Packaging Redesign and Information Accessibility for Semi-Direct Starter Cultures

Sponsors:

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Abstract

This report investigates the supply accessibility and packaging of semi-direct starter cultures from Agroscope, an agricultural research center under the Swiss government, who supplies starter cultures to over 90% of cheesemakers in Switzerland. Our goals were to analyze the current conditions of transportation, storage, and waste management of the product in the Swiss Alps. Through surveys to Alpine cheesemakers and interviews with cheesemaking experts, it was found that the expected barriers in transportation and storage were not prevalent. This project also discusses ways to improve waste management and usability through several proposed redesigned packaging systems, with easily accessible instructions for improving the cheese making process.

Acknowledgments

This project would not have been possible without the help of many individuals over the course of the past seven months.

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Executive Summary

Background

Our project analyzed and suggested improvements to Agroscope's current transportation, packaging, and waste management systems of their liquid semi-direct starter culture products to the summer cheesemakers in the Swiss Alps. Semi-direct starter cultures are liquid or freeze-dried bacterial cultures used by cheesemakers to make cheese. Dairy farmers will often buy pre-mixed starter cultures from special laboratories such as our sponsor, Agroscope. As the semi-direct starter cultures have an ensured lifespan of ten days, most cheesemakers purchase them weekly (Agroscope, n.d.). Agroscope's current concerns, however, include the difficulty of transporting starter cultures to the remote Alpine regions and the generation of waste in the Alps as the packaging for the liquid cultures is made primarily out of plastic (Agroscope, n.d.).

In the summer months, some Swiss dairy farmers will bring their cows up to the Alps and make cheese there (Herzog & Seidl, 2018; Alpkäse, n.d.). Since many of the summer cheesemakers are not professionally trained, Agroscope wanted to make the liquid starter cultures easier to use.

Methodology

To achieve our goal, our objectives were as follows:

1. *Understand the conditions present in the current delivery system*
2. *Investigate the current conditions in which cheesemakers store the product*
3. *Learn what methods cheesemakers are currently using to dispose of the packaging*

4. *Ascertain what improvements in the product could make it more user-friendly*

To accomplish this, we distributed a survey to 150 cheesemakers and received 46 responses. In addition, we interviewed two dairy science experts who have worked at Agroscope and had spent at least one summer making cheese in the Alps. We also interviewed a cheesemaking consultant who works with Alpine cheesemakers in the cantons of Graubünden and Glarus.

Results

After analyzing the data from the surveys and interviews, our key findings for this project were as follows:

For the vast majority of Alpine cheesemakers, transportation is not an issue

Through our research, we found that 93.02% of the Alpine farmers already have adequate road access to their farms or have implemented a method to easily transport the starter cultures up the mountains. However, our data may not give the whole picture because we had a small sample size.

In general, Alpine cheesemakers store their starter cultures under correct conditions

We found that the majority of cheesemakers tend to store their cultures in a cold, dry environment away from sunlight, which Agroscope recommends to ensure that their cultures stay viable long enough until the next shipment arrives.

Recycling is inconvenient for some Alpine farmers

We did find, however, that recycling in the Alps was sometimes inconvenient and a less popular method than disposing of waste in the trash. Only 41.30% of the

respondents recycled their general waste, and only 32.61% of the respondents recycled their starter culture packages. We also found three main barriers that were a concern for 17.39% of the cheesemakers. These barriers were that separating the waste took too much effort, it was hard to access the local collection facility, and that they had limited storage capacity.

> *There is a need for a more convenient source of information and the integrated pipet could be improved.*

Through surveys and interviews, our group has identified that the integrated pipets currently attached to the caps of the starter culture bottles could be improved as many cheesemakers reported having problems with it. In addition, the information located on the Liebefeld Kulturen website may not be accessible to some cheesemakers due to lacking infrastructure on the Alps. This is especially important for inexperienced cheesemakers since they may need reference material when working in an internet dead zone.

Recommendations

After summarizing our findings, these are our group's suggestions:

1. *We recommend no changes in the current delivery system*

Since we found that most of the cheesemakers do not experience any barriers relating to transportation while obtaining the starter cultures, we do not believe there is any worthwhile change that can be made to the current delivery system.

2. *We recommend no changes in the material of the current shipping boxes*

Since the starter cultures stay viable long enough for the next shipment of cultures to arrive, there is no need for a more insulating shipping box material. After comparing various alternative shipping boxes including Styrofoam boxes, biodegradable coolers, reusable plastic containers, and recycled cardboard boxes, we found that cardboard is the best option with respect to cost and environmental impact. We only suggest the addition of a label or sticker to the box stating that the box is both recyclable and compostable.

3. *We recommend implementing a bottle return system to increase the sustainability in the life cycle of the semi-direct starter culture bottles*

In order to provide more of an incentive to cheesemakers to separate their waste, as well as making it more convenient for them to do so, we suggest implementing a bottle return system. In this system, Agroscope can sell used PET bottles as raw material to a third party or glass bottles can be disinfected by Agroscope and reused, depending on which material Agroscope decides to use. More specifically, cheesemakers will return their old starter culture bottles when they pick up the new bottles they ordered. Most companies that implement bottle return systems increase the price of their product a few cents higher than it should be, and customers get that extra few cents back when they return the bottles. Thus, this system creates an incentive to separate waste, which would improve the sustainability of the product.

4. *We recommend replacing the pipet lids that come with the current liquid semi-direct starter cultures*

The main complaint regarding the current design of the packaging is the pipet lid. One idea is to replace the current pipet with a normal lid and include a two-piece syringe with each box. This plastic syringe will be reusable as long as it is properly cleaned, which can be done easily since the pieces can be taken apart and washed individually. In terms of shipment, the new syringes could be included in the current packaging by utilizing the space left over by the removal of the current pipets.

Another idea is to have single-use pipets that are not attached to the lid. This would allow them to be longer than the bottle and thus make it easier to get the last of the starter cultures out, a problem specified by several cheesemakers. Similar to the syringe, these could be included in the current shipping container by using the empty space left over from the pipets, or secured by threading them through the cardboard insert.

Finally, Agroscope could utilize a bottle design that includes a screw-on nozzle cap, which would then feed into a measuring cup included in the box. This cup could be secured by placing it over the cap and filling the extra space with packing paper.

5. *We recommend including a pamphlet in the shipping box for quick reference*

We found a large percentage of the cheesemakers we surveyed are not very experienced, with 54.3% stating that their combined cheesemaking training had lasted less than a month. Therefore, we recommend that Agroscope include a pamphlet in their shipping boxes for quick reference on how to use the starter cultures. Agroscope has a reference for how to use their cultures on their website, however that might not be accessible to the Alpine cheesemakers who do not have internet access or cell service. The pamphlet would be more convenient for them and should include specific instructions on how to use the cultures, common problems that arise in cheesemaking, the solutions to those problems, and how to prevent them in the future.

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1. Introduction

Cheese is a common staple in many western societies and particularly popular in Switzerland. In 2011, Swiss citizens consumed 20.1 kg of cheese per person, compared to 15.4 kg in America (Helgi Library, 2020). This demand for cheese in Switzerland is supplied by hundreds of small-scale cheeseries and dairy farms (Agroscope, n.d.). These cheeseries produce a combined total of 185,000 metric tonnes of cheese each year for both local and international consumption (McCullough, 2018). In order to make all this cheese, the milk needs to be curdled through the use of the cheese starter cultures.

This project's sponsor, Agroscope, is the largest supplier of cheese starter cultures in Switzerland (Agroscope, n.d.). Agroscope is a government organization that is affiliated with the Swiss Federal Office for Agriculture and is managed by their Agroscope Council (Agroscope, n.d.). Agroscope's vision is to "[make] an important contribution to a sustainable agriculture and food sector as well as to an intact environment, thereby contributing to an improved quality of life" (Agroscope, n.d.).

Due to the variety in cultivation and production conditions in Switzerland, Agroscope offices are located all over the country. Their main offices are in Changins, Posieux, and Reckenholz, a part of Zurich (Agroscope, n.d.). There are other specialized research centers and offices located all across the country, as shown in the figure below, such as the one in Liebefeld, which produces the cheese starter cultures (Agroscope, n.d.).

Figure 1: Map of Agroscope Offices and Research Centers (Agroscope, n.d.)

Agroscope produces many different types of cheese starter cultures and supplies the starter cultures to more than 90% of the cheeseries in Switzerland (Agroscope, n.d.). The products that need the most improvement are the liquid semi-direct starter cultures, which are packaged in PET bottles with pipets attached to the lids, and then shipped in cardboard boxes to the Swiss cheesemakers (Agroscope, n.d.).

These cultures are utilized by the cheesemakers to create many different types of cheese, including traditional Alpine cheeses that are made from raw milk (Agroscope, n.d.). In Switzerland, they have a yearly tradition in which low-valley cows are brought to the Alps in the summer (Switzerland Tourism, n.d.). The Alpine cheesemakers use this time to produce cheese in the upper regions (Switzerland Tourism, n.d.). As the cultures have an ensured lifespan of ten days, most cheesemakers collect them weekly (Agroscope, n.d.). The cultures are packaged in single-use containers or plastic bottles, which also generate waste if they are not recycled (Agroscope, n.d.).

Since the early 20th century, Agroscope's research center in Liebefeld has been both producing and supplying cultures to cheesemakers in Switzerland (Agroscope, n.d.). Our project investigated packaging and delivery solutions for liquid semi-direct starter cultures to the cheesemakers that reside in the Swiss Alps, to help the Liebefeld branch improve its sales and sustainability.

2. Background

Cheese is created when proteins in milk are curdled by bacterial cultures. These curds are then drained of excess liquid, packed together, sometimes placed into a brine, stored on shelves, and allowed to age for a few months. The specific texture, color, and taste of the cheese is primarily determined by which bacterial cultures are used. Cheesemakers will often buy pre-mixed starter cultures from special laboratories such as our sponsor, Agroscope, to maintain a high cheese quality (Cultures and Starter Manufacture, 2019). The goal for this project is to help improve the packaging and usability of the liquid starter cultures that are essential to these cheesemakers.

Summer Alpine Dairy Farming

In Switzerland, summer farming is an annual practice among dairy farmers. For about 100 days, some dairy farmers will bring their cows up to the Alps so that they can graze on the many different herbs that grow in the now available pastures (Herzog & Seidl, 2018; Alpkäse, n.d.). The rich Alpine herbs also improve the cows' fertility and general health (Herzog & Seidl, 2018). This practice allows the farmers to focus all of their attention on their valley farms and stock up on hay and silage for the winter months (Herzog & Seidl, 2018). Roughly one-third of the country's dairy herd journey up into the Alps each year and are overseen by many hired Alpine farmers or relatives living in the Alps, instead of the valley farmers that own them (Herzog & Seidl, 2018; Switzerland Tourism, n.d.). These cows are traditionally paraded up the mountain in the spring and then paraded back down in the fall (Bewes, 2012). These parades are celebrations in which both the cows and the locals are dressed in traditional decorations and clothing, respectively (Bewes, 2012). An example of one such cow parade can be seen in Figure 2. It is during these parades that most of the valley farmers give control of the cows to the summer Alpine farmers (Switzerland Tourism, n.d.). Some additional benefits of summer farming include that it preserves the landscape, keeps historical traditions alive, and provides the

opportunity for local artisan cheese production in the Alps, which is a desired commodity among the Swiss people (Bergamaschi et al., 2016). The type of cheese that each Alpine farmer produces is traditional to the region that their farm is located in (Schweizer Alpkäse, n.d.).

In order to keep the various Alpine farms organized and running smoothly, many of the Alps are managed by designated "Alpmeisters" (Agroscope, n.d.). The Alpmeister helps take care of various duties on the mountain, as well as economic management like finances, selling cheese, giving earnings back to the cheesemakers, and recruiting staff (E. Eugster, personal communication, September 3, 2020).

Figure 2: Alpine Herdsmen Leading Dairy Cows up the Alps (Switzerland Tourism, n.d.)

Summer Farming Lifestyle

Summer Alpine farmers work long days milking the cows, making cheese, and maintaining the farm's infrastructure. A day of work will possibly go from 4AM to 10PM, typically starting and ending with milking the cows (Bergamaschi et al., 2016). Since many of the farms are small and independently operated, they may not have the necessary resources to transport large amounts of milk down the mountains (Agroscope, n.d.). However, a gallon of

milk, which weighs about 8.6 pounds, produces about a pound of cheese, so many farmers choose to make cheese on the Alps as it is easier to transport down the mountain and more sought after than raw milk (Federal Department of Foreign Affairs, 2017; USDA, 2020).

These summer cheesemakers are drawn to the Alps through government subsidies and because the cheeses they produce are more desirable than the more common mass-produced cheeses (Baur & Binder, 2013). They "are often high-quality traditional specialties" made of raw milk, so customers are willing to pay a premium for this cheese (Herzog & Seidl, 2018; Bergamaschi et al., 2016). These prices will continue to rise as current trends in the Swiss food market depict a growing interest in locally produced foods, such as the cheese from the Alps (Forney & Häberli, 2016).

The Alpine cheesemakers include both professional cheesemakers and those who are not farmers nor fully trained as professional cheesemakers. A large number of cheesemakers do not have professional training because summer farming is only seasonal work (Agroscope, n.d.). These inexperienced cheesemakers will return to their jobs in the city once the summer is over (Agroscope, n.d.). Thus, they may choose not to spend too much time or money on their cheesemaking training. They most likely would only have taken a two-to-four week cheesemaking course, such as those provided by Agroscope, unlike the valley cheesemakers, and thus may face various difficulties with making cheese (Agroscope, n.d.). For example, using the starter cultures is a multistage process that requires exact temperatures and conditions, and thus hands-on experience is needed in order to make cheese properly. Agroscope aims to make it easier for these cheesemakers to use the cultures by making the product more intuitive.

The Swiss Education System

Unlike many of the Alpine cheesemakers, the valley cheesemakers are professionally educated through the Swiss education system (Agroscope, n.d.). Swiss schooling is composed of three general levels: primary, secondary, and tertiary (Federal Department of Foreign Affairs,

2020). The country's compulsory schooling consists of primary and lower-secondary education and is usually completed by the age of fifteen (Federal Department of Foreign Affairs, 2020). Following this, students will choose between attending a baccalaureate or an upper vocational education and training (VET) school, to continue their education (Federal Department of Foreign Affairs, 2020).

In Switzerland, about 70% of young adults participate in the VET system and specialize in a range of subjects, including "information technology, advanced manufacturing and healthcare, as well as the traditional trades and crafts" (Federal Department of Foreign Affairs, 2020). The valley cheesemakers would have participated in this VET system in order to get their certification (E. Eugster, personal communication, September 3, 2020). In school, they would have not only taken classes but also participated in apprenticeships (Hoffman & Schwartz, 2015). After the apprenticeship is over, students are awarded with a "nationally recognized qualification" (Hoffman & Schwartz, 2015). The two qualifications in Switzerland are the Eidgenössisches Berufsattest (EBA), which translates to "Federal professional certificate" and is a two-year degree, and the Eidgenössisches Fähigkeitszeugnis (EFZ), which translates to "Federal certificate of proficiency" and is a three-to-four year degree (Berufsberatung, 2020). Depending on which school they went to, they would obtain either an EBA or EFZ upon graduation (Berufsberatung, 2020; Hoffman & Schwartz, 2015). However, as Alpine cheesemaking is only seasonal work, some of the Alpine cheesemakers would not have had this extensive training and practical experience, and instead had only taken a short training course (Agroscope, 2020).

Semi-Direct Starter Cultures

A starter culture is a bacterial culture, or a large group of bacteria, that is able to quickly grow and form a colony if given proper food and nutrients (Batt & Tortorello, 2014). There are three types of starter cultures: mother, direct, and semi-direct. According to Batt and Tortorello (2014), other cultures are produced by labs to create direct and semi-direct cultures. Direct

cultures are used by cheesemakers and are added directly to the milk (Batt & Tortorello, 2014). Semi-direct cultures, which we will be focusing on for this project, are grown in milk by the cheesemakers to produce cultures of greater size and then added to more milk to create cheese as shown in Figure 3 (Agroscope, n.d.; Batt & Tortorello, 2014).

Semi-direct starter cultures are a large group of bacteria that are sold with the purpose of growing more cultures (Agroscope, n.d.; Batt & Tortorello, 2014). Cultures are then used for many different things like conducting laboratory experiments, making pharmaceutical products, and producing cheese. The main use of a starter culture in cheese making is to metabolize lactose in order to produce lactic acid which lowers the pH of the milk and helps it coagulate, or curdle (Batt & Tortorello, 2014). They are called "starter cultures" because they "start" the lactic acid production in the cheese.

Figure 3: Steps for Applying Starter Culture to Milk (Agroscope, n.d.)

About 90% of the cheesemakers in Switzerland buy their cheese cultures from Agroscope, which mostly produces semi-direct starter cultures (Agroscope, n.d.). The semi-direct cultures grown by Agroscope are delivered to the farmers and have a shelf life of 10 days. When making cheese, the cheesemakers add the culture, or a mix of cultures, to a growing medium, in this case sterile milk, allowing the cultures to multiply and grow. This turns the milk into a working culture and after about 15 hours the working culture can then be added to fresh

milk to start making cheese (Agroscope, n.d.). The specific type of cheese being made is determined by what specific cultures are used, and what phase of the cheese making process they are added. For example, Penicillium cultures are injected into milk curds to develop the signature flavor and blue ridges of blue cheese. However, the focus of the project is on the cultures that are added right at the beginning of the process. Other food products, like yogurt, butter, and bread, also use starter cultures, but are not covered in this project.

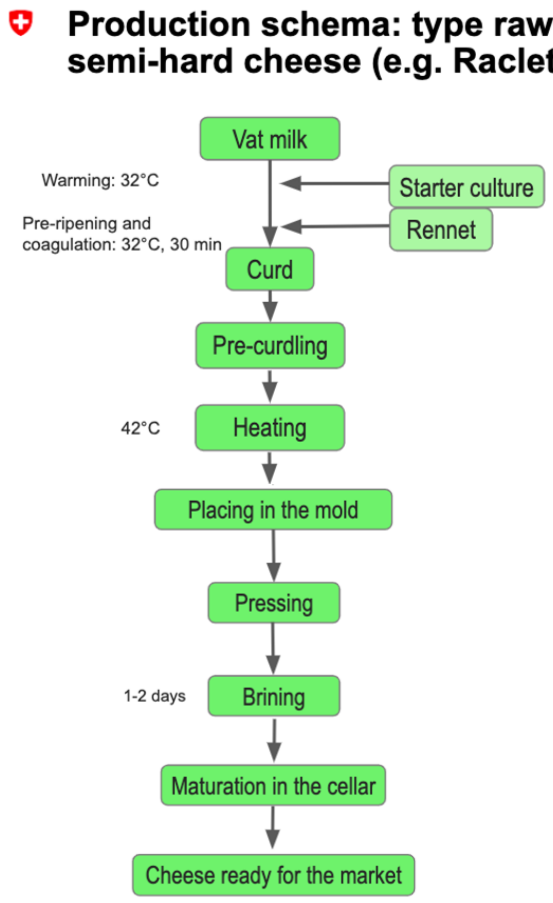

Figure 4: Steps for Making Semi-Hard Cheese (Agroscope, n.d.)

Packaging Designs for Starter Cultures

In order to transport the vital starter cultures, companies like Agroscope naturally have to package the cultures for shipment. Commercially, these cultures generally come in five forms: highly concentrated deep-frozen direct cultures, highly concentrated freeze-dried direct cultures, concentrated deep-frozen semi-direct cultures, concentrated freeze-dried semi-direct cultures, and liquid semi-direct cultures (Tetra Pak, 2019).

One of the most common methods for packaging starter cultures is freeze-drying them. After this process, they need to be stored at 4 degrees Celsius or lower, to keep the cultures viable for about 6 to 12 months (The Cheese Maker, 2020; Połomska et al., 2012).

Agroscope's Current Packaging Designs

Currently, Agroscope produces both freeze-dried cultures and liquid cultures(Agroscope, n.d.). Those that are freeze-dried need to be kept at a steady temperature. The freeze-dried cultures come in stickpacks (Liebefeld Kulturen, 2019). These stickpacks are "tear open" disposable packets and are non-recyclable and create a fair amount of waste (Liebefeld Kulturen, 2019). Agroscope's liquid cultures are packaged in a 80 mL Polyethylene terephthalate (PET) bottle that comes with a pipet that is attached to the lid (Liebefeld Kulturen, 2019). PET is a recyclable thermoplastic polymer resin used in plastic bottles and food containers (Liebefeld Kulturen, 2019). The PET bottle is recyclable while the pipet lids are not (Agroscope, n.d.).

Since PET material is used for each culture mix and can be temperature-controlled, it is clear that this method is sufficient in sustaining the makeup of the culture (Agroscope, n.d.). Other materials have similar properties of being thermal but may have greater production costs and produce more waste than PET.

Figure 5: Cheese Starter Culture Packaging Designs from Agroscope's Liebefeld Kulturen Website (Liebefeld Kulturen, 2019)

Environmentally Friendly Packaging

Switzerland is one of the global leaders in recycling (Swiss Federal Office for the Environment, 2018). According to the Swiss Federal Office for the Environment (2018), up to 53% of its annual 90 million metric tonnes of waste is recycled. Sustainability is of great importance to Swiss people, and by extension, Swiss companies like Agroscope (Bewes, 2012). As such, they are trying to ensure that their products are as environmentally friendly as possible, as shown through this project.

