain is the result of a project of a seed conservation foundation. In addition, the first phase of the project was supported by the public sector, through the National Action Plan for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture. A Swiss organic research institute has also helped by testing different sub-seeds. This support was necessary for the project to start, however, the value chain actors do not have an assured salary and have to earn a living. The risks are still carried by the value chain actors of the private sectors, who need to ensure proper growth. Another positive point for the future, regarding public support, is that direct payments for legume production for feed will be extended to human consumption from 2023 on.

Food value chain: sustainability

All three aspects of sustainability are important: ecological, economic and social. For ecological sustainability, it is important to mention the benefits of faba bean for the environment and agriculture. Faba bean enriches soils by fixing nitrogen. Furthermore, it is a source of food for pollinators and improves the quality of the landscape with its beautiful flowers. Secondly, the processing of faba bean is very low: the faba bean is processed into chunks, semolina or flour, without extreme energy use as could be the case in the protein isolation process.

Social sustainability is also important in the project. All actors in the value chain know each other personally and exchange information. In addition, the former gourmet cook managing faba bean stocks at the mill selects shops and restaurants that are passionate about faba bean, trying to ensure a sustainable and long-term development of the value chain. The value chain actors have no immediate interest in selling the beans to large supermarkets, as this would not be desirable from a marketing point of view for gourmet restaurants. The economic aspect is problematic for the moment, as profitability has not yet been achieved. However, it is considered that the project is still in a pioneering phase. Although there is some interest from large supermarkets, it is seen as too risky (because of cluster risk) to sell the faba beans to them. Cluster risk or concentration risk was described by the interviewee as the risk of selling everything to a single supermarket company, which may 'flip', also change its mind and stop buying the products. Reselling faba bean to various shops and restaurants minimises this risk (diversification strategy).

Food value chain: storytelling

The marketing potential is significant for Swiss mountain faba bean. Indeed, it is possible to draw attention to several positive aspects:

- Tradition, as faba bean was cultivated in ancient times
- The origin, as faba bean has been cultivated for a long time in Switzerland
- The place of cultivation, as faba bean is grown in the mountains
- The organic certification
- The ecological benefits (see: sustainability)
- The taste, according to cooks
- The nutritive aspects, like protein and fibre content
- The gluten-free aspect
- Etc.

However, it is necessary to succeed in bringing these different points to the consumers. It is apparently still difficult to do this in some shops. In restaurants, this requires training of service staff, so that they speak about these positive points to customers.

Feed: reliability of seed supply

For the feed value chain, 100% of the seed is imported from abroad. However, it seems that ensuring that seeds are received in time and in the right quantity is challenging. It is certainly possible to make a reserve in advance to cover a delivery. However, having to deliver a different variety than requested to a producer is not always desirable for seed companies. Of course, the reasons for a lack of reliability may be due to the coronavirus crisis. In addition, Switzerland represents a small market for neighbouring exporters. It is also possible that the general interest has shifted away from faba beans to soybean and/or lupin, which are more interesting than faba beans due to their nutritional profile (more protein and better balance of amino acids). Faba bean is limited in quantity for feeding pigs and poultry because of tannins, vicine and convicine content, especially. However, faba bean could still be used in monogastric and ruminant diets, to a certain percentage. Depending on the tannins, vicine and convicine content of the faba beans, feed intake might drop and hence the percentage of faba bean included in the ration must be carefully chosen. For ruminants, faba bean proteins are quickly digested

in the rumen and hence amino acids are partially absorbed by the intestines. As a consequence, to ensure no performances losses, faba bean intake should be carefully planned. Faba bean has limitations towards feed utilisation when compared with soybean and lupin, which could have been the cause for shifting interest towards soybean and lupin.

Producing seeds in Switzerland would be very difficult and not profitable, for two reasons: pest pressure (from the bean beetle) and the absence of tariff protection. Introducing a tariff protection would however make production not necessarily attractive, as seed prices would probably increase for producers. It would therefore seem that introducing a tariff protection would rather reduce the availability of faba bean seeds.

Feed: profitability

Like the food value chain, faba bean seems currently not the most interesting crop for feed producers, due to low profitability. In the conventional sector, profitability is generally lower. As we reported in part 1.4.3 (Producers, feed), prices are very low for faba beans. In the conventional sector it is even the lowest price among legumes. In the organic sector, legumes get in general an “additional payment” taken from the cereal sector to promote legumes. However, the additional payment is much higher for soybean and lupin. This explains the decrease in interest in faba bean and the increase in interest in soybean and lupin, in the organic sector as well. The lack of profitability is here only represented by the prices paid by downstream value chain actors. Other elements could be taken into account to calculate real profitability of faba bean.