Currently, there are four main techniques on how to reduce packaging waste: reducing, reusing, recycling, and composting. Reducing the waste includes using smaller containers and buying less product. Other than reusing the packages after the product is finished, reuse can also include methods such as glass bottle returns. Plastic is a recyclable material, meaning that it can be sent to a recycling center and used to create new products (LeBlanc, 2020). However, the constant breakdown of recyclable material and the further production of more packages produces some waste and greenhouse gases (Dai, 2012). However, all of these options are better than materials that are neither recyclable or reusable, which can only be sent to landfills or be littered across the globe.

Recyclable

Plastics are one of the most used materials for packaging in the modern world. In addition to being widely used, many forms of plastic are highly recyclable. Polyethylene terephthalate (PET) is used in many bottles and containers, including the current container for the Agroscope liquid semi-direct starter cultures (LeBlanc, 2020). In 2012, this material had a recyclability rate of 52% across the European Union – in other words, only that percentage of it is deposited in recycling bins (LeBlanc, 2020). To recycle PET materials, a processing company must first wash the product thoroughly to remove contaminants, and from there the PET is ground into small flakes (LeBlanc, 2020). These flakes go through several tests and are separated by purity, then sold as is or melted into pellets (LeBlanc, 2020).

Reusable

Another way to reduce this problem is to switch to reusable packaging, like glass bottle returns. Glass has "extremely low oxygen permeability," (Cruz et al., 2007), which is useful when packaging starter cultures (Agroscope, 2020). By using glass bottles, companies can invest more into each individual bottle, meaning that the bottles will be sturdier and of higher quality. However, reusability comes with its own problems, like the customers' responsibility to return the reusable bottles, sterilizing the bottles in between each use, or transporting the bottles to be refilled (Kensal, 2015). Glass in particular is also more expensive than many other materials and can lead to hazards while handling or shipping it due to the fragility of the material (Cruz et al., 2007). Because of these challenges, some companies have started to back away from reusable packaging in recent years in favor of recyclable packaging, like the Scottish soda company Irn-Bru's abandonment of their bottle return policy in 2015 (Kensal, 2015). However, since Agroscope is selling directly to the consumer, and the consumer needs to regularly resupply, reusability might be a viable option because the cheesemakers can easily return the bottles when they travel down the Alps to resupply (Mckerrow, 1996). The pros and cons of using recyclable and reusable packaging are highlighted in Figure 6.

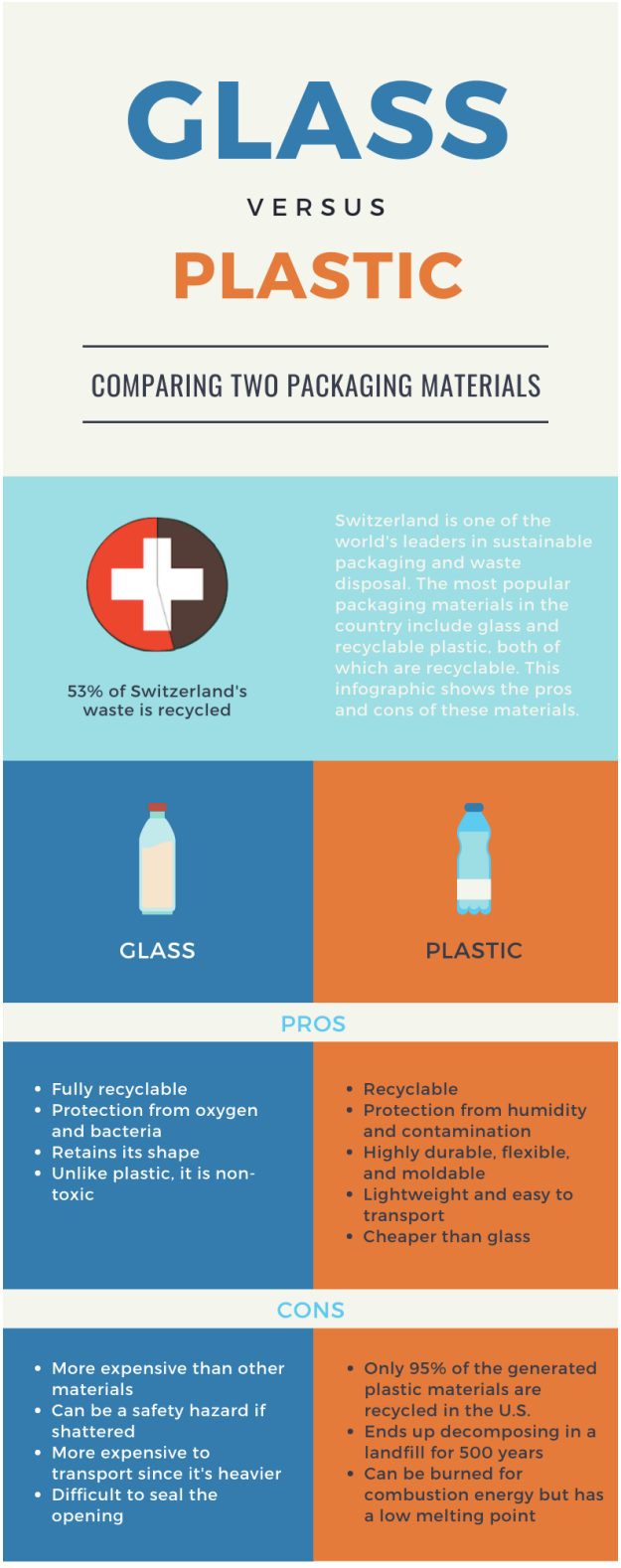

Figure 6: Pros and Cons of Different Packaging Materials

Environmentally Friendly Shipping Containers

The three ways to reduce the environmental impact of shipping containers is the same as the ones highlighted in the previous section for product packaging. Since shipping containers are used to protect packages from the shocks and damages they might obtain through transit, they are designed to be sturdier. In this section, we will describe different materials that can be used instead of the cardboard shipping box that is currently used to ship Agroscope's starter cultures.

Recyclable

Many shipping container materials are recyclable. One of the most common recyclable shipping materials is corrugated cardboard, and it is estimated that more than 90% of all shipping containers were made of this material (Dennis, 2011). Commonly referred to as just "cardboard," corrugated cardboard is composed of three layers where the middle layer is ruffled while the outsides are flat.

Some shipping boxes are made out of plastic and are both reusable and recyclable. For example, Switzerland's national post service has a product called Dispobox, which is made of durable plastic (Swiss Post, n.d.). The sender packages their goods in a Dispobox, which is then mailed to the receiver, and the receiver sends the Dispobox back to the post office so it can be used again (Swiss Post, n.d.). The reusability of the box makes it more sustainable (Swiss Post, n.d.). However, when shipping vast quantities of the product, using corrugated cardboard boxes is better than reusable plastic containers in terms of manufacturing costs and waste management (Koskela et al., 2014).

Insulated

For products that need to be kept at a low temperature, there are shipping boxes with insulating properties. One such material is expanded polystyrene, commonly referred to as "styrofoam," which has excellent insulation properties but cannot be recycled (Chandra et al., 2016). Thus, it typically ends up in landfills or litters the planet (Chandra et al., 2016). Additionally, particles from the styrofoam will be extremely toxic to marine life if it ends up in aquatic ecosystems (Jang et al., 2016).

There are many biodegradable alternatives to styrofoam. For example, the company Paradise Packaging sells insulated shipping boxes that are marketed under the name "Mushroom® Coolers" and are made of MycoComposite™ (Paradise Packaging Company, n.d.). The patented material is made up of "a mix of hemp hurds and mycelium" (Paradise Packaging Company, n.d.). Another unconventional material that can be used to make biodegradable coolers is corn starch. A shipping box design that was invented by James Branham is made of a corn starch foam sheet that is laminated with bio-plastic film to make it more resistant to water (Branham, J. 2014). In addition, the company Igloo sells a product called "ReCOOL 16 Qt Cooler" that is made of recycled paper and alkyl ketene dimer (AKD), which makes the paper more resistant to water (Igloo, n.d.; Hubbe, n.d.). This product states that it can be used to hold ice and can be reused as long as it is emptied of any ice or water after each use and left to air dry (Igloo, n.d.). Other biodegradable raw materials that can serve as alternatives to styrofoam include rice husk and popcorn (Rizal, 2019; Wilkerson, Head 1993). The differences between all of the materials that were highlighted in this section are shown in the figure below.

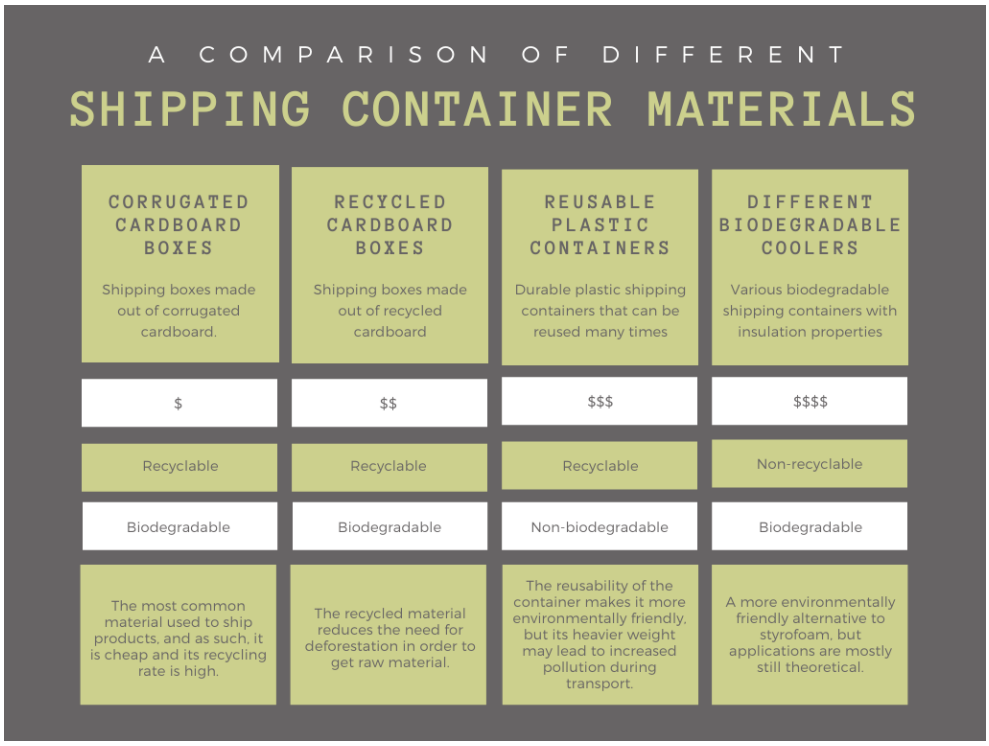

Figure 7: Shipping Container Material Comparison

3. Methodology

Our goal was to improve the convenience and sustainability of semi-direct starter culture packaging and delivery for Alpine cheesemakers. In order to achieve this, our objectives were as follows:

1. Understand the conditions present in the current delivery system
2. Investigate the current conditions in which cheesemakers store the product
3. Learn what methods cheesemakers are currently using to dispose of the packaging
4. Ascertain what improvements in the product could make it more user-friendly

Afterwards, we will take this accumulation of knowledge and develop a series of proposals that can help the farmers transport the cultures more conveniently and dispose of the packaging material in a sustainable manner.

Objective 1: Understand the conditions present in the current delivery system

For our first objective, we researched limitations and drawbacks of current semi-direct delivery systems to summer cheesemakers in the Swiss Alps. We conducted 46 surveys and 3 interviews focused on: the current methods that Alpine cheesemakers use to transport their starter cultures, the frequency of their restocking trips, and the current solutions the cheesemakers implement to alleviate traveling difficulties.

Surveys

The survey allowed us to reach a larger population and was more generalized compared to the focus-group in order to crowdsource ideas from various points of view. However, this was necessary to fully understand any problems before we began any preliminary designs. In the next paragraph, we describe our focus groups, which allowed us to gather more detailed information and elaborate on things we did not understand.

We surveyed the Alpine cheesemakers about the current delivery methods for the starter cultures. This method allowed us to obtain data from more cheesemakers than if we were to only use interviews. Though Agroscope has many customers all over Switzerland, we only focused primarily on surveying those who farm in the Alps. We asked Agroscope to print out the survey questions and send them through the mail with the starter culture orders. On average, we expected that it would take the participant about ten minutes to answer the multiple-choice questions of the survey. The survey questions we asked can be found in Appendix A, B and C.

The results of this survey, which can be found in Appendix M, N, O, and P, were reviewed to determine any difficulties the cheesemakers face while obtaining their starter cultures. Write-in answers were recorded carefully as this was more personal data to the particular respondent. We organized those answers into different categories and analyzed them in Excel bar graphs to visualize statistics gathered from our target population. For yes or no questions, Y represented yes, N represented no, M represented maybe, if there was that option, and 0 represented no response. For one-answer multiple choice questions, each answer was written out as the letter the respondent put, or 0 if they skipped that question. For the select-all-that-apply questions, each option had a column, and if a respondent selected that option that column was filled with a 1, otherwise it was filled with a 0. There were also a few clarifications or notes written out by the respondents. We logged these comments in a column next to the question, so we had the complete data in the excel file. This data was then summed together and used to calculate percentages.

We generated our percentages by dividing the number of respondents that answered the question a certain way by the total number of respondents that answered that question, since some respondents did not answer all the questions. We also cross-analyzed some of the questions

to gather more specific statistics, for instance, of the respondents who take longer than an hour to get their cultures, what percentage of them use a car or truck? To calculate these types of statistics, we counted the number of respondents who belong to both populations and divided by the total number of cheesemakers in the population of interest. For example, we would count the number of respondents who both take longer than an hour to get their cultures and also use a car or truck to get down the Alps, and then divide that number by the total number of respondents who take longer than an hour to get their cultures.

Dairy Science Expert Interviews

Our target population for these interviews were experts in dairy science who have worked at Agroscope and had spent at least one summer making cheese in the Alps. We found members of this demographic through Agroscope. Three interviews were scheduled, but only two ended up taking place.

We used video conference platforms Microsoft Teams for our interviews with the dairy science experts. During the interviews, we had multiple group members taking notes to ensure that we did not miss any information. These interviews followed a set of guiding questions, listed in Appendix D, but were otherwise freeform in nature. Meetings lasted about an hour, which was enough time to gather the information we needed without feeling rushed. These interviews primarily focused on the science of cheesemaking, the Alpine cheesemaking experience, the different types of summer cheesemakers, the current delivery system, and the difficulties acquiring the starter cultures.

After collecting this data, we categorized it into common problems that the experts brought up. We then used these issues to develop a better understanding of the problem.

Cheesemaking Consultant Interview

After researching cheesemakers and compiling a list of various experts in the field, our team sent emails to 38 Alpine cheesemakers and cheese consultants who were not affiliated with Agroscope asking if they would be willing to conduct personal interviews with us. From this list, we received one confirmation and two others asking for us to simply send them the interview

questions. We used the video conference platform Zoom for our interview with the Alpine cheese consultant. During the interview, we had multiple group members taking notes to ensure that we did not miss any information. In addition, we recorded the interview so we could translate and transcribe everything the cheesemaker said. This interview followed a set of guiding questions, listed in Appendix E, but was otherwise freeform in nature. Questions were translated into German beforehand as the interviewee spoke predominantly Swiss German. Our advisor Professor, Ulrike Brisson, helped with these translations and with interpreting during the meeting. This meeting lasted about half an hour. This interview primarily focused on the Alpine cheesemaking experience, the different types of summer cheesemakers, the problems that arise during cheese making, as well as access to utilities.

After collecting this data, we categorized it into common problems that the experts brought up. We then used these issues to develop a better understanding of the problem.

Cheesemaker Focus Groups

We hosted three virtual focus groups, in which groups of people were to be interviewed to determine how they are affected by specific issues (Beebe, 2014). We wanted to use this to gather more in depth information about the Alpine cheese making lifestyle, and the difficulties they face, that we could hopefully find solutions for. We included a question in the survey that asked the respondent whether or not they would be interested in participating in a focus group to talk about their thoughts on the current product, of which we received 7 replies. As the end of the Alpine farming season for the farmers coincided with our time window for holding focus groups, we unfortunately had no attendance as they were most likely busy moving out of the mountains.

Objective 2: Investigate the current conditions in which cheesemakers store the product

Using the responses from our survey, we determined how the cultures were currently being stored so that we could get an idea of the constraints we needed to follow when designing our system. We also wanted to understand any possible dangers to the bacteria that could be present. We gathered this data by surveying and interviewing the Alpine cheesemakers about their current storage habits.

Surveys

We added objective-related questions to the survey described in Objective 1. The survey questions we asked are specified in Appendix A, B and C. The results of this survey were copied into Excel to determine patterns on how the Alpine cheesemakers store their cultures. This data was analyzed in a similar fashion to objective 1. Excel graphs were then generated so we could easily visualize the statistics about our target population and develop clear constraints for our recommendations.

Interviews

Next, we used interviews to obtain a more detailed explanation on effective ways the cheesemakers store and transport their cultures. The questions our team used to guide the interviews are shown in Appendix D and E. Results from the interviews were coded and analyzed with similar methods to our survey results.

Objective 3: Learn what methods Alpine cheesemakers are currently using to dispose of the packaging

For our third objective, we collected information regarding the various disposal methods that are currently being used by the cheesemakers, when discarding the starter culture packaging. We incorporated additional questions about the cheesemakers' disposal methods to both the survey and the interview described in Objective 1.

Surveys

We added packaging disposal method specific questions to the survey described in Objective 1, Appendix A, B and C. Data was collected in Excel, and categorized to create a list of the preferred disposal methods available to the Alpine cheesemakers we surveyed. This data was separated by question and used to generate bar charts. Other data that cannot be easily grouped was moved into separate documents and analyzed independently. In addition, we used the data to create a list of reasons why Alpine cheesemakers are unable to recycle effectively. We then categorized the responses based on the barriers to recycling they gave, as well as whether they were already recycling. We then summed up the number of responses in each group to generate relevant statistics about the barriers to recycling.

Interviews

We added a section to the interview specified in Objective 1 to obtain a more detailed explanation on the methods used by the Alpine cheesemakers to dispose of their packaging. The questions our team used to guide the interviews are shown in Appendix D and E. Results from the interviews were coded and analyzed with similar methods to our survey results.

Objective 4: Ascertain what improvements in the product could make it more user-friendly

For our third objective, we collected information regarding the various disposal methods that are currently being used by the cheesemakers, when discarding the starter culture packaging. We incorporated additional questions about the cheesemakers' disposal methods to both the survey and the interview described in Objective 1.

For our fourth objective, we gathered information from the Alpine cheesemakers about the ease of use of Agroscope's semidirect starter cultures. To accomplish this, we hosted three virtual interviews to obtain detailed descriptions of concerns and suggestions regarding the product. In addition, we added questions to the previously mentioned survey to get more generalized data. The data we collected allowed us to suggest new packaging designs that would improve the product's ease of use for the Alpine cheesemakers.

Surveys

We included a fill-in-the-blank question in the survey described in Objective 1 where participants could freelist their thoughts, concerns, and suggestions for the starter culture packaging design. The questions added are specified in Appendix A, B and C. Since these questions were open-ended, we first started by categorizing the responses by the part of the packaging they wanted to see changed. We then sub-categorized each category by the issue described by the participant or how that specific part of the packaging could be improved. Next, we summed up the number of respondents in each category and divided that number by the total number of Alpine cheesemakers who had responded to the survey. This was done in order to gather percentages. Afterwards, we analyzed the results to determine the main concerns with the current packaging and wrote down suggestions for design modifications.

Interviews

In the interviews described in Objective 1, we also added questions to specifically obtain a more detailed description of the issues present with the starter culture bottles. We recognized

that for the dairy science experts who had spent at least one summer making cheese in the Alps, they may not necessarily have used Agroscope's starter cultures since about 10% of the cheeseries and dairy farms in Switzerland use starter cultures from other brands (Agroscope, n.d.). Thus, even though they may have responded with issues that are specific to the brand they used, we also wanted to know whether or not the cheesemaking experience in general was difficult to adapt to. Since there are many inexperienced cheesemakers who go up to the Alps in the summer, we wanted to learn whether or not more information or instructions should be included with the starter culture packaging in order to make it more user-friendly. The questions our team used to guide the interviews are shown in Appendix D and E. Results from the interviews were coded and analyzed with similar methods to our survey results.

Conclusion

In order to suggest any improvements, we investigated the current delivery methods and difficulties with the starter cultures, the conditions in which the cultures are stored, how the packaging is being disposed of, as well as any suggestions the cheesemakers had to improve the cultures. We did this through a mixture of surveys and interviews designed to answer different portions of our objectives, then organized the data to generate statistics about the Alpine cheesemakers. Though we set up multiple focus groups, unfortunately they had no attendance. This was because the timing of this project coincided with the end of the Alpine summer farming season and so most of the cheesemakers were busy returning to the valley.

The objectives described in this chapter helped us fully understand the problems faced by the Alpine cheesemakers and provide the knowledge that was essential to suggesting relevant recommendations for the current delivery system and packaging of Agroscope's starter cultures.

4. Results

In this chapter, we used our survey and interview data, which are listed in Appendices I, J, K, L, M, N, and O, to evaluate the current delivery method used by Agroscope and analyzed how difficult it was for the cheesemakers to obtain their starter cultures. We also looked into how long the cultures stay viable in the current storage conditions employed by the cheesemakers. We then looked into the waste disposal methods for the starter culture packaging, as well as any barriers the cheesemakers may face in regard to using specific disposal methods. Finally, we summarized the ideas provided by the cheesemakers for improving the product. In this chapter, we present our findings, which are as follows:

1. For the vast majority of Alpine cheesemakers, transportation is not an issue
2. In general, Alpine cheesemakers store their starter cultures under correct conditions
3. Recycling is inconvenient for some Alpine farmers
4. There is a need for a more convenient source of information and the integrated pipet could be improved

Our survey data, however, is still limited as it only came from the cheesemakers that responded to the survey. It will be skewed due to the very small sample size since of the 150 surveys that were sent out, we received responses from only 46 farmers. Although this number is not ideal, the data represents enough of the population to get a general idea about the current conditions.

Finding 1: For the vast majority of Alpine cheesemakers, transportation is not an issue

Through the data collected from the survey, we found that the vast majority of the Alpine cheesemakers did have road access. When we first began this project, our sponsors had believed that a substantial percentage of the Alpine cheesemakers might not have had access to motorized vehicles. As such, it was thought that a more efficient delivery system would have been needed in order to accommodate the cheesemakers without road access. However, our data suggests the contrary. It was found, through our surveys and interviews, that the vast majority of participants do have access to motorized transportation. Additionally, it was stated by the majority of respondents that their trips take less than an hour, with nearly half of that majority claiming to spend less than 10 minutes per trip. A large portion of the farmers would resupply on other essentials every week even if they did not need to restock on cultures. Our team also found out that some of the Alpmeisters, the people who manage the cheesemakers on the Alps, help their farmers by picking up the cultures from the post office, to help deliver the cultures.

Though we do not have the exact statistic for how many participate in similar systems, from our data we estimate that at most 69.56% of the respondents get help from their Alpmeister in acquiring their cultures. This statistic was calculated by counting every participant who fit one of two cases. The first case was that their cultures are not delivered to their door, but they do not have to go to the post office, inferring that they might travel to someone else's house to pick them up. The second case was that the cultures are delivered to their door, inferring that someone leaves them at their door, this most likely also includes those who have the post office deliver the cultures to them with a mail carrier. Respondents who stated that they work in the valley were excluded from this figure. However, since we only received three responses that outright stated that they did receive help from the Alpmeister, we believe that this statistic is actually much lower.

Shipping Destinations

In our survey, we asked if the cultures were delivered to their door and if they had to pick up the cultures at the post office. For both questions, respondents mainly indicated that they did

not, as shown in both Figure 8 and Figure 9. The 22 respondents who said no to both questions are those we can assume have assistance from the Alpmeisters or neighbors. For the 8 cheesemakers (17.39%) who responded that they do not have to go to the post office but do get it shipped directly to their doors, they most likely have it brought to them by the Alpmeister or by postal carriers. For example, two of these respondents said that their cheese dairies are located in a town and are most likely serviced by the postal carriers. In addition, other respondents claimed that the "Alpmeister brings us the cultures with the car/motorcycle" (Survey Respondent 39).

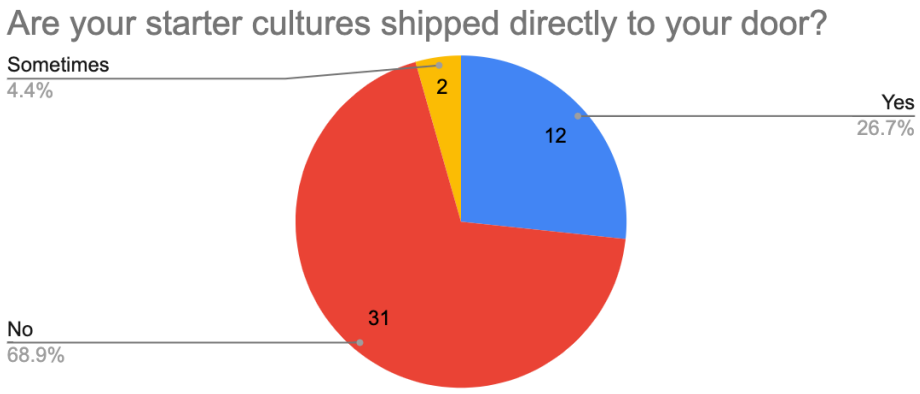

Figure 8: Are your starter cultures shipped directly to your door?

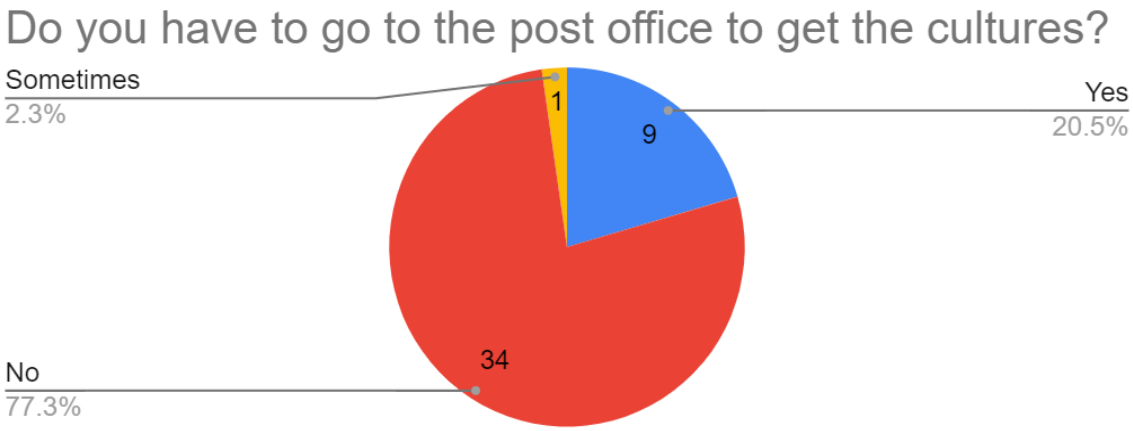

Figure 9: Do you have to go to the post office to get the cultures?

Transportation Used for Resupply Trips

As seen in Figure 10, nearly all respondents (93.02%) declared that they use some form of motorized vehicle as transport down the mountain, with 90.70% having access to a car or truck and 2.33% having access to a motorcycle. In total, 7 cheesemakers selected other forms of transportation; however, many of them also have access to a motorized vehicle. In total, only 2 people did not have access to a car, truck, or motorcycle. These respondents utilize bicycles and gondolas as their method of transportation.

Additionally, we found that only 2 respondents said that they walk down the mountain to get their starter cultures. They also marked that the trip up the mountain takes 1-3 hours and that they also use a car or truck in addition to walking. However, due to the wording of the question, we are unsure if the participant might decide to walk up the mountain some days, drive half way up then walk the rest of the way to the farm, or if they walk some days and drive others. We are likewise unsure of whether the 1-3 hour time refers to the time it takes to walk to town or a combination of walking and driving as our survey questions did not go that in depth.

But for the vast majority (88.64%) of the people who responded to the questions, seen in Figure 10 and Figure 11, said that the trip to get the starter cultures takes less than an hour. About half of the Alpine cheesemakers who responded to this question (52.27%) state that it takes them between 10 minutes and an hour to get their starter cultures, and 36.36% take less than 10 minutes. Of the participants whose trips take more than an hour, 80.00% have to go to the post office, and 80.00% have access to some form of motorized vehicle. There was only one respondent who answered that they had to physically go resupply cultures and that they did not have access to a motorized vehicle. This respondent said that it took between one and three hours to resupply on cultures but they also said that they had to restock on essentials once a week, even if they didn’t need the cultures.

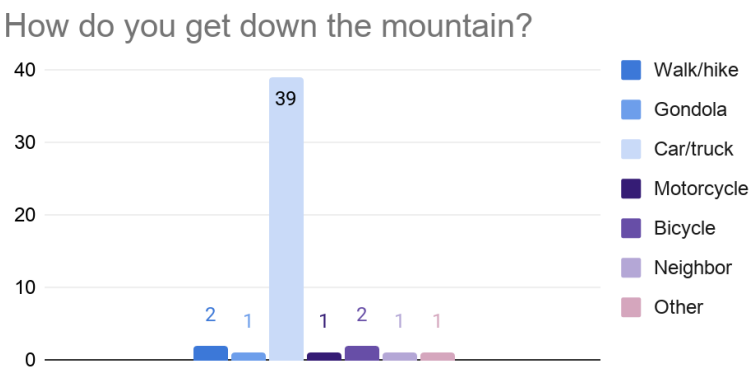

Figure 10: How do you get down the mountain?

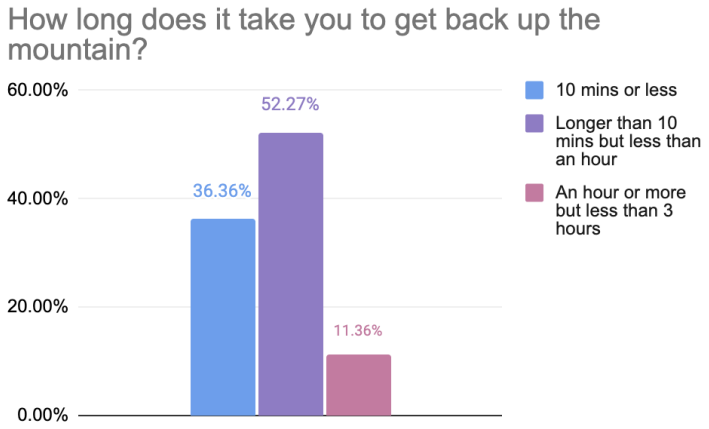

Figure 11: How long does it take you to get up the mountain?

Frequency of Resupply Trips

The responses to the survey also indicate that 88.89% of Alpine cheesemakers get new cultures once a week, while the remaining 11.11% resupply every two weeks, as shown in Figure 12. These trips may occur at different frequencies than the trips used to restock on food and other living essentials. Shown in Figure 13, 46.34% of the participants said they would take this trip once a week if they did not need to restock on cultures, 21.95% claim they would go every two weeks, 21.95% would go once a month, and the remaining 9.76% say they could last 3 months or

more without going into town to resupply on food and essentials as they have someone resupply for them like a friend or the Alpmeister, or they can last for the entire summer in the Alps.

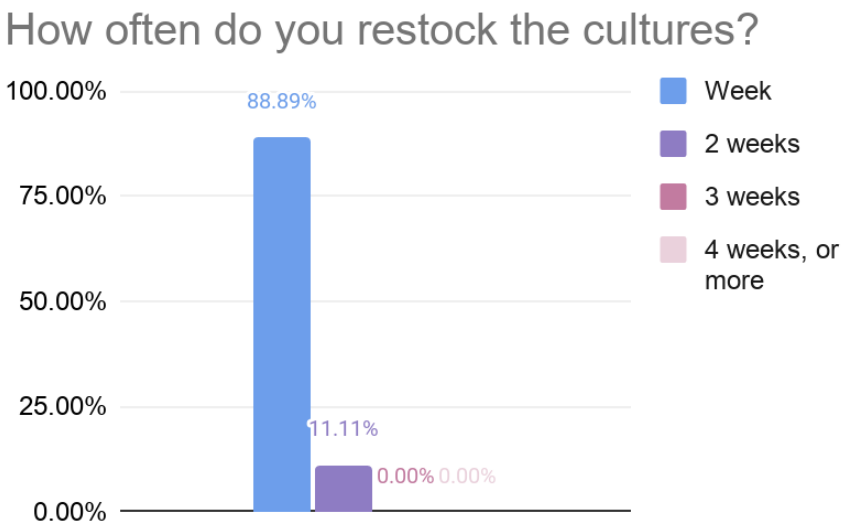

Figure 12: How often do you restock on cultures?

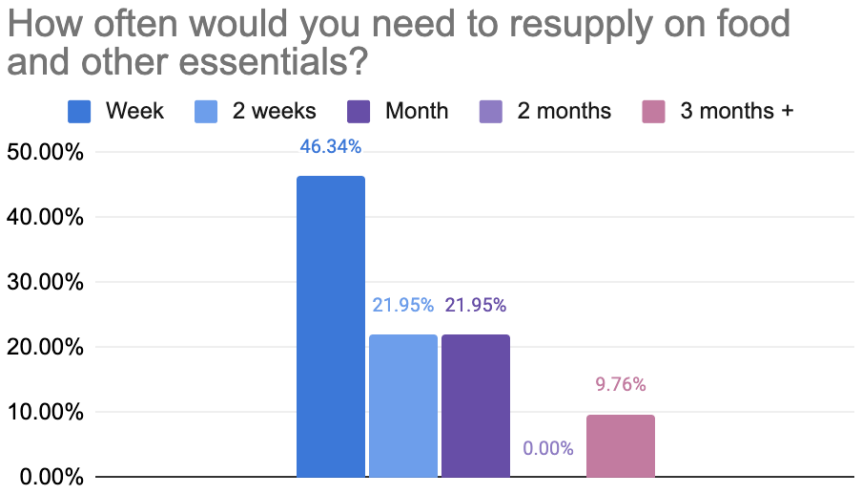

Figure 13: How often would you need to resupply on food and other essentials if you did not have to restock on starter cultures?

Road Access

In separate meetings with cheese experts, we asked about road access. In the interview with technical dairy science expert Mr. Kohn, Appendix J, he stated that when he spent his summer in the Bernese Alps, he had road access and that the nearest cheese farm was 3 miles away. Another technical dairy science expert, Dr. Eugster, said that she had road access and claimed that if cheesemaking equipment broke down, those roads would be crucial to getting help from a mechanic who could help fix these issues, Appendix I.

However, with respect to our survey results, we did not have a specific question asking if they had access to roads and instead asked them how they get their starter cultures. This could lead to skewed results. Someone could have road access but chooses to walk down the mountain or someone without road access could have someone bring them cultures like the Alpmeister. Whichever method the farmers use to obtain their cultures works, so we decided not to change the delivery system as even the experts say it is not an issue.

Finding 2: In general, Alpine cheesemakers store their starter cultures under correct conditions

Through our survey, we also found that the cultures seem to stay viable for the given time frame Agroscope guarantees. Since our data shows that most farmers restock weekly, they will not have the cultures die before they can get them restocked. The cultures stay viable because the majority of cheesemakers store the starter cultures under Agroscope's recommended conditions, in a cool, dry place, away from sunlight.

Replacing the Cultures

According to the survey the vast majority of respondents use or replace their cultures within the recommended time period. As shown below in Figure 12, 88.89% of respondents

replace their cultures within a week, with the remainder replacing them within two weeks. This is optimal as the cultures are guaranteed by Agroscope to last ten days, but if stored in ideal conditions they can easily exceed that number. As most of the respondents claim to restock weekly, it can be assumed that they are for the most part ordering exactly what they will need for the following week, however as the question is not specifically geared towards asking this, it can only be inferred.

Storage Conditions

The data also shows that the vast majority of the respondents keep the cultures at temperatures below 5°C, as shown in Figure 14. Only 11.11% of the sample population reported that they store their cultures above the 5°C recommendation that is printed on the bottle. Although it is not specifically stated by the question, it can be inferred that the majority of cheesemakers have refrigerators since this temperature is otherwise hard to simulate during the summer months.

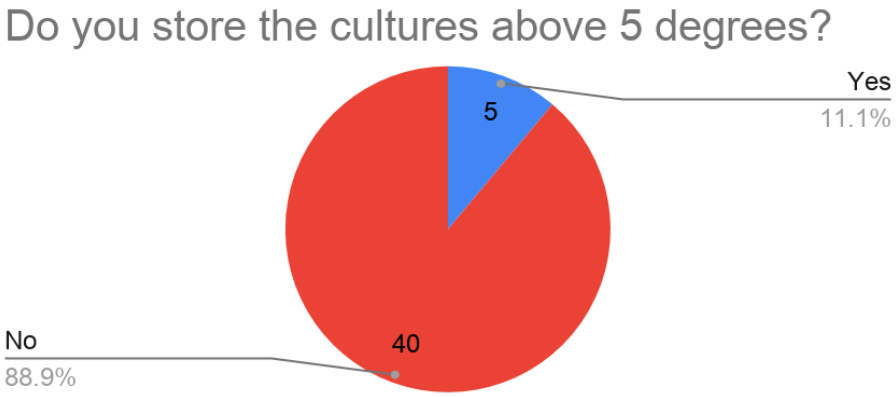

Figure 14: Do you store the cultures above 5 degrees?

Additionally, every single respondent stated that they did not store their cultures near windows. From this data it can be concluded that for the most part people do not store their cultures in direct sunlight, which can be bad for the cultures. However, upon further review, it

was decided that for more clear answers the question should have asked directly whether the cultures are stored in direct sunlight as this data might be skewed due to the wording of the question. This does not cover the case where they store their cultures outside, in direct sunlight, but is still technically not near any windows. Our team does not believe that this had any significant effect on the results but is still worth mentioning.

In addition to no one storing their cultures near windows, most respondents said that they do not store their cultures in a humid area. As shown in Figure 15, 41 respondents (91.11%) are able to follow Agroscope's recommendation for not storing the cultures in a humid area. There was, however, a problem with the question that was brought to our attention by a comment written on one of the surveys. A few people did not know if a refrigerator counted as a humid area. We concluded that it does not, so the number of people who did report to storing their cultures in humid conditions may be lower. This is supported by the fact that 3 of the 4 respondents that said they store the cultures in humid areas also said they store the cultures at or below 5°C, which implies they store them in some kind of refrigerator.

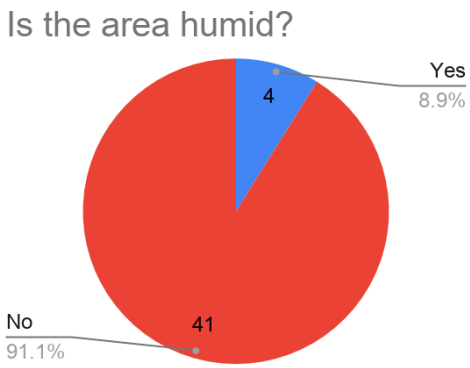

Figure 15: Is the area humid?

Finally, all these results are reinforced by the fact that 97.73% of the respondents said that their starter cultures stay viable for at least a week, as shown in Figure 16. This is most likely due to them storing the cultures in ideal conditions. From our survey, we received only one response that said the cultures last for less than a week, with this respondent claiming that their cultures did not last longer than a day. However, this could also be a miscommunication since

the question – “Nachdem Sie die Kulturen bekommen haben, wie lange können Sie die Kulturen nutzen?” which translates to “After you receive the cultures, how long can you use the cultures for?” – could be interpreted a few different ways. One interpretation of the participant’s response could be that they bulk order freeze-dried starter cultures and use an entire stick pack each day. Another interpretation could be that they go through their entire order of starter cultures in 1 day. The scenario where a single customer is continually receiving defective cultures is highly unlikely.

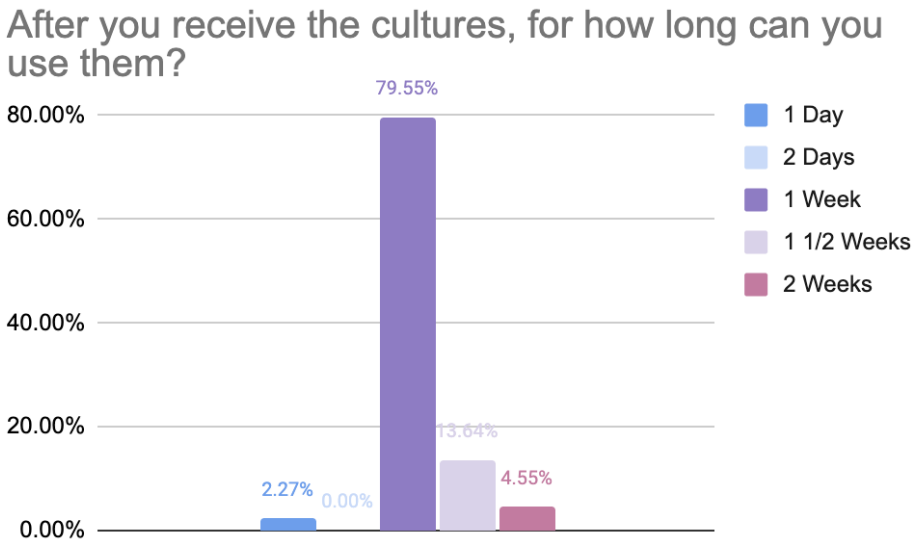

Figure 16: After you receive the product, for how long can you use the cultures?

Finding 3: Recycling is inconvenient for some Alpine farmers

After analyzing the data collected from the survey, which are listed in Appendices J-P, our team discovered that the most common method of waste disposal was the trash, followed by recycling. In addition, we found three main barriers to recycling that were specified by the

Alpine cheesemakers. These problems were that it took too much effort to separate the waste, it was hard to access the collection facility, and that there was limited storage capacity. However, the vast majority of cheesemakers did not report that they experience these barriers.

Waste Disposal Methods

The majority of Alpine cheesemakers dispose of their general waste by throwing it in the trash (67.39%), or by recycling it (41.30%) as shown in Figure 17. This accounts for 93.48% of the sample population we surveyed. Although composting, burning, and returning (10.87%, 15.22%, and 19.57%, respectively) are also cited as methods of waste disposal used by some cheesemakers, these exact words may have been interpreted differently in the Swiss culture. Burning may have been interpreted as the incineration process in a trash collection facility and returning may have been interpreted as the recycling process (Agroscope, n.d.). In America, burning is often associated with people burning waste themselves, and returning is not exactly synonymous with recycling since most recycling systems are pickup services. Thus, the calculated proportions of those who use trash and recycling may be smaller than they actually are. However, the divide in the interpretations of these two words is not concrete, since one participant specified that they "burn on the spot," which is more akin to littering than sending it to be incinerated.