In fact, faba bean could be(come) an interesting crop within the crop rotation in view of rising fertiliser prices and its positive preceding crop effect. The integration of faba bean in a crop rotation allows ecological benefits and possibly a direct payment for the quality of the landscape due to a diverse rotation or pretty flowers. However, this could also be the case for lupine and soybean.

Demand and trend

In general, the two faba bean value chains examined show that while the profitability of faba bean cultivation is not high, some interest in this crop is nevertheless present. Several companies (large or start-up) show an interest in using this crop for food. However, the challenges are great for the plain, as the pest pressure seems to be high compared to the mountains.

The protein content of faba bean, which is lower than that of lupin or soybean, further reduces its attractiveness for the food and feed sector. However, it is possible that the positive points (Swissness, ancientness, mountain cultivation) with which the Swiss mountain faba bean can be marketed will offset this competition. For the feed value chain, the greater knowledge of the actors in the value chain may allow faba bean to be more attractive than other legumes, and thus not to be sidelined.

An important point mentioned is the use of faba beans in green manure. It is hoped that this use in green manure can also indirectly benefit the feed and food sector.

Table 1. Summary of the challenges, strategies and potential benefits for each value chain actor.

VC actor	Main challenges/opportunities (order: most important first)	Strategies undertaken/to undertake	Potential & benefits for the actor in the VC chain
Input suppliers (Breeders, researchers, seed producers, seed traders)	<ul style="list-style-type: none"> Reliability of seed supply Feed: No CH adapted varieties 	<ul style="list-style-type: none"> Feed: Ordering seeds timely, establish relations with foreign seed producers Food: exchange parcel with other producers or convince them to grow faba bean Food: get interest from seed production organisation 	<ul style="list-style-type: none"> Feed: the more reliable the faba bean supply, the better for keeping clients Food: more surface available for seed and food production Food: risk sharing of food production
Producers	<ul style="list-style-type: none"> Yield level and variability Profitability Plains: pest pressure 	<ul style="list-style-type: none"> Feed: find sales opportunities Feed: find and convince collection centre to take their goods, or work with other producers 	<ul style="list-style-type: none"> Food: exchanging a parcel results in loss of benefits of faba bean for its parcel Higher volume of food production results in scale economies for the downstream VC part Diversification of earnings Faba bean is advantageous in crop rotation
Collection centres	<ul style="list-style-type: none"> Feed: low tonnages (for existing infrastructure and processes) 	<ul style="list-style-type: none"> Convince producers to bring their goods together to reach an higher tonnage Specialization on infrastructure for low tonnages 	<ul style="list-style-type: none"> Diversify their products Attract new clients specially looking for a collection centre accepting faba bean
Food mill	<ul style="list-style-type: none"> No machine for dehulling faba bean Different coarse sizes Hard hull Pest pressure (broad bean beetle) would hinder food production 	<ul style="list-style-type: none"> More experience with faba bean drying and processing Research for a way of removing the hull 	<ul style="list-style-type: none"> Getting another product: entire beans without hull Getting the wanted coarse sizes
Feed mill	<ul style="list-style-type: none"> Organic standards (BioSuisse) increase the demand for Swiss protein Not enough supply for faba bean Not as interesting as soybean or lupin: unbalanced amino acid patterns, presence of tannins, vicine and convicine 	<ul style="list-style-type: none"> Try to convince producers to produce faba bean for feed Raise attractiveness of faba bean 	<ul style="list-style-type: none"> Less reliance on import or concurrent for feed mixtures Lower prices
Sellers	<ul style="list-style-type: none"> Food: clients do not know faba bean and how to use it 	<ul style="list-style-type: none"> Communicate with clients about legume and their benefits Direct selling is already allowing direct marketing to the consumers There is still a need to promote legume and faba bean in general 	<ul style="list-style-type: none"> Diversity of products offered might attract new clients that know about faba bean Positive image of the shop for selling a Swiss mountain faba bean
Restaurants	<ul style="list-style-type: none"> Not enough supply (for more restaurants, "interested list") Clients do not know faba bean Faba bean is attractive when niche, not in mass production 	<ul style="list-style-type: none"> Convince other producers to produce Swiss mountain faba bean Inform clients about faba bean trough service personal Listing of faba bean in big supermarkets raise faba bean acceptance but lower interest for niche products 	<ul style="list-style-type: none"> Positive image of the restaurant for selling a Swiss mountain faba bean Increased demand through exclusivity of restaurants preparing Swiss mountain faba (not found in supermarket)

1.5.3 Limitations

We conducted various interviews and obtained different opinions of the importance of faba bean in Switzerland. Regarding the food value chain, research was conducted at all stages of the value chain. To deepen the present analysis, it would be interesting to examine the experiences of restaurants and retail shops in more detail. They are in direct contact with consumers and know about their buying motives, wishes and expectations for niche plant-based products. This knowledge is important for the further and broader marketing of faba beans. However, the former cook who manages the marketing of faba bean and has contacts in the gourmet scene and with the shops could transmit us some opinions of shops and restaurants, to a certain extent.