Figure 17: How do you normally dispose of waste?

The largest percentage of Alpine cheesemakers dispose of Agroscope's packaging in the trash (43.48%), while the percentages of those who use recycling (32.61%) and burning (28.26%) are about the same, as shown in Figure 18. These numbers are different from the percentages that were calculated for general waste disposal methods in the previous paragraph. However, there are three parts to Agroscope's packaging: PET bottles to store the cultures, the detachable pipet lid, and a cardboard box to store the bottles. Thus, as noted by some cheesemakers in the survey, they may recycle one part and dispose of the other parts in the trash.

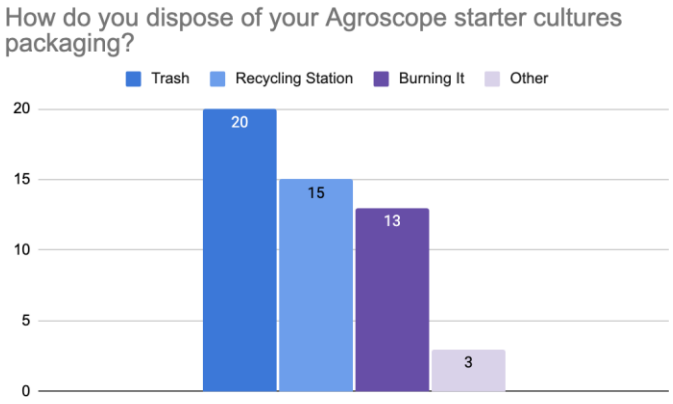

Figure 18: How do you dispose of your Agroscope starter cultures packaging?

Many Alpine cheesemakers need to travel to town in order to dispose of their waste in the collection centers there. The majority of them do not have a weekly garbage pickup service like they might have in less mountainous areas, presumably because they are located in geographically remote areas. Thus, they must find other ways to dispose of their waste, and mostly travel to collection centers by car, truck, or motorcycle (68.89%), as shown in Figure 19.

The two technical experts that we interviewed, Dr. Eugster and Mr. Kohn, disposed of their waste in different ways. Dr. Eugster stored all of her waste in plastic bags and brought it down from the Alps to collection centers in the valley every 10 days. Mr. Kohn separated the recyclables from the non-recyclables, and both were then picked up separately by trash and

recycling services that travelled to the farm he worked at. Since he did not have to travel to a collection facility each week, it can be assumed that it took less effort overall to separate the trash, thus incentivizing him to do so.

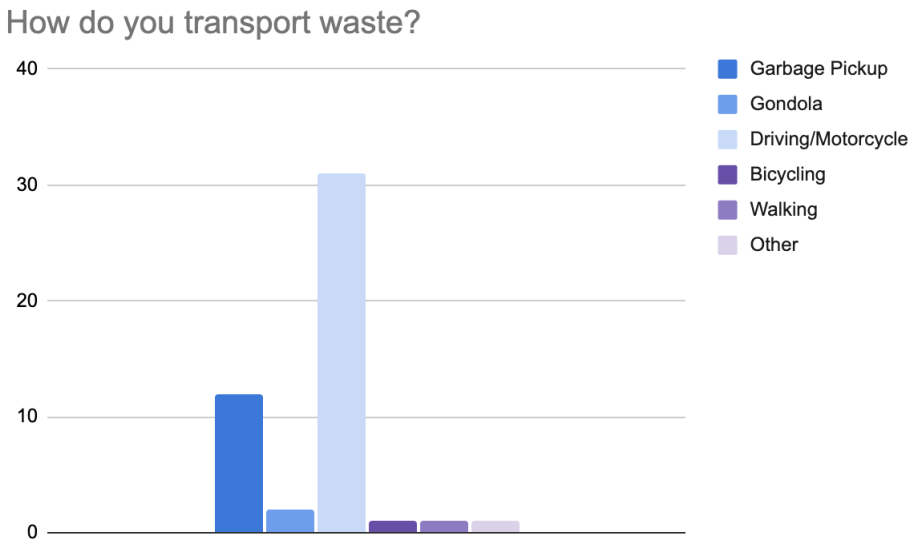

Figure 19: How do you transport waste?

Barriers to Recycling

The cheesemakers gave varied answers as to why they did not recycle, with 41.30% saying that they did not recycle for whatever reason. Of these responses, the cheesemakers gave three main barriers: the effort of separating the waste, access to a collection facility, and limited storage capacity. Four cheesemakers (8.70%) cited that the effort of separating or cleaning their waste was too laborious or tedious. Additionally, there were many (23.91%) respondents who said that they had no barriers but did not recycle anyways, and so it was assumed that they simply chose not to recycle. Three cheesemakers (6.52%) explained that either the journey to the valley was difficult or there was not a local recycling collection facility. More specifically, one participant stated that the journey was hard and takes between 10 minutes and an hour to get to

the valley by car or truck. Another participant stated that the journey was long; however, their trips take less than 10 minutes by car or truck. One cheesemaker (2.17%) stated that they did not have enough storage capacity.

Finding 4: There is a need for a more convenient source of information and the integrated pipet could be improved

Through the data yielded by the survey and our interviews, our group has identified that the pipets attached to the starter culture bottles could be improved, and that the information located on the Liebefeld Kulturen website may not be accessible to some cheesemakers. The questions in the survey relating to this topic were purposely written as open ended with the objective of gathering ideas that our team may not have been able to think of. As such, the results of this section come purely from analysis of this data.

Product Suggestions

In the survey that was sent out, we included a question that stated “Was sollte man bei den Agroscope Kulturen für die Benutzerfreundlichkeit verbessern?” which translates to “What about Agroscope’s cultures could be improved for your ease of use?” with the purpose of hearing what the cheesemakers saw as an issue with the packaging and starter culture container. Upon review of the returned surveys, our team discovered that 41.66% of that question’s respondents had a problem with the pipet that comes attached to the starter culture lids. Responses included statements such as:

- Survey Respondent 6: “Sometimes the pipet gets clogged.”
- Survey Respondent 24: “A longer pipet, it is difficult to get the last of the liquid out.”
- Survey Respondent 35: “Sometimes the pipet is too stiff.”

As shown by the responses, there was some slight variation with what exactly was wrong with the pipet, but it can still be generalized that the integrated pipet model could be redesigned. Although the dataset is relatively small, with only twenty-four people having responded to this question, the fact that such a large percentage of respondents made the same claim led us to believe that this is a prevalent issue.

Access to Utilities

We also found that cheesemakers may not have reliable access to electricity or the internet. In our interview with Mr. Kohn, he estimated that up to 30% of Alpine farms did not have electrical access. Through our interview with a cheesemaking consultant, we were told that all of 130 Alpine farms he is in contact with did have access to electricity, from either the grid, generators, or solar panels, although up to 10% of them did not have reliable access to the internet (cheesemaking consultant, personal communication, September 28, 2020). However, the consultant theorized that in the near future internet access in the Alps will improve greatly (cheesemaking consultant, personal communication, September 28, 2020).

Cheesemaking Education

We also found out through our interview with the cheesemaking consultant that many of the cheesemakers are first time cheesemakers with very little training (cheesemaking consultant, personal communication, September 28, 2020). He estimates that about 50% of the cheesemakers he works with are new to cheesemaking (cheesemaking consultant, personal communication, September 28, 2020). This is supported by the fact that we also found from our survey that 54.3% of the respondents have had a month or less of cheesemaking training, as seen in the figures below.

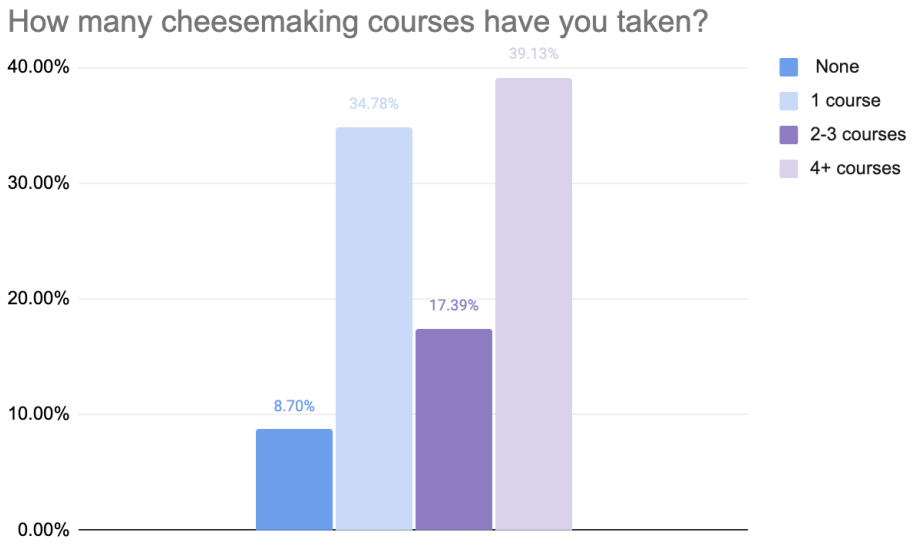

Figure 20: How many cheesemaking courses have you taken?

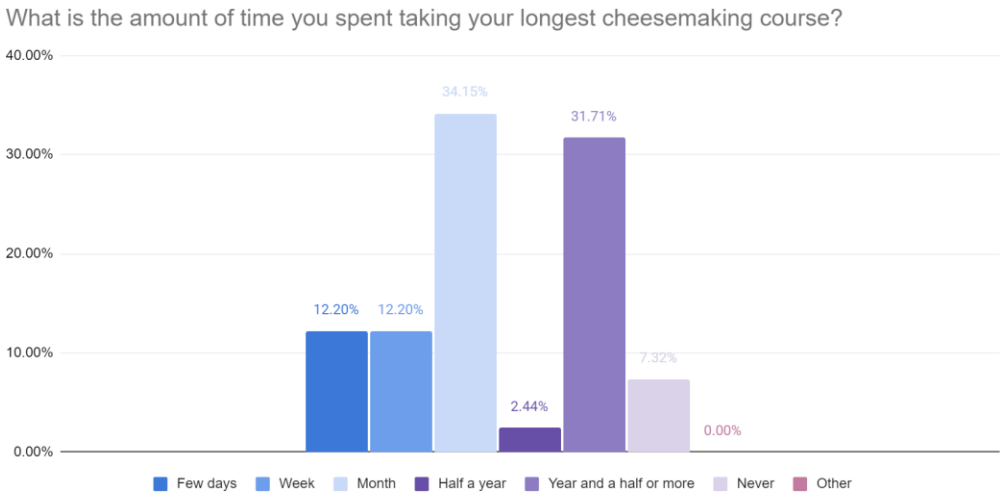

Figure 21: What is the amount of time you spent taking your longest cheesemaking course?

Additional Suggestions

In addition to the two prevalent issues addressed above, there were several other suggestions that included asking for smaller culture sizes (Survey Respondent 30), using glass

bottles instead of PET (Survey Respondent 32), including a lid to reduce oxygen exposure (Survey Respondent 14), and that the freeze dried cultures accumulate moisture if not used immediately as explained by Dr. Eugster (E. Eugster, personal communication, September 3, 2020). However, as each of these were only mentioned by a single person, it was determined that they were either of low priority or due to individual experience.

5. Conclusions and Recommendations

In this chapter, we will highlight the conclusions we have drawn from our data and make several recommendations for improving the packaging design of Agroscope's liquid semi-direct starter culture bottles. We have analyzed the common problems faced by Alpine cheesemakers and will suggest ways to help alleviate these problems. We will also discuss ideas for future research in order to further improve these recommendations.

Summary of Key Findings

Through our research, we found that the Alpine farmers already have adequate road access to their farms or have implemented a method to easily get the starter cultures up the mountains. We found that 93.02% of the respondents used cars, trucks, or motorcycles to get the cultures, and the average commute time was between 12 minutes and 56 minutes. We found that the majority of the cheesemakers also had electricity in one form or another and a larger percent also had internet.

We also found that they have adequate storage conditions for the cultures in the alps, as their cultures stay viable long enough until the next shipment arrives. We found that 88.89% of the cheesemakers were able to store their cultures at or below 5°C as well as storing them away from direct sunlight and humidity.

However, we did find that their waste disposal practices could be improved. For instance, only 41.30% of the respondents recycled their waste, and only 32.61% of the respondents recycled their starter culture packages. We also found that the pipet that comes with the bottle could be improved, as 41.66% of respondents who answered the question specifically mentioned the pipet when asked what can be improved about the packaging.

Finally, we found that about half of the Alpine cheesemakers were new to cheesemaking, having only taken courses and not had much practical experience.

Recommendations

We recommend no changes in the current delivery system

After analyzing the data collected from the surveys and interviews, our team has come to the conclusion that there is no need to implement any changes to the current method of bottle delivery. This conclusion was made after analyzing several factors including transportation methods and travel time. As stated in the previous section, when asked about the methods they utilize to get down the mountain, 93.02% claimed to have access to some form of motorized vehicle. In addition to this, 88.63% of the respondents reported that it takes less than an hour, with nearly half of those respondents stating that it takes them less than ten minutes. Furthermore, our interviews with the dairy science experts and cheesemaking consultants have reinforced that transportation does not seem to be a problem.

We also found that some cheesemakers have already developed their own solution to solve existing issues with transportation. They implemented additional delivery systems for which the Alpmeister picks the cultures up from the post office and then helps deliver them to the cheesemakers on their alp, though we do not have the exact statistic for how many participate in similar systems.

We recommend no changes in the material of the current shipping boxes

After looking at the current disposal methods and storage conditions utilized by the Alpine farmers and researching different materials used for shipping boxes, we recommend that Agroscope not change their current packaging material. According to our research, the Alpine cheesemakers are able to keep the cultures viable for at least a week, long enough until the next shipment arrives. Also, corrugated cardboard is recyclable and biodegradable if it is broken into smaller pieces. Currently, the cheesemakers need to bring the boxes back down the mountain and throw it away in town, where in 43.47% of the cases they don't bother to recycle the packaging, but instead just throw them in the trash.

The alternatives that we researched were styrofoam containers, biodegradable coolers, reusable plastic containers, and recycled cardboard boxes. Styrofoam has very good insulating properties, but it can also lead to lasting impacts on the environment since it is not recyclable (Chandra et al., 2016). As the name suggests, biodegradable coolers also have insulating

properties. Even though they are more environmentally friendly than styrofoam since they can be composted, they may be more expensive than cardboard (Paradise Packaging Company, n.d.; Igloo, n.d.). Additionally, only 10.87% of the cheesemakers we surveyed use composting, so the containers are more likely to end up in the landfill. However, the insulating properties from styrofoam containers and biodegradable coolers are not necessary since the vast majority of Alpine cheesemakers store the starter cultures in the correct conditions, and all of them are able to keep the cultures viable until their next shipment. Thus, we do not recommend switching to those options.

Another alternative we researched was durable plastic containers that can be reused. However, the additional weight of the plastic makes transportation less environmentally friendly than for cardboard boxes (Koskela et al., 2014). Cardboard is also better than reusable plastic in terms of manufacturing prices and waste management (Koskela et al., 2014).

Agroscope could also switch to recycled cardboard. Although it may be more expensive than regular cardboard, since the boxes will be made from old materials instead of new wood, the amount of energy needed to make the product will be much less, and thus will have a smaller carbon footprint. Whether it be regular cardboard or recycled cardboard, in general, we recommend that Agroscope keep using cardboard shipping boxes.

The only thing to possibly add is a label on the cardboard that says that the cardboard is recyclable and biodegradable, as well as instructions on how to properly compost it, so if the Alpine cheesemakers have a compost heap, they can throw it in there instead of bringing it down the mountain and throwing it in the trash. Additionally, they can use the cardboard as fuel for wood stoves.

We recommend implementing a bottle return system to increase the sustainability in the life cycle of the semi-direct starter culture bottles

We discovered that the recycling rate of the current Agroscope packaging in the Alps could be significantly improved as 67.39% of respondents do not recycle the packaging. The most common barrier to recycling that was described by the cheesemakers was that it took too much effort to separate the waste, saying it is too boring to sit for a period of time just separating recyclables from trash, or that it takes too much time or energy. Thus, in order to provide more of an incentive to cheesemakers to separate their waste, we suggest implementing a bottle return

system. More specifically, cheesemakers will return their old starter culture bottles when they pick up the new bottles they ordered. For those who have access to a motorized vehicle, making enough space to carry the old bottles down the Alps should not be too difficult. Most companies that implement bottle return systems increase the price of their product a few cents higher than it should be, and customers get that extra few cents back when they return the bottles. Since a few cents is almost negligible when compared to the price of the product, customers tend to feel like they are getting free money upon return. Thus, this system creates incentive to separate waste, which would improve the sustainability of the product.

In order to implement this system, Agroscope will first need to look into possible government subsidies by contacting other departments in the Swiss government, especially the Federal Office for the Environment (FOEN, n.d.). In addition, Agroscope will need to calculate the shipping costs needed for the return system and add that cost to the price of the cultures themselves. Additionally, they may need to work with the post office to create additional shipping labels for returning the boxes back to Agroscope. They will also need to develop a system to efficiently count and track the number of bottles each customer returned and refund them in a timely fashion.

For this system, we suggest two versions: a bottle return system for PET bottles, and a bottle return system for glass bottles. The following sections will describe these in more detail.

PET Bottle Return

For the PET bottle return system, the cheesemakers will return their bottles to Agroscope so that they can be recycled or reused by another company. As explained in "Environmentally Friendly Packaging" in the Background chapter, Agroscope will not be able to reuse the bottles themselves since the chemicals needed to clean them render the plastic harmful to the starter cultures. By adopting this system, cheesemakers will have another way to dispose of these bottles properly if there is not any access to a recycling facility.

Before implementing this solution, Agroscope will first need to research how they could sell the bottles to plastic recycling companies and cover any shipping costs in the price of the product. Additionally, if the recycling company that Agroscope decides to partner with only accepts clean bottles, an additional pamphlet or infographic must be included to inform the cheesemakers that they need to clean the bottles before returning them.

Glass Bottle Return

Agroscope had stated that they had used glass bottles before they switched to PET, and so it will not be unfeasible to bring that packaging design back. Unlike plastic, glass does not release any toxic chemicals when it is cleaned, so Agroscope will be able to reuse the bottles. In addition, since glass cannot be easily disposed of on the Alps, it needs to be brought down the mountain anyway. Thus, more people will be incentivized to return them, making the product life cycle more sustainable.

In order to implement this system, Agroscope will need to cover return shipment costs as well as the glass cleaning costs in the price of the product. Since glass is fragile and would be unusable if shattered, Agroscope may want to switch to a thicker shipping box material like those used for biodegradable coolers.

Additionally, a cleaning system will need to be acquired by Agroscope in order to clean the bottles. Cleaning units such as the one suggested in Appendix R can easily handle Agroscope's current sale volume and could be paid for with the profits that the system would generate.

A possible equation to calculate yearly net profit for switching from the current PET bottle system to the glass bottle return system could be as follows:

Net Profit =
(Plastic bottle yearly cost) - (Glass bottle return yearly cost) - (Glass bottle non-returning yearly cost)

Net Profit =
[B*RP + SP*B] - [2*SG*B + C*(B - (B/U)) + RG*(B/U)]*P - [B*RG + 2*SG*B]*(1-P)

B = Num Culture Bottles Sold
U = Avg Num Uses Per Glass Bottle
SP = Shipping Cost Per Plastic Bottle (1 way)
SG = Shipping Cost Per Glass Bottle (1 way)
C = Cleaning Cost Per Glass Bottle
RG = Cost Per Glass Bottle
RP = Cost Per Plastic bottle

P = Percent of People Returning Glass Bottles

1-P = Percent of People Not Returning Bottles

Example 1: Assuming that 10,000 bottles sold yearly, Glass bottles can be used 20 times, Glass shipping cost $0.40 per bottle ($1.20 for the box of 3), Glass bottle cost $2, Cleaning cost $0.10, Shipping cost for plastic $0.30 ($0.90 for the box of 3), Cost for plastic bottle $1, Percent of people who return the glass bottles 90%

This will evaluate to $130,00 - $11,755, which will save Agroscope $1,245 yearly.

However, if the shipping cost for glass is more expensive it quickly becomes unprofitable. For instance, if the shipping cost of glass rises to just 50 cents, and all else is constant, Agroscope will then lose $755 each year. So, the shipping cost will most likely be the limiting factor.

We recommend replacing the pipets that come with the current liquid semi-direct starter culture bottle design

Through our survey, we found that the main complaint about the current design of the packaging is the pipet lid, shown in Figure 22, with about 41.66% of the suggestions stating that it should be changed.

Figure 22: Agroscope's Current Packaging

Syringe

One idea is to replace the current pipet with a normal lid and include a two-piece syringe with each box, as shown in Figures 23 and 24. This syringe will be reusable as long as it is properly cleaned, which can be done easily since the pieces can be taken apart and washed individually. Since the number of syringes produced will be much lower than the number of pipets currently produced, more money can be invested into each syringe, and thus provide higher quality products that are not defective or hard to use. Additionally, this could cut down on non-biodegradable waste. Depending on the quality of the syringe, it could be included in each box or it could be included in the first shipment and then reused until it needs to be replaced.

If the second option is implemented, should the user need another syringe, they can indicate on the order form for another to be included in their next shipment. If the user is already on a predetermined shipping schedule, they can indicate the frequency at which a new syringe should be sent. In the case that they need a new syringe sooner than their next shipment, a phone ordering system could be set up so that the Alpine farmers can place an order for a new syringe by just calling Agroscope. After calling Agroscope, this system would prompt the cheesemakers to enter numbers on their phone corresponding to different services, such as placing an order. Customers could also input order numbers of previous shipments to specify delivery destinations.

Figure 23: Two-Piece Syringe Model

Before Agroscope can implement this, they must first research companies that produce syringes, such as the ones shown in Appendix R, and get an estimate on how much it would cost to purchase and package both the syringes and the new lid designs, which should fit onto the existing bottles. They would then need to do a cost analysis comparing the reusable syringe and the attached pipet to determine whether this idea is a cost-effective strategy. Afterwards, they would need to adjust their packaging machinery to be able to produce the new lids. In terms of shipment, the new syringes could be included in the current packaging by utilizing the space left over from the removal of the current pipets and securing the syringe by cutting out two semicircles that would then be folded out, as shown in Figure 24 and Appendix S.

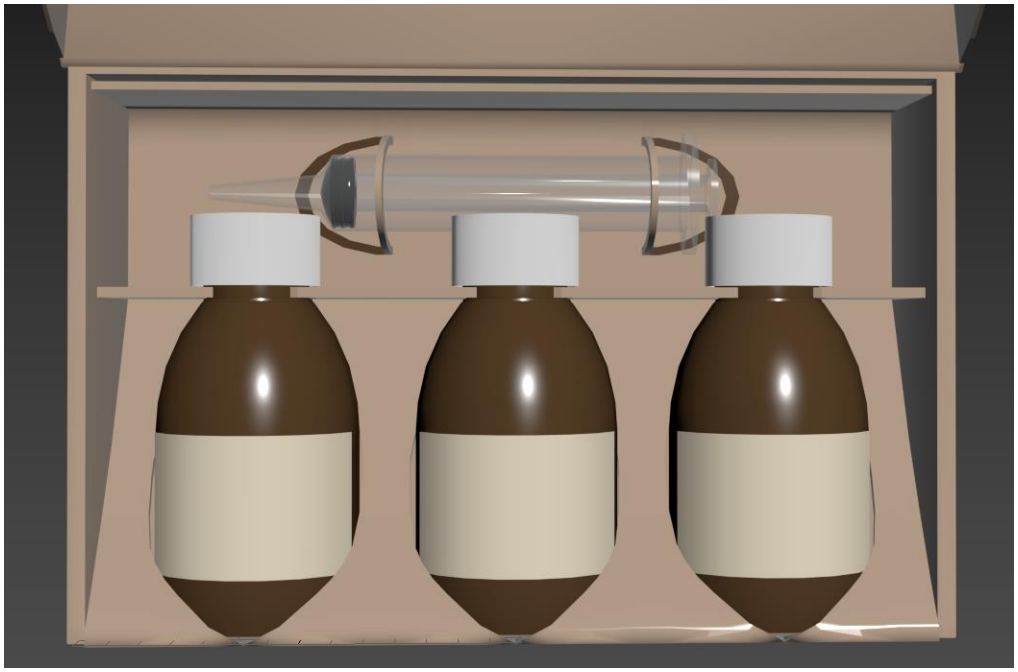

Figure 24: Integrated Two-Piece Syringe Storage

Separate Pipets

Another idea is to have single-use pipets that are not attached to the lid. A model of this is shown in Figures 25 and 26. This would allow them to be longer than the bottle and thus it will be easier to get the last of the starter cultures out, which was a problem specified by several cheesemakers. Since they are separate parts, the production should be simpler, and thus the cost should be lower.

Before Agroscope can implement this system, they must first look into the companies that produce these types of pipets. Then, they would need to get an estimate for the costs of purchasing and packaging the pipets, the costs of purchasing the new lids, and adjusting the machinery to be able to use the lids. With this information, they can then do a cost analysis comparing the single-use pipets with the attached pipet. They will also need to take into account that the new separate pipets may end up producing more waste than the current design. However, the original pipet lids are non-recyclable, but the new single lids would be recyclable (Agroscope, n.d.). In Appendix R, we include places where these can be bought.

Figure 25: Separate Pipets Model

As the pipets will not break from jostling, these could be included in the current shipping container by using the empty space left over from the pipets, as shown in Figure 26. Additionally, for more stability, six incisions could be made into the cardboard to hold the individual pipets, as shown in Figure 27. The places where the incisions could be made are shown in Appendix S.

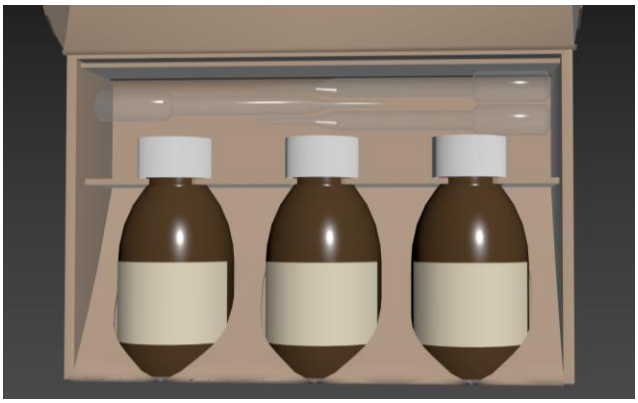

Figure 26: Integrated Separate Pipets Storage Option 1

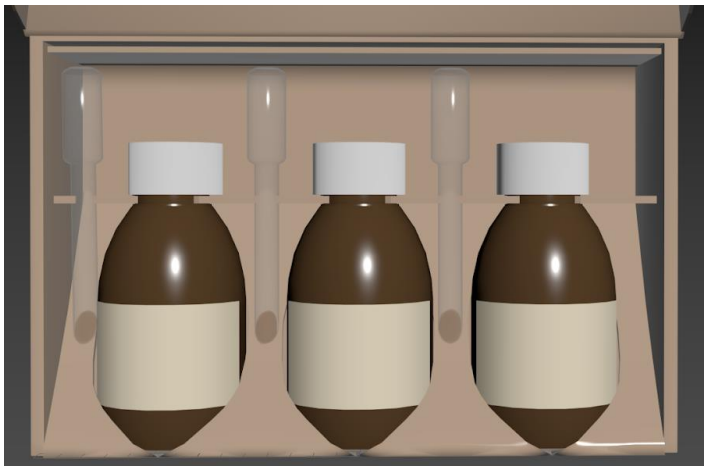

Figure 27: Integrated Separate Pipets Storage Option 2

Nozzle Cap and Measuring Cup

Agroscope could also utilize a bottle design that includes a screw-on nozzle cap, with a measuring cup that would be included with the box as shown in Figures 28 and 29 and 30. The cheesemakers should be able to easily measure out the cultures with the measuring cup without worrying about not catching the last of the cultures or worrying about the pipets being clogged since the nozzle cap is removable. In order to implement this, Agroscope will need to look into companies in their area that can produce these nozzle caps. This cup can be secured by placing it over the cap, as shown in Figure 30, and filling the extra space with packing paper, packing peanuts, or a biodegradable alternative. Or, thicker boxes, such as the biodegradable coolers highlighted in the Environmentally Friendly Shipping Containers section of the Background

chapter, could be used. However, if this idea is adopted, there may be a need to add an instruction on the bottle to shake before pouring. This is because the viscosity of the cultures may be too high to flow easily and shaking the bottle can help liquify it (Ueli von Ah, personal communication, October 13, 2020).

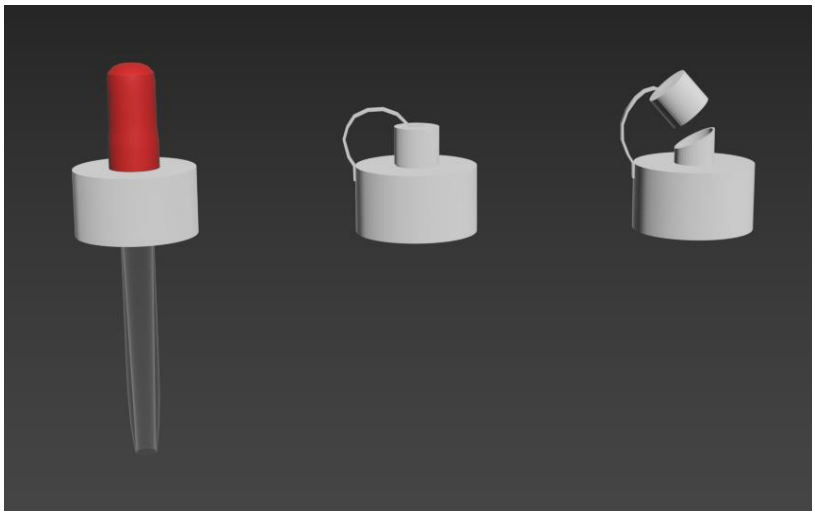

Figure 28: Current Pipet Lid and Nozzle Cap Comparison

Figure 29: Nozzle Cap and Measuring Cup

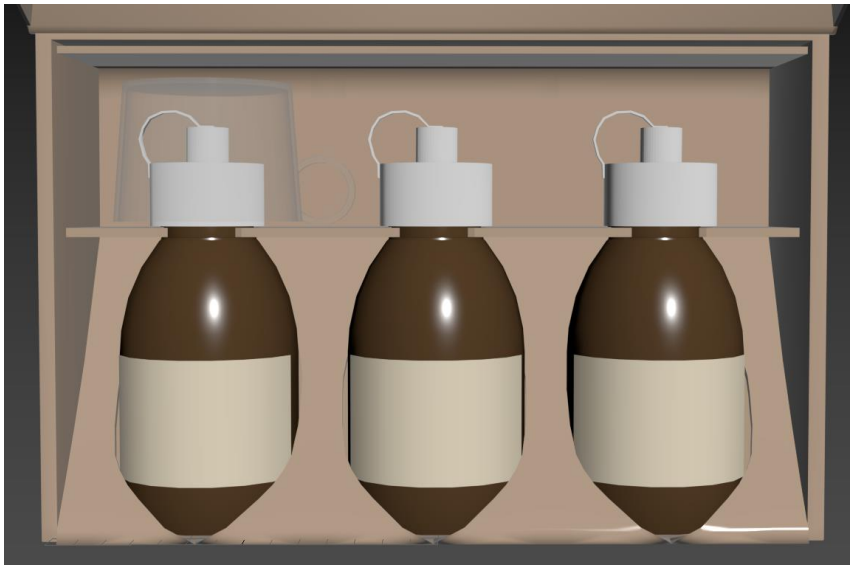

Figure 30: Integrated Measuring Cup Storage

We recommend including a pamphlet in the shipping box for quick reference

According to our research, a large percentage of the cheesemakers are not very experienced. According to the cheesemaking consultant we interviewed, about 50% of the cheesemakers in the cantons of Graubünden and Glarus, which are the cantons where he works as a consultant, are first time cheesemakers who have only taken brief courses on cheesemaking (cheesemaking consultant, personal communication, September 28, 2020). Although 91.30% of the participants who took our survey have taken at least one course, these courses were probably surface level classes as 54.34% of the respondents reported spending a month or less taking them. Therefore, we recommend that Agroscope include a pamphlet in their shipping boxes for quick reference on how to use the starter cultures. Agroscope already has a reference for how to use their cultures on their website, which might not be accessible to the Alpine cheesemakers who do not have internet access or cell service. The pamphlet should include specific instructions on how to use the cultures, contact information for consultant agencies, common problems that arise in cheesemaking, the solutions to those problems, and how to prevent them in the future.

Our team has already created an example of this pamphlet, which can be found in Appendix Q. In order to finalize this pamphlet, Agroscope would have to compile a list of the most common problems that the cheesemakers face and how to solve these problems and add

them to the pamphlet. They would also have to add a list of regional cheese consultant agencies on the pamphlet.

After Agroscope finalizes the pamphlet design, they will need to find a cost-effective way to reliably print out the pamphlets, either on Agroscope's campus or outsourced to a printing company. The pamphlet would be double-sided, so an employee is needed to fold each paper into thirds. They would then include them loosely behind the cardboard insert within the shipping box, as shown in Figure 31. Additionally, this pamphlet could be attached directly to the box, as shown in Figure 32, should Agroscope not want to include separate pieces of paper. The pamphlet could also be included in the first shipment for each customer or the first shipment of each month in order to reduce paper waste.

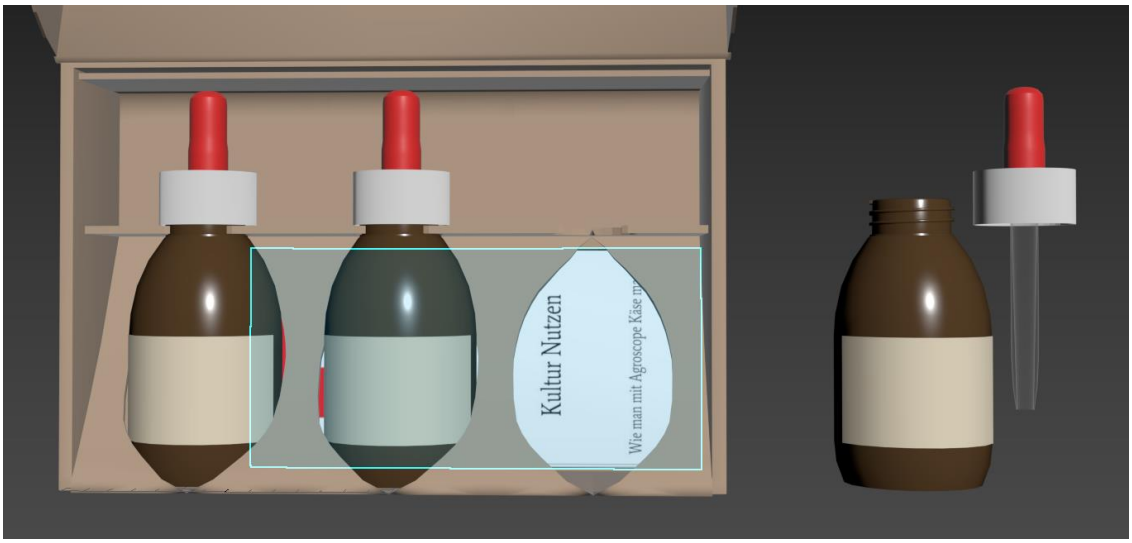

Figure 31: Integrated Pamphlet Storage Option 1

Figure 32: Integrated Pamphlet Storage Option 2

Recommendations for Further Study

1. *We recommend researching how to help the Alpmeisters who deliver starter cultures to the Alpine cheesemakers.*

Since the Alpine cheesemakers were the target population for the survey and interviews, we did not receive any substantial feedback from the Alpmeisters. As such, there may be unaddressed concerns or problems that are faced specifically by the Alpmeisters but not by the cheesemakers. For future study, the Alpmeisters can be interviewed about any obstacles they run into while providing a delivery service. They will also be a valuable resource on the everyday life of the Alpine cheesemakers as they are directly supervising them.

2. *We recommend gathering data from more consultation services.*

The project focused on improving the starter culture product and delivery system for all Alpine cheesemakers. Since we were only able to conduct an interview with a consultant overseeing the Graubünden and Glarus cantons, researching more regions would give a more generalized view of the problems amongst the cheesemakers. In order to provide recommendations that are beneficial to all Alpine cheesemakers, not just regionally specific cheesemakers, there is a need for input from more cheesemaking consultants.

3. *We recommend researching how long syringes last between orders.*

In order to better understand whether or not a syringe is more effective and more sustainable than the existing pipette caps, more research needs to be done. Through study, the average amount of time from when a cheesemaker receives a new syringe to when they need to order a new one can be calculated. From this data, the quality, reusability, and environmental impact of these syringes compared to the pipet can be deduced. Once enough data is collected, the syringe ordering system could be almost obsolete as Agroscope would know the average amount of time a syringe would last before needing replacement. Ordering for emergency syringes would then only be needed in the event of an unexpected breakage or loss.

4. *We recommend researching ways of profiting from the returns of non-reusable packaging*

In order to maximize profits and increase sustainability, we recommend researching ways to sell the non-reusable bottles and boxes that are returned to Agroscope rather than just sending them to be recycled. This could include looking into companies that will buy the raw material, companies that export raw material, or government subsidies that sponsor recycling programs and proper disposal methods.

5. *We recommend holding focus groups with Alpine cheesemakers to better understand their needs and concerns*

Although we hosted three virtual focus groups, unfortunately no cheesemakers were able to attend them. Despite being able to get a sufficient amount of data from the interviews we were able to conduct, using a focus group would have been better than conducting an interview since we would have been able to obtain multiple inputs from different people at the same time (Beebe, 2014). In addition, a focus group would have created a more relaxed and casual setting. This would have facilitated a more in-depth discussion between the Alpine cheesemakers and thus provided more detailed feedback on the delivery system and packaging of Agroscope's starter cultures. Had we been able to conduct the focus groups, we would have proceeded as follows:

The focus groups would have lasted about half an hour in order to not take too much of the participants' time. Two teammates would have facilitated the focus group while the other two observed and took notes, and a translator would have helped with interpretations since the cheesemakers speak mainly Swiss German. We also would have asked the cheesemakers if we could record the session on Zoom so that we could transcribe what was said afterwards.

The guiding questions we would have used for this focus group are listed in Appendix F and G and were designed to prompt the cheesemakers to tell us the difficulties and possible work-arounds they have encountered while making cheese. These interviews would have primarily focused on the current delivery system, the struggles the cheesemakers face when they get the cultures, and what needs to be improved.

After collecting the data, we would have categorized it into common problems that the cheesemakers have brought up. We then would have used these issues to develop a better solution to the starter culture packaging that addresses these issues.

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Appendix A

Survey Questions

On behalf of the Worcester Polytechnic Institute in Massachusetts, USA, and in collaboration with Agroscope Liebefeld, the SemiDirectEasy IQP Group would like to invite you to participate in this survey. This survey is a part of a project in which we are investigating alternative ways to package and deliver starter cultures to Alpine cheesemakers, like yourself. The research will be recorded and published in a report online. Our goal is to determine how Alpine cheesemakers currently obtain their starter cultures, store the cultures, dispose of the packages, and what improvements they would like to the current packaging design. This survey should take about 10 minutes. Your personal information will not be included in our final published report. This survey is completely voluntary, and you have the right to skip any questions that you do not want to answer. You are also free to contact us for any questions, comments, or concerns using the contact information below.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

The SemiDirectEasy IQP Group (Email: gr-a20semidirecteasyiqpteam@wpi.edu)

IRB Manager (Ruth McKeogh, Tel. 508-831-6699[LPA2], Email: irb@wpi.edu)

Human Protection Administrator (Gabriel Johnson, Tel. 508[LPA3]-831-4989, Email: gjohnson@wpi.edu)[BHA4]

Supervisor of the project from Agroscope Liebefeld: Ueli von Ah, Tel. +41 58 463 81 99, Email: ueli.vonah@agroscope.admin.ch

Part 1: Delivery and Storage

For the following questions, please circle the response that best fits your situation.

1. Are your starter cultures shipped directly to your door?

Circle: Yes No Sometimes

2. Do you have to go to the local post office to get your starter cultures?

Circle: Yes No Sometimes

3. If/When you go into the village to get your starter cultures, how do you get down the mountain? (Select all that apply)
    a. Walk/hike
    b. Gondola
    c. Car/truck
    d. Motorcycle
    e. Bicycle
    f. My neighbor helps get them for me
    g. Other
4. How long is the trip back up to your house/your farm/cheese dairy when you are getting the starter cultures from the post office?
    a. 10 mins or less
    b. Longer than 10 mins but less than an hour
    c. An hour or more but less than 3 hours
    d. 3 hours or more

5. How often do you restock the cultures?
    a. About every week
    b. About every 2 weeks
    c. About every 3 weeks
    d. About every 4 weeks, or more
6. Assuming you don't need to restock on cultures, how often would you resupply on food and other essentials? (We want to know how often you would have to resupply other goods besides starter cultures.)
    a. About every week
    b. About every 2 weeks
    c. About every month
    d. About every 2 months
    e. About every 3 months, or not at all during the entire alpine season
7. After you receive the cultures, for how many days do they actively acidify? Choose the closest answer:
    a. About a day
    b. About 2 days
    c. About half a week
    d. About a week
    e. About a week and a half
    f. About 2 weeks, or more

8. When you store the starter cultures, are they stored in temperatures above 5°C?

Circle: Yes No

9. Do you store your cultures near windows?

Circle: Yes No

10. Is your storage area humid?

Circle: Yes No

Part 2: Waste Disposal

For the following questions, please circle the letter(s) that best apply to your situation.

1. How do you normally dispose of your waste? Select all that apply.
    a. In the trash
    b. At a recycling station
    c. By composting
    d. By burning it
    e. Returning it (i.e. bottle returns)
    f. Other, please specify _____
2. How do you get the packaging to the waste disposal area? Select all that apply.
    a. Garbage pick up
    b. Gondola
    c. Driving/motorcycling
    d. Walking

e. Bicycling

f. Other, please specify _____

3. How do you dispose of your Agroscope starter cultures packaging? Select all that apply.

a. In the trash

b. At a recycling station

c. By burning it

d. Other, please specify _____

Please write out your thoughts for the remaining two questions.