Regarding the feed value chain, we think that we could capture the essence of faba bean feed mixtures value chain. Many of the interviews done for faba bean were crossed interviews. In order to deepen the analysis of this case study, some stages of the value chain could be more deeply analysed; for example, the collection centre and the feed mill stages. In addition, deepening the understanding of the differences between the organic and the conventional sector would be interesting.

1.6 Synthesis

Faba bean production was much more important in the past. Knowledge and cultivation experience has declined over the years, supplanted by common beans and potatoes. In addition, animal products such as meat and dairy products replaced faba bean as protein source. However, its cultivation for the animal sector has (probably) never completely ceased, as it is a crop with a certain potential for Switzerland.

The ecological potentials are certain, however, some challenges remain for faba beans. First, the unreliability of seed importation is to be noted. In addition, pest pressure seems to be important, and yields seem to be highly dependent on rainfall. Climate change, favouring drought episodes and increasing insect reproduction, does not play in favour of faba bean. However, faba beans seem resilient against extreme rainfall, so the importance of an agrobiodiverse farming system should not be underestimated.

The demand for Swiss organic protein plays an important role in the organic sector for faba bean production. In the conventional sector, profitability is low, so the use of faba bean may have to be based on the willingness of the industry to substitute imported goods such as soya. New prospects in the food sector could provide better opportunities for conventional producers.

Looking at the food value chain, Swiss mountain faba beans are already adopted by several gourmet restaurants; their taste and use in cooking are considered very well by restaurants and their clients. Furthermore, several positive aspects can be used in the marketing and promotion of Swiss mountain faba beans. Thus, if the project launched has allowed the conservation and revival of a variety of Swiss mountain faba bean, increasing the scale of production still seems very difficult. Upscaling seed production is challenging, and the lack of willingness of neighbouring producers to produce faba bean might not help with resolving this challenge. The reasons for this unwillingness would be risk aversion, as faba bean cultivation is a new experience. However, low upscaling would allow for a sustainable and long-term scaling of the value chain, which remains important for the actors in the chain.

Seed conservation initiatives such as the Swiss mountain faba bean allow preserving biodiversity within Switzerland by producing food with a relatively interesting market potential. Introduction of Swiss mountain faba bean in gourmet restaurants is a good example of a successful seed conservation

project, contributing to preserve biodiversity. Preserving agrobiodiversity is the core concept of the CROPDIVA's project. Thus, producing new food products through such an initiative or substituting other protein crops in feed mixtures or ration represent possible solutions to start with for maintaining a certain level of faba bean production.