4. Is anything preventing you from recycling your recyclables?

5. What about the product could be improved for your ease of use?

Part 3: Cheesemaking Training

For the following questions, please circle the response that best fits your situation.

1. How many cheesemaking courses have you taken?
    a. None
    b. 1 course
    c. 2-3 courses
    d. 4+ courses
2. What is the amount of time you spent taking your longest cheesemaking course? Choose the closest option:
    a. A few days
    b. A week
    c. A month
    d. Half a year
    e. A year, or more
    f. Never took a cheesemaking course
3. If you took more than one course, what is the combined amount of time you spent taking all your cheesemaking courses? Choose the closest option:
    a. A week
    b. A month
    c. Half a year
    d. A year

e. Two years, or more

f. Never took more than one cheesemaking course

4. Did you learn cheese making from your family?

Circle: Yes No

5. Who first started making cheese in your family?

a. No one/my family doesn't make cheese

b. My Siblings

c. My parents or aunt or uncle

d. My grandparents

e. My great grandparents

f. Other: Please Specify _____

Part 4: Focus Group Interest

We will be holding a focus group sometime in September to allow you to share any thoughts and concerns about the current starter culture design, as well as any ideas for a new design. If you would like to be a part of this focus group, please indicate your interest by entering an email or phone number we can use to contact you:

_____

_____

Appendix B

German Survey Questions

Wir studieren am Worcester Polytechnic Institute in Massachusets, USA. In Zusammenarbeit mit Agroscope, Liebefeld möchte die SemiDirectEasy IQP (Interactive Qualifying Project) Gruppe Sie zur Teilnahme an dieser Umfrage einladen. Diese Umfrage ist Teil eines Projekts, in dem wir nach alternativen Möglichkeiten suchen, Starterkulturen zu verpacken und an Hersteller von Alpkäse wie Sie zu liefern. Die Forschung wird ausgewertet und in einem Online-Bericht veröffentlicht. Unser Ziel ist es zu bestimmen, wie Hersteller von Alpkäse derzeit ihre Starterkulturen erhalten, die Kulturen lagern, die Verpackungen entsorgen und welche Verbesserungen sie am aktuellen Verpackungsdesign wünschen. Diese Umfrage sollte ungefähr 10 Minuten dauern. Ihre Persönlichen Daten werden nicht in unseren veröffentlichten Abschlussbericht aufgenommen. Diese Umfrage ist völlig freiwillig und Sie haben das Recht. Alle Fragen zu überspringen, die Sie nicht beantworten möchten. Sie können sich bei Fragen, Kommentaren oder Bedenken gerne an uns wenden.

Weitere Informationen zu dieser Forschung erhalten Sie von:

Ueli von Ah, Projektbetreuung Agroscope Liebefeld (tel. +41 58 463 81 99, Email: ueli.vonah@agroscope.admin.ch)

The SemiDirectEasy IQP Gruppe (Email: gr-a20semidirecteasyiqpteam@wpi.edu)

Ruth McKeogh, IRB Manager (Email: irb@wpi.edu)

Gabriel Johnson, HP Administrator (Email: gjohnson@wpi.edu)

Teil 1: Lieferung und Lagerung

Für die folgenden Fragen, kreisen Sie bitte die Antwort ein , die Ihre Situation am besten beschreibt.

1. Werden Ihre Kulturen direkt in die Alpkäserei gelierfert?

   Ja Nein Manchmal

2. Müssen Sie zur Post gehen, um die Kulturen zu bekommen?

   Ja Nein Manchmal

3. Ob/Wenn Sie hinunter in das Dorf gehen, wie gehen Sie den Berg hinunter? (Markieren Sie bitte alle Antworten, die Sie für richtig halten.)

   a. Zu Fuß

   b. Gondel

   c. Auto

   d. Motorrad

   e. Fahrrad

   f. abwechselnd mit meinem Nachbarn

   g. Sonstiges. Was?_____

4. Wie lange dauert der Weg in die Alpkäserei, nachdem Sie die Kulturen bekommen haben?

   a. 10 min oder weniger

   b. Mehr als 10 min aber weniger als eine Stunde

   c. Ein Stunde oder mehr aber weniger als 3 Stunden

   d. 3 Stunden oder mehr

5. Wie oft werden Ihnen neue Kulturen zugestellt?
    a. Etwa jede Woche
    b. Etwa alle 2 Wochen
    c. Etwa alle 3 Wochen
    d. Etwa alle 4 Wochen oder mehr
6. Selbst wenn Sie keine Kulturen abhollen müssten, wie oft müssten Sie dennoch Essen und anderen Nachschub abholen?
    a. Etwa jede Woche
    b. Etwa alle 2 Wochen
    c. Etwa alle Monat
    d. Etwa alle 2 Monate
    e. Etwa alle 3 Monate oder mehr
7. Nachdem Sie die Kulturen bekommen haben, wie lange können Sie die Kulturen nutzen?
    a. Etwa einen Tag
    b. Etwa 2 Tage
    c. Etwa eine Woche
    d. Etwa eineinhalbe Woche
    e. Etwa zwei Wochen oder mehr
8. Lagern Sie die Kulturen bei einer Temperatur von über 5°C?

    Ja Nein

9. Lagern Sie die Kulturen in der Nähe vom Fenster?

   Ja Nein

10. Ist der Lagerbereich feucht?

    Ja Nein

Teil 2: Abfallentsorgung

Für die folgenden Fragen, kreisen Sie bitte die Buchstaben ein, die Ihre Situation am besten beschreiben.

1. Was machen Sie mit Ihrem Müll? (Markieren Sie bitte alle Antworten, die für Sie zutreffen.)
   a. In die Abfalltonne
   b. Ablieferung bei einer Sammelstelle
   c. Kompostieren
   d. Verbrennen
   e. Wiederverwertung (z.B. Flaschenrückgabe)
   f. Sonstiges. Was?_____
2. Wie gelangt Ihr Müll zur Mülldeponie oder -verbrennungsanlage? (Markieren Sie bitte alle Antworten, die Sie für richtig halten.)
   a. Müllabfuhr der Gemeinde
   b. Gondel
   c. Auto/ Motorrad
   d. Fahrrad

e. Zu Fuß

f. Sonstiges. Was?_____

3. Wie entsorgen Sie die Agroscope-Kulturen Verpackung? (Markieren Sie bitte alle Antworten, die Sie für richtig halten.)

a. Abfalltonne

b. Ablieferung bei einer Sammelstelle

c. Verbrennen

d. Sonstiges. Was?_____

Schreiben Sie bitte Ihre Meinung über die nächsten 2 Fragen.

4. Gibt es etwas, was Sie am Recycling von wiederverwertbarem Material hindert?

5. Was sollte man bei den Agroscope Kulturen für die Benutzerfreundlichkeit verbessern?

Teil 3: Käser-Ausbildung

Für die folgenden Fragen, kreisen Sie bitte die Buchstaben ein, die Ihre Situation am besten beschreiben.

1. Wie viele Lehrgänge zur Käseherstellung haben Sie besucht?
    a. keinen
    b. 1 Lehrgang
    c. 2-3 Lehrgänge
    d. 4+ Lehrgänge
2. Wie lange dauert ihr längster Lehrgang? Wählen Sie die zutreffendste Antwort:
    a. Wenige Tage
    b. Eine Woche
    c. Einen Monat
    d. Ein halbes Jahr
    e. Ein Jahr
    f. Eineinhalbe Jahre oder mehr
    g. Ich habe nie einen Lehrgang besucht.
3. Falls Sie mehr als einen Lehrgang besucht haben, was ist die Gesamtzeit der Lehrgänge? Wählen Sie die passendste Antwort:
    a. Eine Woche
    b. Einen Monat
    c. Ein halbes Jahr
    d. Ein Jahr

e. Zwei Jahre oder mehr

f. nicht zutreffend

4. Haben Sie die Herstellung von Käse von Ihrer Familie gelernt?

   Ja Nein

5. Wer hat in Ihrer Familie als erster oder als erste Käse gemacht?

   a. Niemand

   b. Meine Geschwister

   c. Meine Eltern/ Onkel/ Tante

   d. Meine Großeltern

   e. Meine Urgroßeltern oder weiter zurück

   f. Sonstiges. Was?_____

Teil 4: Fokusgruppe Interesse

Wir werden irgendwann im September eine Fokusgruppe befragen, damit sie Ihre Gedanken und Bedenken über das aktuelle Starter-Kulturen Design äußern können, und ihre Gedanken für ein neues Design mitteilen können. Falls Sie an der Fokusgruppe teilnehmen wollen, zeigen Sie bitte Ihr Interesse, indem Sie Ihr e-mail oder Ihre Telefonnummer oder andere Kontaktinformationen aufschreiben, damit wir Sie kontaktieren können.

Appendix C

French Survey Questions

En collaboration avec Agroscope, Liebefeld, le groupe SemiDirectEasy IQP (Interactive Qualifying Project) du Worcester Polytechnic Institute (Massachusetts, États-Unis) souhaite vous inviter à participer à une enquête. Celle-ci fait partie d'un projet dans le cadre duquel nous cherchons d'autres moyens pour conditionner les cultures starter et les livrer aux producteurs de fromages d'alpage comme vous. La recherche sera évaluée et publiée dans un rapport en ligne. Notre objectif est de déterminer comment les producteurs de fromages d'alpage reçoivent actuellement leurs cultures starter, les stockent, éliminent les emballages et quelles améliorations ils souhaiteraient voir apporter à la conception actuelle des emballages. Cette enquête devrait vous prendre environ 10 minutes. Vos données personnelles ne paraîtront pas dans notre rapport final. Cette enquête est entièrement volontaire et vous avez le droit de sauter les questions auxquelles vous ne souhaitez pas répondre. Vous pouvez également nous contacter pour toute question, commentaire ou préoccupation.

Pour plus d'informations sur cette etude, vous pouvez contacter:

Ueli von Ah, suivi du projet chez Agroscope Liebefeld (tel. +41 58 463 81 99, e-mail: ueli.vonah@agroscope.admin.ch)

The SemiDirectEasy IQP Gruppe(e-mail: gr-a20semidirecteasyiqpteam@wpi.edu)

Ruth McKeogh, IRB Manager (e-mail: irb@wpi.edu)

Gabriel Johnson, HP Administrator (e-mail: gjohnson@wpi.edu)

Partie 1: Livraison et stockage

Pour les questions suivantes, veuillez faire un cercle autour de la réponse qui décrit le mieux votre situation.

1. Les cultures commandées sont-elles livrées directement à la fromagerie d'alpage?

   Cercle: Oui Non Parfois

2. Devez-vous aller chercher les cultures à la poste?

   Cercle: Oui Non Parfois

3. Si/quand vous descendez au village, comment vous y rendez-vous? (Veuillez cocher toutes les réponses qui correspondent à votre situation)

   a. Á pied

   b. En télécabine

   c. En voiture

   d. En moto

   e. En vélo

   f. Á tour de rôle avec mon voisin

   g. Autres: _____

4. Combien de temps vous faut-il pour retourner dans votre fromagerie d'alpage après avoir été chercher les cultures?

   a. 10 minutes ou moins

   b. Plus de 10 minutes, mais moins d'une heure

   c. Une heure ou plus, mais moins de 3 heures

d. 3 heures ou plus

5. Combien de fois des cultures vous sont-elles livrées?

    a. Environ chaque semaine

    b. Environ toutes les deux semaines

    c. Environ toutes les 3 semaines

    d. Environ toutes les 4 semaines ou plus

6. Si vous ne deviez jamais aller chercher de cultures, à quelle fréquence auriez-vous besoin de vous ravitailler (nourriture et autres fournitures)?

    a. Environ chaque semaine

    b. Environ toutes les deux semaines

    c. Environ une fois par mois

    d. Environ tous les deux mois

    e. Environ tous les 3 mois ou jamais pendant toute la saison

7. Après avoir reçu les cultures, combien de temps pouvez-vous les utiliser?

    a. Environ une journée

    b. Environ 2 jours

    c. Environ une semaine

    d. Environ une semaine et demie

    e. Environ deux semaines ou plus

8. Conservez-vous les cultures à une température supérieure à 5°C?

    Cercle: Oui Non

9. Stockez-vous les cultures près d'une fenêtre?

   Cercle: Oui Non

10. La zone de stockage est-elle humide?

    Cercle: Oui Non

Partie 2: Élimination des déchets

Pour les questions suivantes, veuillez faire un cercle autour des lettres qui décrivent le mieux votre situation (plusieurs réponses possibles).

1. Que faites-vous de vos déchets?
    a. Dans la poubelle
    b. Dépôt dans un point/centre de collecte
    c. Compostage
    d. Incinération
    e. Recyclage (par exemple, retour des bouteilles)
    f. Autres: _____
2. Comment vos déchets sont-ils transportés à la décharge ou à l'usine d'incinération? (Veuillez marquer toutes les réponses qui s'appliquent à votre situation))
    a. Ramassage des déchets par la commune
    b. En télécabine
    c. En voiture/ moto
    d. En vélo

e. Á pied

f. Autres: _____

3. Comment éliminez-vous les emballages des cultures Agroscope? (Veuillez marquer toutes les réponses qui s'appliquent à votre situation)

    a. Poubelle

    b. Dépôt dans un point/centre de collecte

    c. Incinération

    d. Autres: _____

Décrivez en quelques phrases votre avis sur les deux questions suivantes.

4. Y a-t-il quelque chose qui vous empêche de recycler des matériaux recyclables?

_____

_____

_____

5. Que faut-il améliorer selon vous dans les cultures de liebefeld pour en faciliter l'utilisation?

_____

_____

_____

Partie 3: Formation des fromagers

Pour les questions suivantes, veuillez faire un cercle autour des lettres qui décrivent le mieux votre situation.

1. Combien de cours de formation sur la production de fromage avez-vous suivis? Choisissez la réponse la plus appropriée:

a. Aucun

b. 1 cours de formation

c. 2 ou 3 cours de formation

d. 4 cours de formation ou plus

2. Combien de temps a duré votre cours de formation le plus long? Choisissez la réponse la plus appropriée:

    a. Quelques jours seulement

    b. Une semaine

    c. Un mois

    d. Six mois

    e. Un an ou plus

    f. Je n'ai jamais suivi de cours de formation

3. Si vous avez suivi plus d'un cours de formation, quelle est la durée totale de la formation? Choisissez la réponse la plus appropriée:

    a. Une semaine

    b. Un mois

    c. Six mois

    d. Un an

    e. Deux ans ou plus

    f. Aucune réponse correspondante

4. Avez-vous appris à fabriquer du fromage au sein de votre famille?

    Cercle: Oui Non

5. Qui dans votre famille a été le premier ou la première à fabriquer du fromage?

    a. Personne

    b. Mes frères et sœurs

    c. Mes parents / oncle / tante

    d. Mes grand-parents

    e. Mes arrière-grands-parents ou plus loin encore

    f. Autres: _____

Partie 4: Groupe de réflexion

Nous organiserons un groupe de réflexion en septembre afin que vous puissiez exprimer votre avis et vos préoccupations au sujet de la forme d'offre actuelle des cultures starter d'Agroscope et partager vos idées et besoins en vue d'une nouvelle conception. Si vous souhaitez participer à ce groupe, veuillez indiquer votre adresse e-mail, votre numéro de téléphone ou d'autres coordonnées afin que nous puissions vous contacter.

_____

_____

Appendix D

Interview Questions

On behalf of the Worcester Polytechnic Institute in Massachusetts, USA, the SemiDirectEasy IQP Group would like to invite you to participate in this interview. This interview is a part of a project in which we are investigating better ways to package and deliver starter cultures to Alpine cheesemakers, like yourself. We will ask you open ended questions through our translator and if you feel comfortable you can respond with answers to the questions. We will take notes on your responses, and record audio with your permission. The research will be recorded and published in a report online. Our goal is to determine how Alpine cheesemakers currently obtain their starter cultures, store the cultures, dispose of the packages, and what improvements they would like to the current packaging design. This interview should take about half an hour.

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit. You have the right to skip any questions that you do not want to answer. There are no risks involved in this study. While there are no direct benefits, participating in this study could improve the quality of the cultures you purchase in the future, and may lead to an easier delivery method for the cheesemakers.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact:

The SemiDirectEasy IQP Group (Email: gr-a20semidirecteasyiqpteam@wpi.edu)

IRB Manager (Ruth McKeogh, Tel. 508-831-6699, Email: irb@wpi.edu)

Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu)

Warm Up and Demographics

Experience

- How long have you been making cheese?
- How long have you been farming in the Alps?
- Do you only stay in the Alps during the summer months or during the whole year?
- Do you come up to the Alps every year?

Alpine lifestyle

- Do you enjoy the Alpine lifestyle?
- Are they your cows or someone else's cows?

Cheese

- Why do you continue making cheese?
- Can you describe the cheesemaking process?
- Who do you sell your cheese to?

Objective 1: Understand the conditions present in the current delivery system

- What are your resupplying trips like?
    - Are they easy or tedious?
    - How do you travel to resupply?
    - How much do you carry back?
- Have you figured out any tricks to make the trip easier? (Do you have solutions to lessen the frequency you need to travel into town)?

    - This is to see if groups of farmers trade off resupply duties, each farmer will take a turn heading down the mountain and resupply everyone.
- When you go to resupply on cultures, do you also bring up other foods/supplies?

Objective 2: Investigate the current conditions in which cheesemakers store and transport the product

- Where do you store your starter cultures?
- Can we examine your storage conditions? (if else, ask if they could supply us with a picture/video of their storage conditions)
- Where do you store your starter cultures while you are traveling from the post office to the cheesemaking facility?

Objective 3: Learn what methods cheesemakers are currently using to dispose of the packaging

- How do you normally dispose of your packaging?
- How do you normally dispose of your waste?
- Do you compost anything?

Objective 4: Ascertain what improvements in the product could make it more user-friendly

- If you introduce this product to one of your friends who hasn't made cheese before, would you have to help them use it or would they be okay on their own?
    - What specifically would you have to help them with?

- What do you like about the product?
- What do you dislike about the product?
- What changes in the product would you like to see?
- Would having instructions or tips included on the packaging be helpful to you?

Appendix E

German Interview Questions

Im Namen des Worcester Polytechnic Institute in Massachusetts, USA, möchte die SemiDirectEasy IQP Gruppe Sie zur Teilnahme an diesem Interview einladen. Dieses Interview ist Teil eines Projekts, in dem wir nach besseren Möglichkeiten suchen, Starterkulturen zu verpacken und an alpine Käsehersteller wie Sie zu liefern. Wir werden Ihnen offene Fragen über unseren Übersetzer stellen. Wenn Sie sich wohl fühlen, können Sie Antworten auf die Fragen geben. Wir machen uns Notizen zu Ihren Antworten und zeichnen mit Ihrer Erlaubnis Audio auf. Die Forschung wird aufgezeichnet und in einem Online-Bericht veröffentlicht. Unser Ziel ist es zu bestimmen, wie alpine Käsehersteller derzeit ihre Starterkulturen erhalten, die Kulturen lagern, die Verpackungen entsorgen und welche Verbesserungen sie am aktuellen Verpackungsdesign wünschen. Dieses Interview sollte ungefähr eine halbe Stunde dauern.

Ihre Teilnahme an dieser Forschung ist freiwillig. Ihre Verweigerung der Teilnahme führt zu keiner Strafe für Sie oder zu einem Verlust von Leistungen, auf die Sie sonst möglicherweise Anspruch haben. Sie können jederzeit die Teilnahme an der Forschung beenden, ohne dass eine Strafe oder ein Verlust anderer Vorteile anfällt. Die Projektprüfer behalten sich das Recht vor, die experimentellen Verfahren jederzeit abzubrechen oder zu verschieben. Sie haben das Recht, alle Fragen zu überspringen, die Sie nicht beantworten möchten. Mit dieser Studie sind keine Risiken verbunden. Obwohl es keine direkten Vorteile gibt, könnte die Teilnahme an dieser Studie die Qualität der Kulturen, die Sie in Zukunft kaufen, verbessern und zu einer einfacheren Versandmethode für die Käsehersteller führen.

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Warm Up and Demographics

Experience

- Wie lange machen Sie schon Käse?
- Wie lange sind Sie schon Alpenbauer?
- Leben Sie für das ganze Jahr in den Alpen, oder nur die Sommermonate über?
- Gehen Sie jedes Jahr in die Berge?

Alpine lifestyle

- Gefällt Ihnen der Lebensstil in den Bergen?
- Besitzen Sie die Kühe oder gehören Sie einer anderen Person?

Cheese

- Warum machen Sie Käse?
- Können Sie die Käseherstellungsprozess beschreiben? ODER Können Sie beschreiben, wie man Käse herstellt?
- Wem verkaufen Sie Ihren Käse?

Objective 1: Understand the conditions present in the current delivery system

- Beschreiben Sie bitte Ihren Weg den Berg hinunter, um Notwendigste zu holen.
    - Ist er leicht oder beschwerlich?
    - Was ist Ihr Transportmittel, wenn Sie Ihre Vorräte aufstocken wollen?
    - Wie viel tragen Sie zurück?
- Haben Sie Methoden entwickelt, um den Transport leichter zu machen? Haben Sie Methoden entwickelt, damit Sie den Weg weniger häufig machen müssen?

- Wenn Sie neue Starterkulturen besorgen, bringen Sie auch Essen und andere notwendige Dinge mit?

Objective 2: Investigate the current conditions in which cheesemakers store and transport the product

- Wo lagern Sie die Kulturen?
- Würden Sie uns den Lagerbereich zeigen?
    - Nein
    - Würden Sie uns Bilder vom Lagerbereich zeigen?
- Wie bewahren Sie die Kulturen auf während des Transports von der Post bis zum Gebäude, wo der Käse hergestellt wird?

Objective 3: Learn what methods cheesemakers are currently using to dispose of the packaging

- Was machen Sie mit den leeren Verpackungen der Kulturen?
- Was machen Sie normalerweise mit Ihrem Müll?
- Kompostieren Sie etwas?

Objective 4: Ascertain what improvements in the product could make it more user-friendly

- Wenn Sie dieses Produkt einem Freund oder Freundin geben würden, der oder die vorher noch nie Käse gemacht hat, würde diese Person Ihre Hilfe brauchen oder nicht?

    - Mit was müssten Sie ihm/ihr helfen?

- Was gefällt Ihnen an diesem Produkt?
- Was gefällt Ihnen an diesem Produkt nicht?
- Was hätten Sie an diesem Produkt gern anders?
- Würden auf der Verpackung Anleitungen oder Hinweise über die Käseherstellung mit diesen Kulturen, hilfreich sein?

Appendix F

Focus Group Questions

Warm Up and Demographics

- Names/Introductions
- What brought you to cheese making?
- Do you enjoy the Alpine lifestyle?

Experience

- How long have you been making cheese?
- How long have you been farming in the Alps?
- Do you only stay in the Alps during the summer months or during the whole year?
- Do you come up to the Alps every year?

Alpine lifestyle

- Are they your cows or someone else's cows?

Cheese

- Could you describe the process you go through to get your starter cultures?
- Why do you continue making cheese?
- Who do you sell your cheese to?

Cows

- Do the cows not produce as much milk when they head up the mountain?
- Does the milk production pick up after they get used to the alp?
- Do they produce more milk in the alps?
- Do they produce better milk in the alps?

Objective 4: Ascertain what improvements in the product could make it more user-friendly

- What aspects of the product do you find difficult?
- What do you think of the pipet?
- What do you think of a bottle return system for the starter cultures?
- What would be the easiest method of returning the bottles?
- If you introduce this product to one of your friends who hasn't made cheese before, would you have to help them use it or would they be okay on their own?
    - What specifically would you have to help them with?
- What do you like about the product?
- What do you dislike about the product?
- What changes in the product would you like to see?
- Would having instructions or tips included on the packaging be helpful to you?

Appendix G

German Focus Group Questions

Aufwärmen / Demografie

- Namen / Einführungen
- Was hat Sich zur Käseherstellung gebracht?
- Gefällt Sich der alpine Lebensstil?

Erfahrung

- Wie lange machen Sie schon Käse?
- Wie lange bewirtschaften Sie schon in den Alpen?
- Bleiben Sie nur in den Sommermonaten oder das ganze Jahr in den Alpen?
- Kommen Sie jedes Jahr in die Alpen?

Alpiner Lebensstil

- Sind es Ihre Kühe oder die Kühe eines anderen?

Käse

- Können Sie den Prozess beschreiben, den Sie durchlaufen, um Ihre Starterkulturen zu erhalten?
- Warum machen Sie weiter Käse?
- An wen verkaufen Sie Ihren Käse?

Kühe

- Produzieren die Kühe nicht so viel Milch, wenn sie den Berg hinaufsteigen?
- Nimmt die Milchproduktion zu, nachdem sie sich an die Alp gewöhnt haben?
- Produzieren sie mehr Milch in den Alpen?
- Produzieren sie in den Alpen bessere Milch?

Ziel 4: Stellen Sie fest, welche Verbesserungen am Produkt die Benutzerfreundlichkeit verbessern könnten?

- Welche Aspekte des Produkts finden Sie schwierig?
- Was denken Sie über die Pipette?
- Was halten Sie von einem Flaschenrückgabesystem für die Starterkulturen?
- Was wäre die einfachste Methode, um die Flaschen zurückzugeben?
- Wenn Sie dieses Produkt einem Ihrer Freunde vorstellen, der noch keinen Käse hergestellt hat, müssten Sie ihm dann bei der Verwendung helfen oder wären sie alleine in Ordnung?
    - Womit müssten Sie ihnen konkret helfen?
- Was mögen Sie an dem Produkt?
- Was mögen Sie an dem Produkt nicht?
- Welche Änderungen am Produkt möchten Sie sehen?
- Wäre es für Sie hilfreich, Anweisungen oder Tipps auf der Verpackung zu haben?

Appendix H

Active packaging

There are many factors to consider when choosing a material for packaging food, as shown in Figure 5. Some companies that produce foods containing cultures use active packaging (AP). The material used for these packages absorb compounds that could spoil the food and release "compounds that extend the shelf-life of the product," (Cruz et al., 2007). AP technologies include systems that are antimicrobial, release antioxidants, release carbon dioxide, absorb oxygen, absorb moisture or absorb ethylene (Yildirim et al., 2011). Oxygen and moisture are detrimental to the lifespan of freeze-dried packaging (Wolfe, 1964), which is the main technique to package cheese starter cultures in America (The Cheese Maker, 2020; New England Cheese Making Supply Company, 2020). Plastic is very permeable to oxygen so it is not ideal for packaging freeze-dried starter cultures. Ways to remove oxygen in AP include adding oxygen-absorbing compounds like ascorbic acid or including films that act as oxygen barriers on the packaging (Cruz et al., 2007).

Figure 31: General properties required for food packaging materials (Wróblewska-Krepsztul et al., 2018)

Appendix I

Minutes From an Interview Dairy Science Expert Elisabeth Eugster

September 3, 2020

Could you please introduce yourself and what you do?

Dr. Elisabeth Eugster lectures at the Bern University of Applied Sciences in the School of Agricultural, Forest and Food Sciences under the Division of Food Science and Management. She teaches the science of making cheese, yogurt, and butter. The lecture on how to turn milk to cheese is very important. To make cheese, milk and rennet are the two main ingredients.

What is your experience making cheese in the Alps?

She traveled up the Alps to make cheese in the summers of 2005 and 2013.

Did you use liquid or freeze-dried starter cultures?

She used freeze-dried starter cultures. Liquid cultures need cool conditions (below 5°C) so a refrigerator is needed. There is not much infrastructure on the Alps, though that has changed in the last 10 years or so. Thus, (since supposedly there isn't much access to refrigerators), most people use freeze-dried cultures.

What was your cheesemaking process like?

She first put a whole package of freeze-dried cultures into sterilized milk, divided up the mixture, and put the divided sections in a freezer so they would freeze. Then each evening, she would take one of those frozen cultures out of the freezer, thaw it, and use it as a starter culture (she would dump it into a milk vat in order to turn that milk into cheese).

When making cheese in the Alps, did you have road access to the cheesemaking place?

She did have road access. It is important to have road access because when you don't have the desired pH after adding the starter cultures to the milk, you have only a short amount of time to find a solution before it is too late – if you don't have road access, it isn't possible to find help quickly.

Also, if something breaks down (e.g. fridge, boiler), you need to call a mechanic or technician and ask them to come up the Alps to help. Having road access makes this easier. In 2013, her boiler broke down and a technician came up the Alps to fix it. This was because the machines are only used in the summer months (3-4 months a year), and stand still for the rest of the year. In 2005, there was a fire that was started by one of the machines. Unused machines tend to break down easily since they need certain time to be able to warm up and make good cheese.

Did you have electricity?

She always had ready access to electricity and water. She did not use fuel – there was a direct power supply from the valley to the Alps.

What was the Alpine culture like? Are the farmers closely packed or isolated?

In 2013, there were a total of three people at the farm. There was the shepherd and their dog, which is sometimes more important than the shepherd, the cheesemaker (Dr. Eugster), and an assistant. It was tough work for the shepherd. They needed to wake up at 4:30 AM, start milk the cows at 5:00 AM, which typically takes 2 hours, and then deliver the milk to the cheese plant so Dr. Eugster could start making cheese. Then, the cheese was sold to a cheese seller.

The milking station and cheesemaking station were separated and so the shepherd and Dr. Eugster only saw each other at dinnertime. She didn't have a lot of contact with the shepherd, only with the assistant. It was very isolated in the Alps, but sometimes friends and family came to visit.

Do you teach any of the Alpine cheesemakers?

She doesn't teach those in the Alps but those enrolled in the master degree program at the Bern University of Applied Sciences. She teaches college students, not farmers – she has a background in the scientific side of cheesemaking, not so much the practical usage. When making cheese, the technical side is not that relevant – cheesemaking is more about mitigating mistakes and disasters and being able to produce good cheese. Practitioners have much more experience with that.

Did you attend any cheesemaking courses?

She was always interested in cheese production (she likes cheese very much). In 2005, she attended a 1 week practical course conducted by cheese manufacturing association. In 2013, she attended another course.

Why did you use freeze-dried cultures instead of liquid cultures?

Agroscope cultures are mainly intended for cow cheese but she produced goat cheese since the farm only had goats. She wasn't sure if it was okay to use the cultures for goat cheese, so she used the same ones that were used the year before (the previous cheesemaker used freeze-dried starter cultures). If she wanted to use liquid starter cultures, she would've needed to conduct trials, which would have wasted time.

What brand of freeze-dried starter cultures do you use?

She used starter cultures from Danisco. However, the surface ripening cultures, which are not the same type of bacteria as starter cultures, were from Agroscope and were liquid cultures so they could keep for longer time in the fridge.

What are the students in university doing?

They are studying milk science (milchtechnologe). A vocational education is needed for a position in a cheese factory in the valley.

How did you sign up to be a cheesemaker? Is it open to anyone in the summer or do you need some lessons first?

There are no tests or degree required, but taking the course is highly suggested. Typically, the courses last for 3-5 weeks. You just ask the government to sign up as a summer Alpine cheesemaker. Thus, there are very different people on the Alps. Some are from abroad thinking it'll be a simple life but actually it is very hard work.

What is the Switzerland educational system like?

Compulsory education is equivalent to elementary school and middle school in the U.S. Then, students can choose to go to either a high school or a vocational school (3-4 years). In a vocational school, an apprenticeship is required and can be done with a cheese manufacturer. Both high school graduates and vocational graduates can apply to a university such as the Bern University of Applied Sciences.

In some of our surveys, participants mentioned that they had an EFZ. What is an EFZ?

It is one of the vocational degrees you can get.

What were your resupply trips from the Alps to the village like? How often did you take them?

She went to town every ten days, mainly to buy food. Freeze-dried can be bought in bulk and will stay good for 1 year.

Did you encounter any issues with the packaging?

When the freeze-dried package is opened, water is sucked into powder so it isn't easily weighed afterwards (the weight changes due to the addition of water). When the water content increases, it binds powder particles together so it is more like a paste instead of its original powdery form. You should use the whole bag at once so this doesn't happen - it only happens when you reuse and refreeze the cultures. More knowledge is needed to work with liquid cultures than freeze-dried cultures since it needs more sterile conditions.

Do you think that having instructional information on the side of the starter culture bottles would be a good idea?

It would be nice, but it might not be possible because there is too much information.

How did you deal with waste?

She stored all of her waste in plastic bags and dropped it off in town every 10 days.

In some of our surveys, people put down the word "Alpmeister." What does this mean?

An Alpmeister is a person who organizes regions of an alps. They take care of the animals, finances, selling cheese, giving earnings back to farmers and cheesemakers, and recruits staff. They are also one of the farmers and the job doesn't require any professional training. When Dr. Eugster was in the Alps, the Alpmeister was her boss - she had to report to him.

Would you be able to give us some contact information to vocational schools or practitioners?

She will talk to Ueli and Hans-Peter (our sponsors). She has a lot of contacts.

Appendix J

Minutes From an Interview With Dairy Science Expert Christoph Kohn

September 7, 2020

Could you please introduce yourself and what you do?

Christoph Kohn is responsible for culture productions at Agroscope. He supervises a 10 person staff and has been working there since 2012.

What is your experience in practical cheese making and cheesemaking in the Alps?

He has professional cheese making training. He had 3 years of cheese making experience. He went up to the Alps in 2016 to make Bernese Alpine cheese.

Which starter cultures did you use for the Bernese cheese?

He purchased one package of starter cultures at the beginning of the summer and then he just prepared his own culture from the whey after he made a batch of cheese. He just kept reusing the whey as a culture, and didn't need to restock. However, he did start with freeze-dried cultures.

Did you have electricity or road access in the alps?

He did have road access to his farm. He also spent the summer up there with his family and kids.

How often would you need to resupply?

He would need to resupply about once a week

One of the people we interviewed had one person be the shepherd and one would be the cheese maker. Did you have the same division of roles?

They did not have specific roles, he did both the cows and the cheese making. He had to milk 20 cows twice a day.

Did he ever teach cheese making classes at Agroscope?

He taught some of the classes.

Could anyone take a cheese making class from Agroscope?

Anyone could take the courses as long as they go to the Bernese alps.

How hard was the work in the alps?

He worked from 4 am to 10 pm feeding the Cows, making cheese, and ripening the cheese. It was hard work.

How did you deal with the waste?

He collected the PET bottles (water bottles) separately, and recycled those. The normal waste was just thrown away. He brought the trash down the mountain. He didn't have that many bottles, because the only thing he used them for was butter.

When would you have free time on the alps?

He would be free around Noon or 8 PM.

Do most farmers have wifi?

⅓ of the cheesemakers don't have real electricity, he estimates.

How close was the nearest cheese making farm?

He was in a little valley with 9 cheese dairies, but the closest one was 3 miles away.

Are cheesemakers usually located close together?

In the east of Switzerland there is a lot more space for the cheesemakers to spread out and his valley was relatively small.

You mentioned hikers go through you farm occasionally, could you elaborate on them?

A few hikers would hike through when there was good weather. They would eat, drink, and then leave. We set up a sort of restaurant.

Were you in contact with the Alpmeister (2016)?

He came every week, to manage and answer questions

Were all the cows owned by separate farmers in the valley, or were they all 1 farmer's cows?

17 farmers owned rights to the cows each with 1 to 2 cows. The farms would separate their cows and bring them to separate alps

What is the process of making cheese?

Medium for bacteria, ski milk + anti filming agent, 115 degrees celsius , seed culture (precultrure), fermented over night 38 degrees

Did you use liquid cultures?

Yes but only for butter. He used freeze dried for cheese

What do we need to worry about packaging wise

Protect culture from shock and bottle breaking, the temperature is not really a problem for the 12-15 hour transportation to a cool storage room. If they stay warm for longer they will start to die and they should be stored at 4C after that. And the current system works quite well, he believes.

Some bacteria cultures die with exposure to oxygen, is this a problem?

They don't like it but it's not too big a problem. Especially if you limit exposure.

How do cheesemakers without wifi order cultures?

They call us on the phone

What resources does Agroscope have to explain how to use the cultures?

They have technical data sheets on their website

How do the regional consultants work?

They work with Agroscope and stay in contact everyday. They perform after sales service and explain how the cultures work to the cheesemakers, and handle research and complaints.

How do the consultants contact the cheesemakers?

They are called and they go. If the problem is simple they give feedback over the phone.

What website that provides feedback/has the pamphlets and technical sheets?

www.liebefeld-kulturen.**ch**

Appendix K

Transcript of an Interview with a Cheesemaking Consultant

September 28, 2020

Note: The questions and comments denoted (UB) are ones that were spoken by our advisor and translator, Professor Ulrike Brisson.

Could you tell us more about Plantahof and what your job entails?

Plantahof is a school for agriculture. As a consultant, I am responsible for all aspects of dairy farming including cheesemaking. I work both in the school and on the farms. It is therefore a combination of theory and application.

Do you help cheesemakers in Graubünden only or all of Switzerland?

Normally, I help in Graubünden and the canton Glarus, this year I also helped farmers in several other cantons using the telephone. I have to drive a lot, about 4-5 hours in my car up and down the mountains. The road conditions are not the best sometimes.

When you go to the cheeseries, what problems do they have?

The problems that occur are early bubbling (Frühblähungen) or adjustments during the production (of the Alpine cheese). Two of us supervise 130 Alpine farms in Graubünden and Glarus. We have many beginners on the Alpine farms. About 50% of Alpine cheesemakers in Graubünden are always new ones (dairy farmers).

- Frühblähungen = the cheese lifts up and turns into soccer ball round parts.

Are these new ones (cheesemakers) from your school? (UB)

Yes, we train them. It is a bit more difficult this year with Corona, with the mask and distancing.

Are they all summer farmers or a combination between valley farmers and summer farmers?

Alpine cheese making is possible for 3 months only, from the end of May until now, the end of September. Everybody and all the cows are back down in the valley.

When the cows are back in the valley, milk production will continue. (UB)

The milk goes to a part into the industry (probably general dairy plants) or partly into cheesery plants (large cheese production).

Do the cheesemakers in the Alps have access to electricity? And do they also have access to milking machines to milk the cows?

Everything is done with machines. Electricity either from a generator or from the grid in the valley, because of gondolas nearby. Some also have solar.

Do the farmers also have access to cell phone service?

Yes. Nothing works without a mobile phone.

But I suppose not many have an internet connection. (UB)

Rising tendency. Only few don't have it. In Graubünden there are about 10% without it. In Glarus perhaps a few more. But with rising tendency, the net is getting better and better.

Is it because the mountains have more transmitters? (UB)

Not necessarily. It also depends on how the transmitter is erected and which radius it covers. On the other side of the valley is a new transmitter which improves the reception on the Alp. It is also because more and more people go into the mountains for recreation.

And it is also very important for rescue operations. (UB)

Yes.

How many cows are on most of the farms?

80-100 cows per farm. The largest herd is 190 split between two farms.

Can you elaborate on the cheese bubbling in the cheese production? Is it related to the starter cultures themselves?

Mostly with hygienic problems during milk curdling or the cooling

Hygiene issues when the machines have not been cleaned properly? (UB)

Yes, it happens when the teat cups (Zitzenbecher) are not clean. In the canton Graubünden, we produce cheese from raw milk. It is not pasteurized, in America everything is pasteurized. Our greatest pleasure is that it is raw milk cheese.

You can occasionally also get cheese from raw milk in the US, but it is more expensive, which is probably also the case with you (implied in Switzerland). (UB)

Can you explain the problems with cooling? Is the temperature too warm or too cold? (UB)

Cooling of the milk has been done up to now, traditionally, with water. But the amount of water and the temperature are becoming a problem. The temperature goes up during the Alp summer, we can no longer cool the milk well. Technical cooling, as you know it in America with refrigerants, is the case today with renovations/reconstructions, that we install it that way. That we do not only use water for cooling but that we will entirely do without water.

Is that the case because there is less water because of drier weather? You notice global warming. (UB)

It is becoming increasingly warmer. We have snow again, I showed Erich the snow-covered mountains earlier, but in the course of the summer the water reserves, the snow from the winter, is gone at some point.

One of the previous interviews mentioned that if you screw up the pH or acidity of the milk after the incubation period, what are some of the ways that you can fix that?

Adding the starter culture (lactic acid) helps us to guarantee the quality of the cheese production. Fresh milk has a pH of 6.7 and adding the lactic acid lowers it to 6.5. Today we can control this with pH strips.

What can you do when the ph strip shows a wrong pH amount? (UB)

On the one hand, you can add warmth so that the bacteria will be active again. But when it drops rapidly and when it does not develop acidity at all, there are two examples. You can either add a blocker (Hemmstoff), then nothing works. A blocker are antibiotics. Then we have another problem. Whenever the cheese produces too little acidity, when it gets too cold on the press, then I can add warmth again.

- The differences between Swiss German and German may have resulted in a translation that is slightly different than the real answer

But this does not happen often. (UB)

Very little. These are exceptions. Once each cheese maker, once a year.

Do you have anything you would like to share with this team? (UB)

The subject of starter cultures. You are in contact with Agroscope. The part who use liquid cultures in the canton Graubünden is about 50%, as Agroscope offers, and 50% are dry cultures as the companies Danisko, Hansen, Sanko offer, dry cultures.

They don't have to be stored in a freezer, right? (UB)

No, they are freeze dried. I can, especially if they have already been opened. When they are still unopened it is enough to store them in a dry and cool space. It is also important to know that AUP, which means cheese labeled as "original," can only be made with one culture, instead of many different cultures.

- The differences between Swiss German and German may have resulted in some missing information, but the interviewee did not say that the freeze-dried cultures should be stored in a freezer

This is interesting, you can basically mix different cultures. (UB)

Those from Agroscope, you can mix different strains (of bacteria), those that match, even those that don't work.

Appendix L

Survey Responses for Section 1, Questions 1-5

Note: All comments are the English translations.