References

- Agristat. (2021a). Pflanzenbau. In *Statistische Erhebungen und Schätzungen über Landwirtschaft und Ernährung 2020* (pp. 7-28). Schweizer Bauernverband. https://www.sbv-usb.ch/fileadmin/user_upload/02_SES2020_Pflanzenbau.pdf
- Agristat. (2021b). *Schätzung der Schweizer Ackerfläche 2021*. Schweizer Bauernverband. https://www.sbv-usb.ch/fileadmin/sbvuspch/04_Medien/Agristat_aktuell/2021/Aktuell_AGRISTAT_2021-08.pdf
- Bauhin, J. C., Heinrich; Chabrey, Dominicus; Graffenried F. L. von Yverdon. (1650). *Historia Plantarum Universalis* (Vol. 2). <https://www.christies.com/en/lot/lot-4165255>
- BAZG. (2022). *Swiss working tariff*. Bundesamt für Zoll und Grenzsicherheit. Retrieved from <https://xtares.admin.ch/tares/login/loginFormFiller.do?l=en>
- Crépon, K., Marget, P., Peyronnet, C., Carrouée, B., Arese, P., & Duc, G. (2010). Nutritional value of faba bean (*Vicia faba* L.) seeds for feed and food. *Field Crops Research*, 115(3), 329-339. <https://doi.org/https://doi.org/10.1016/j.fcr.2009.09.016>
- Dierauer, H., & Böhler, D. (2009). *Merkblatt Bioackerböhen*. Research Institute of Organic Agriculture (FiBL). <https://orgprints.org/id/eprint/31182/1/1000-bioackerböhen.pdf>
- Guevara Oquendo, V. H., Rodriguez Espinosa, M. E., & Yu, P. (2021). Research progress on faba bean and faba forage in food and feed types, physiochemical, nutritional, and molecular structural characteristics with molecular spectroscopy. *Critical Reviews in Food Science and Nutrition*, 1-11. <https://doi.org/10.1080/10408398.2021.1931805>
- Jacomet, S. B., Christoph; Schraner, Elisabeth. (1999). Ackerbau und Sammelwirtschaft während der Bronze- und Eisenzeit in den östlichen Schweizer Alpen – vorläufige Ergebnisse. In *Prehistoric alpine environment, society, and economy = Prähistorische Umwelt, Gesellschaft und Wirtschaft in den Alpen : papers of the international colloquium PAESE '97 in Zurich / ed. by Philippe Della Casa* (Vol. 55, pp. 231-244). Rudolf Habelt. <http://edoc.unibas.ch/dok/A5252515>
- Kezeya Sepngang, B., Stauss, W., Ina, S., & Mergenthaler, M. (2018). The Market of grain legumes in Germany: First results of the EU-project LegValue (727672). 44. https://publikationen.fhb.fh-swf.de/receive/fhswf_mods_00000168 (Forschungsberichte des Fachbereichs Agrarwirtschaft Soest)
- Khazaei, H., Purves, R. W., Hughes, J., Link, W., O'Sullivan, D. M., Schulman, A. H., Björnsdotter, E., Geu-Flores, F., Nadzieja, M., Andersen, S. U., Stougaard, J., Vandenberg, A., & Stoddard, F. L. (2019). Eliminating vicine and convicine, the main anti-nutritional factors restricting faba bean usage. *Trends in Food Science & Technology*, 91, 549-556. <https://doi.org/https://doi.org/10.1016/j.tifs.2019.07.051>
- Koblet, R. (1965). *Der landwirtschaftliche Pflanzenbau. Unter besonderer Berücksichtigung der schweizerischen Verhältnisse*. (Vol. 16). Birkhäuser.
- Kolbe, H. K., Wolfgang; Hänsel, Martin; Grünbeck, Anka; Gramm, Marina; Arp, Britta; Krelling, Bernd (2002). *Körnerleguminosen im Ökologischen Landbau*.
- Mattioli, P. A., Handsch, G. H., Georgen Melantrich von, A., & Valgrisi, V. (1563). *New Kreüterbuch : mit den allerschnsten und artlichsten Figuren aller Gewechss, dergleichen vormals in keiner Sprach nie an Tag kommen*. Durch Georgen Melantrich von Auentin, auff sein und Vincenti Valgriss Buchdruckers zu Venedig uncosten. <https://www.biodiversitylibrary.org/item/37059>
- Meier, C., Harms, E., Früh, B., Stoffers, H., Bee, G., Hugelshofer, D. H., Quander-Stoll, N., & Stolz, H. (2021). The effect of polyunsaturated fatty acids (PUFA) and organic labeling on Swiss consumers' acceptance of pork salami. *Organic Agriculture*, 11(4), 519-537. <https://doi.org/10.1007/s13165-021-00369-9>
- Ramseyer, N. S., Barbara; Vonlanthen Irene; Brugger, David. (2021). *Potential ausgewählter Ackerkulturen in der Schweiz. Bericht zur aktuellen Lage im Ackerbau und den möglichen*

Entwicklungen. [https://www.sbv-
usp.ch/fileadmin/sbvuspch/04_Medien/Medienmitteilungen/PM_2021/Bericht_Potential_Schw
eizer_Ackerkulturen_DE_def.pdf](https://www.sbv-
usp.ch/fileadmin/sbvuspch/04_Medien/Medienmitteilungen/PM_2021/Bericht_Potential_Schw
eizer_Ackerkulturen_DE_def.pdf)

Rosenvold, K., & Andersen, H. J. (2003). Factors of significance for pork quality—a review. *Meat science*, 64(3), 219-237.

SBV. (2020). *Preise Pflanzenbau*. Schweizer Bauernverband. [https://www.sbv-
usp.ch/de/preise/pflanzenbau/getreide/](https://www.sbv-
usp.ch/de/preise/pflanzenbau/getreide/)

Schilperoord, P. (2016). *Ackerbohne*. Verein für alpine Kulturpflanzen. <https://doi.org/10.22014/97839524176-e3>

Swissgranum. (2021). *Inländische Produktion*. Retrieved 05.06.2022 from [https://www.swissgranum.ch/documents/741931/6810561/2021-12-
22_Verwendbare_Produktion.pdf/e071cb8b-17a4-5b40-079b-eba6f71f2264](https://www.swissgranum.ch/documents/741931/6810561/2021-12-
22_Verwendbare_Produktion.pdf/e071cb8b-17a4-5b40-079b-eba6f71f2264)