Respondent	S1:Q1	S1:Q2	S1:Q3 A	S1:Q3 B	S1:Q3 C	S1:Q3 D	S1:Q3 E	S1:Q3 F	S1:Q3 G	S1:Q3 Comments	S1:Q4
	Are your starter cultures shipped directly to your Alpine Cheesery?	Do you have to go to the local post office to get your starter cultures?	If/When you go into town to get your starter cultures, how do you get down the mountain? (Select all that apply)								How long is the trip back up to your Alpine cheeserie after you get the starter cultures from the post office?
			A) By foot B) Gondola C) Car/Truck D) Motorcycle E) Bicycle F) Neighbor G) Other								A) <10mins B) 10 mins-1 hr C) 1hr-3hrs D) 3hrs or more
1	N	N	0	0	1	0	0	0	0		A
2	Y	N	0	0	1	0	0	0	0		A
3	N	N	0	0	1	0	0	0	0		B
4	N	Y	0	0	0	1	0	0	0		B
5	Y	N	0	1	0	0	0	0	0		A
6	N	N	0	0	1	0	0	0	0		A

7	N	Y	0	0	1	0	0	0	0		A
8	N	N	0	0	1	0	0	0	0		C
9	N	Y	0	0	1	0	0	0	0		B
10	Y	N	0	0	1	0	0	0	0		A
11	N	Y	1	0	1	0	0	0	0		C
12	N	N	0	0	1	0	0	1	0		B
13	N	Y	0	0	1	0	0	0	0		B
14	Y	0	0	0	1	0	0	0	0		C
15	N	Y	0	0	1	0	0	0	0		B
16	N	N	0	0	1	0	0	0	0		B
17	Y	N	0	0	1	0	0	0	0		A
18	N	Y	0	0	0	0	1	0	0		C
19	N	N	0	0	1	0	0	0	0		B
20	N	Y	0	0	1	0	0	0	0		B

21	Y	N	0	0	1	0	0	0	0		A
22	Y	N	0	0	1	0	0	0	0		A
23	Y	N	0	0	0	0	0	0	0		A
24	Y	N	0	0	1	0	0	0	0		0
25	N	N	0	0	1	0	0	0	0		B
26	M	M	0	0	1	0	0	0	0		A
27	N	N	0	0	1	0	0	0	0		B
28	N	N	0	0	1	0	0	0	0		B
29	N	N	0	0	1	0	0	0	0		B
30	M	N	0	0	1	0	1	0	0		B
31	N	N	0	0	1	0	0	0	0		B
32	Y	Y	0	0	1	0	0	0	0		C
33	N	N	0	0	1	0	0	0	0		A
34	N	N	0	0	1	0	0	0	0		A

35	N	N	0	0	1	0	0	0	0		A
36	N	N	0	0	0	0	0	0	0		B
37	Y	N	0	0	1	0	0	0	0		B
38	N	N	0	0	1	0	0	0	0		B
39	N	N	0	0	0	0	0	0	1	The Alpmeister brings us the cultures with motorcycle/car	B
40	Y	N	0	0	1	0	0	0	0		A
41	N	N	0	0	1	0	0	0	0	The Alpmeister brings it with the car	B
42	0	N	0	0	1	0	0	0	0		B
43	N	N	1	0	1	0	0	0	0	The Alpmeister delivers them	B
Reply-45	N	0	0	0	0	0	0	0	0		0
Reply-46	N	N	0	0	1	0	0	0	0		B
Reply-47	N	N	0	0	1	0	0	0	0		A

Appendix M

Survey Responses for Section 1, Questions 6-10

Note: All comments are the English translations.

Respondent	S1: Q5	S1:Q6		S1: Q7	S1:Q8	S1: Q9	S1:Q10
	How often do you restock the cultures?	Assuming you don't need to restock on cultures, how often would you resupply on food and other essentials?		After you receive the cultures, for how long can you use them?	Do you store the cultures in temperatures above 5°C?	Do you store your cultures near windows?	Is your storage area humid?
	A) 1 week B) 2 weeks C) 3 weeks D) 4 weeks or more	A) 1 week B) 2 weeks C) 1 month D) 2 months E) 3 months or more F) Other	Comments	A) Day B) 2 days C) week D) Week and a half E) 2 weeks F) More than 2 weeks			
1	A	C		C	N	N	N
2	A	B		C	N	N	N
3	B	A		D	N	N	N
4	A	C		C	N	N	Y
5	A	B		D	N	N	N
6	A	C		C	N	N	N
7	A	B		C	N	N	N
8	A	A		C	N	N	N
9	A	C		C	N	N	N
10	B	A		C	N	N	N
11	A	A		D	Y	N	Y
12	0	0		0	0	0	0
13	A	A		C	N	N	N
14	A	B		C	N	N	N
15	A	A		A	Y	N	N

16	A	A		C	N	N	Y
17	A	0	We have a central cheesery in Dorfmond	C	Y	N	N
18	A	A		C	N	N	N
19	A	A		DE	N	N	N
20	B	A		E	N	N	N
21	A	A		C	N	N	N
22	B	A		C	N	N	N
23	A	0	Cheesery in the town of [Illegible]	C	N	N	N
24	A	B		C	N	N	N
25	A	A		C	N	N	N
26	A	B		C	N	N	Y
27	A	A		C	N	N	N
28	A	A		C	N	N	N
29	A	E		D	N	N	N
30	A	C		C	N	N	N
31	A	E		C	N	N	N
32	A	B		C	N	N	N
33	A	A		C	N	N	N
34	A	E		C	Y	N	N
35	A	B		D	N	N	N
36	A	0		C	N	N	N
37	A	C		C	N	N	N
38	A	B		C	N	N	N
39	A	E		C	N	N	N
40	A	A		D	N	N	N
41	A	C		C	N	N	N
42	A	C		C	Y	N	N
43	B	C		E	N	N	N

Reply-45	A	0		C	N	N	N
Reply-46	A	A		C	N	N	N
Reply-47	A	A		C	N	N	N

Appendix N

Survey Responses for Section 2, Questions 1-3

Note: All comments are the English translations.

Respondent	S2: Q1 A	S2: Q1 B	S2: Q1 C	S2: Q1 D	S2: Q1 E	S2: Q1 F		S2:Q2 A	S2:Q2 B	S2:Q2 C	S2:Q2 D	S2:Q2 E	S2:Q2 F	S2:Q 3 A	S2:Q 3 B	S2:Q 3 C	S2:Q 3 D	
	How do you normally dispose of your waste? Select all that apply.							How do you get the packaging to the waste disposal area? Select all that apply.						How do you dispose of your Agroscope starter cultures packaging? Select all that apply.				
	A) Trash B) Recycling station C) Composting D) Burning it E) Returning it F) Other Last column: Comments							A) Garbage pickup B) Gondola C) Driving or motorcycle D) Bicycling E) By foot F) Other						A) Trash B) Recycling station C) Burning it D) Other Last column: Comments				
1	1	0	0	0	0	0		0	0	1	0	0	0	1	0	0	0	
2	1	0	0	0	0	0		1	0	0	0	0	0	1	0	0	0	Reuse
3	1	0	0	0	0	0		0	0	1	0	0	0	0	0	1	0	
4	1	0	0	0	0	0		0	0	1	0	0	0	1	0	0	0	
5	1	1	0	0	0	0		1	1	0	0	0	0	0	1	0	0	
6	0	1	0	0	0	0		0	0	1	0	0	0	1	0	0	0	
7	0	1	0	0	0	0		0	0	1	0	0	0	0	0	1	0	

8	1	0	0	0	0	0		1	0	0	0	0	0	1	0	0	0	
9	1	0	0	0	0	0		0	0	1	0	0	0	0	0	1	0	
10	1	0	0	1	0	0		0	1	0	0	0	0	1	0	1	0	
11	1	0	0	0	0	0		0	0	0	0	1	0	1	0	0	0	
12	1	0	1	0	1	0		0	0	1	0	0	0	1	0	0	0	
13	0	0	0	0	1	0		0	0	1	0	0	0	0	1	0	0	
14	0	1	0	0	0	0		1	0	0	0	0	0	0	1	0	0	
15	1	0	0	0	0	0		0	0	1	0	0	0	0	1	0	0	
16	1	0	0	0	0	0		0	0	1	0	0	0	0	0	1	0	
17	0	0	0	0	0	1	[Illegible] trash separation	1	0	0	0	0	0	0	1	0	0	
18	1	0	0	0	0	0		0	0	0	1	0	0	0	0	1	0	
19	1	1	0	0	0	0		0	0	1	0	0	0	1	0	0	0	
20	1	1	0	0	1	0		0	0	1	0	0	0	1	0	0	0	

21	1	0	0	1	1	0		1	0	1	0	0	0	1	0	0	0		
22	0	1	0	0	0	0		0	0	1	0	0	0	0	1	0	0		
23	0	1	0	0	0	0		1	0	0	0	0	0	0	1	1	0		
24	1	0	0	0	0	0		1	0	0	0	0	0	1	0	0	0		
25	0	1	0	0	1	0		0	0	1	0	0	0	0	1	0	1	Carton collection	
26	1	0	0	0	0	0		0	0	1	0	0	0	0	0	1	0		
27	1	0	0	0	0	0		0	0	1	0	0	0	0	0	1	0		
28	0	0	0	1	0	0		0	0	0	0	0	1	0	0	0	1		
29	1	0	0	0	0	0		0	0	1	0	0	0	1	0	0	0	I	
30	0	1	1	1	1	0		1	0	1	0	0	0	0	1	0	0		
31	1	0	0	0	0	0		0	0	1	0	0	0	1	0	0	0		
32	0	1	0	0	0	0		0	0	1	0	0	0	0	1	0	0		
33	1	0	0	0	0	0		1	0	0	0	0	0	1	0	0	0		

34	1	1	1	1	1	0		0	0	1	0	0	0	0	0	0	1	Plastic collection
35	0	1	0	0	0	0		0	0	1	0	0	0	0	0	1	0	
36	1	1	0	0	0	0		1	0	0	0	0	0	1	0	0	0	
37	1	0	1	1	1	0		0	0	1	0	0	0	0	0	1	0	
38	0	1	0	0	0	0		0	0	1	0	0	0	0	1	1	0	B) Bottles C) Carton packaging
39	0	1	0	0	0	0		0	0	1	0	0	0	0	1	0	0	
40	1	0	0	0	0	0		0	0	1	0	0	0	0	1	0	0	
41	0	1	0	0	0	0		0	0	1	0	0	0	0	1	0	0	
42	0	1	0	0	0	0		0	0	1	0	0	0	0	1	0	0	
43	1	0	0	1	0	0		0	0	1	0	0	0	1	0	1	0	
Reply-45	1	0	0	0	0	0		0	0	0	0	0	0	1	0	0	0	
Reply-46	1	0	0	0	0	0		1	0	0	0	0	0	1	0	0	0	

Reply-47	1	1	1	0	1	0		0	0	1	0	0	0	1	0	0	0		

Appendix O

Survey Responses for Section 2, Questions 4-5

Note: All comments are the English translations.

Respondent	S2:Q4	S2:Q5
	Is anything preventing you from recycling your recyclables?	What about the product could be improved for your ease of use?
1	No	
2	If there is a lot of things to throw away and there isn't a garbage place near, no	I find the pipet not optimal maybe a spoon
3	No	No
4	No	Please don't change anything
5	No	Nothing, it is the best
6		The pipet sometimes gets clogged
7		
8		
9	No	The pipet part is defective
10	Yes there is not collection facility nearby	Nothing
11		
12		
13	No	
14	No we recycle all the materials	For example a lid(cap) where one can with the needle insert
15		
16	No	Better pipet - and product information more readily available
17	No, we recycle as much as possible	
18		
19	No	Dry cultures as abundant as liquid cultures
20	No	Nothing, [illegible]
21		
22		

23	No	Nothing
24	No	A longer pipet, it is difficult to get the last of the liquid out
25		
26	Storage capacity	Its tip top
27	No	Nothing to change
28	Bored	The pipette is useless, he thinks
29	The effort of disposal	I find it bad that the RSWsol Kulture not on 7 days available is how [illegible]
30	No	Smaller bottle sizes
31	Cleanliness	Better functioning pipet, sometimes it doesn't work
32	No	It's better with glass packaging, if possible
33	No	Nothing
34	No it is great to recycle, [illegible]	Reuse the bottles
35		The pipette too stiff
36		
37		
38	No, reusable materials are cleaned	For us it is very user friendly
39	[illegible], there should be more information about the recycling	The pipet is sometimes defective, Illegible, a deposit system for the bottles
40	Long path	For me it's perfect
41	I think that's great because we separate the waste. and the Alpmeister properly disposed of it pg 201	Show that the pipet from yogurt functions
42		
43	No	
Reply-45		
Reply-46	Sometimes the effort to the alps and to the valley is hard	
Reply-47		

Appendix P

Survey Responses for Section 3, Questions 1-5

Note: All comments are the English translations.

Respondent	S3:Q1		S3: Q2	S3: Q3	S3: Q4	S2: Q5	
	How many cheesemaking courses have you taken?		How long did your longest course last? Choose the closest option:	If you took more than one course, what is the combined amount of time you spent taking all your cheesemaking courses? Choose the closest option:	Did you learn cheese making from your family?	Who first started making cheese in your family?	
	A) 0 B) 1 C) 2-3 D) 4+ E) Other	Comments	A) A few days B) A week C) A month D) A half year E) A year and a half or more F) Never	A) Week B) Month C) Half a year D) A year E) A year and a half or more F) Never		A) No one B) Siblings C) Parents/ Aunt/Uncle D) Grandparents E) Great grandparents F) Other	Comments
1	B		C	0	Y	F	Cousin
2	B		C	B	N	A	Alpine Cheese
3	A		F	0	N	A	
4	D		C	C	Y	F	My Wife
5	B		B	A	Y	CDE	
6	B		C	B	N	A	
7	C		C	B	N	A	
8	D		E	E	N	A	
9	D	No courses, I got an education for milktechnology EFZ	0	0	0	C	
10	B		E	E	N	E	
11	B		E	0	N	A	
12	B		C	0	N	C	

13	D		C	B	N	A	
14	D	I am an expert cheese maker	E	E	Y	DE	
15	A		0	0	N	C	
16	D		E	E	N	A	
17	D	He was an apprentice and is now a cheese master	0	0	0	C	
18	C		A	0	Y	B	
19	D	Cheese master	E	0	Y	0	
20	C	2 cheese classes and 1 milktechnology	E	A	N	D	
21	B		A	A	Y	C	
22	D	EFZ	0	0	N	E	
23	D	Cheese master	0	0	0	0	
24	B		C	F	N	A	
25	B		B	F	N	A	
26	B		B	F	N	A	
27	D		A	B	N	0	
28	D		A	B	N	A	
29	B	Comment Illegible	C	0	Y	C	
30	C		C	B	N	A	
31	B		C	B	N	A	
32	C		C	D	N	D	
33	B		A	0	Y	C	
34	A	3 years training as cheesemaker	F	A	Y	C	Father
35	B		E	E	N	A	
36	C		E	E	Y	D	
37	D		B	B	N	E	
38	C		C	F	N	C	
39	A	Educated to be a milktechnoligist	E	E	N	C	

40	D	Milktechnoligist, and milk school graduated in 1984	F	E	N	C	
41	D	Was a cheesemaker for 3 years, it's my job	E	E	N	F	
42	C		E	E	Y	C	
43	D	EFZ for 3 years	C	0	Y	E	
Reply-45	D		D	0	N	0	
Reply-46	D		E	E	N	A	
Reply-47	B		B	0	Y	C	

Appendix Q

Pamphlet

Preparation

1. Heat fresh milk in a cooking pot at 90°C for 5 minutes
    a. Or use UHT skim milk (no heating necessary)
2. Reduce contamination risk
    a. Clean work surface
    b. Heat-disinfect instruments
    c. Clean, dry hands
3. Cool or heat to incubation temperature
        i. Preheat thermos bottle

REFER TO INCUBATION TIME AND TEMP INSIDE

4. Shake the bottled culture
5. Measure out culture into milk
    a. Stir with instrument or gently shake
        i. Thermophilic cultures: 0.1-0.3% v/v
        ii. Mesophilic cultures: .05-1% v/v
6. Final inspection
    a. Required acidity
    b. Looks normal
    c. Smells sour
7. Refrigerate
    a. maximum of 5 days

Agroscope Website

See our website for instruction videos, the specific incubation timing and temperature, and ordering more cultures.

https://www.liebefeld-kulturen.ch

Insert phone number later

Using the Culture

How to start making cheese with Agroscope

type of acidification culture	Name	PRICE	Incubation	
		diff name?		price
Mesophilic starter cultures	LC 17	LK 17	30-32 ° C / 10-14 h, acidity 35-40 ° SH	25
	CMM 501	MMK 501	30-32 ° C / 10-14 h, acidity 35-40 ° SH	25
	RSW 901	RSW 901	20-30 °C/15-20 h	25
Thermophilic starter cultures	AOP-G1	AOP G1	38 °C/6-18 h	25
	AOP-G3	Aop G3	38 °C/6-18 h	25
	CMB 101	RMK 101	38 °C/6-18 h	25
	CMB 105	RMK 105	38 °C/6-18 h	25
	CMB 115	RMK 115	38 °C/6-18 h	25
	CMB 124	RMK 124	38 °C/6-18 h	25
	CMB 150	RMK 150	38 °C/6-18 h	25
	CMB 190	RMK 190	38 °C/6-18 h	25
	CMB 202	RMK 202	38 °C/6-18 h	25
	CMB 203	RMK 203	38 °C/6-18 h	25
	CMB 280	RMK 280	38 °C/6-18 h	25
	CMB 291	RMK 291	38 °C/6-18 h	25
	CMB 302	RMK 302	38 °C/6-18 h	25
	CMB 305	RMK 305	38 °C/6-18 h	25
	CM 170	MK 170	38 °C/6-18 h	25
	CM 174	MK 174	38 °C/6-18 h	25
	CM 650	MK 650	38 °C/6-18 h	25
Starter cultures mixtures (mesophil & thermophil)	CM 401	MK 401	30-38 °C/6-18 h	25
	CM 420	MK 420	30-38 °C/6-18 h	25
	CM 2020	MK 2020	30-38 °C/6-18 h	25
Thermophilic streptococci	Sc abf		38 °C/8-12 h	25
yoghurt culture	yogurt B1	Joghurt B1	42 °C/4-5 h	25
crops for summering farms	Jog K1		38-42°C/3-5 h	25
	CM 409	JMK 409	30-38 °C/6-18 h	25
	CM 410	MK 410 Lyo	various options	12.5
Facultative Heterofermentative lactobacilli	CM 3008	MK 3008	38 °C/14-20 h	25
	CM 3010	MK 3010	38 °C/14-20 h	25
	CM 3012	MK 3012	38 °C/14-20 h	25

Preparation

1. Erhitzen Sie frische Milch in einem Kochtopf 5 Minuten lang auf 90 ° C.
    a. UHT-Milch kann verwendet werden (keine Heizung notwendig)
2. Kontaminationsrisiko reduzieren
    a. Sauberer Arbeitstisch
    b. Hitzedesinfektionsinstrumente
    c. Hände reinigen und trocknen
3. Abkühlen oder auf Inkubationstemperatur erhitzen
    a. Thermosflasche

Siehe Die Kulturspezifikationen Im Inneren

4. Schütteln Sie die abgefüllte Kultur
5. Kultur abmessen und in Milch gießen
    a. Mit dem Instrument umrühren oder leicht schütteln
        i. Thermophile Starterkulturen: 0.1-0.3% v/v
        ii. Mesophile Starterkulturen: .05-1% v/v
6. Endkontrolle
    a. Erforderliche Säure
    b. Sieht normal aus
    c. Riecht sauer
7. Maximal 5 Tage im Kühlschrank lagern

Agroscope Webseite

Auf unserer Website finden Sie Anleitungsvideos, den spezifischen Inkubationszeitpunkt und die Temperatur sowie die Bestellung weiterer Kulturen.

https://www.liebefeld-kulturen.ch

Insert phone number later

Kultur Nutzen

Wie man mit Agroscope Käse macht

Versauerungskulturen	Produkt		Bebrütung	Preis
Mesophile Starterkulturen	LC 17	LK 17	30-32°C/10-14 h, Säuregrad 35-40°SH	25
	CMM 501	MMK 501	30-32°C/10-14 h, Säuregrad 35-40°SH	25
	RSW 901	RSW 901	20-30 °C/15-20 h	25
Thermophile Starterkulturen	AOP-G1	AOP G1	38 °C/6-18 h	25
	AOP-G3	Aop G3	38 °C/6-18 h	25
	CMB 101	RMK 101	38 °C/6-18 h	25
	CMB 105	RMK 105	38 °C/6-18 h	25
	CMB 115	RMK 115	38 °C/6-18 h	25
	CMB 124	RMK 124	38 °C/6-18 h	25
	CMB 150	RMK 150	38 °C/6-18 h	25
	CMB 190	RMK 190	38 °C/6-18 h	25
	CMB 202	RMK 202	38 °C/6-18 h	25
	CMB 203	RMK 203	38 °C/6-18 h	25
	CMB 280	RMK 280	38 °C/6-18 h	25
	CMB 291	RMK 291	38 °C/6-18 h	25
	CMB 302	RMK 302	38 °C/6-18 h	25
	CMB 305	RMK 305	38 °C/6-18 h	25
	CM 170	MK 170	38 °C/6-18 h	25
	CM 174	MK 174	38 °C/6-18 h	25
	CM 650	MK 650	38 °C/6-18 h	25
Gemischte Starterkulturen (mesophil & thermophil)	CM 401	MK 401	30-38 °C/6-18 h	25
	CM 420	MK 420	30-38 °C/6-18 h	25
	CM 2020	MK 2020	30-38 °C/6-18 h	25
Thermophile Streptokokken	Sc abf		38 °C/8-12 h	25
Joghurtkulturen	yogurt B1	Joghurt B1	42 °C/4-5 h	25
Kulturen für Alpkäse	Jog K1		38-42°C/3-5 h	25
	CM 409	JMK 409	30-38 °C/6-18 h	25
	CM 410	MK 410 Lyo		12.5
Fakultativ heterofermentative Laktobazillen	CM 3008	MK 3008	38 °C/14-20 h	25
	CM 3010	MK 3010	38 °C/14-20 h	25
	CM 3012	MK 3012	38 °C/14-20 h	25

Appendix R

Manufacturing Examples and Suggestions

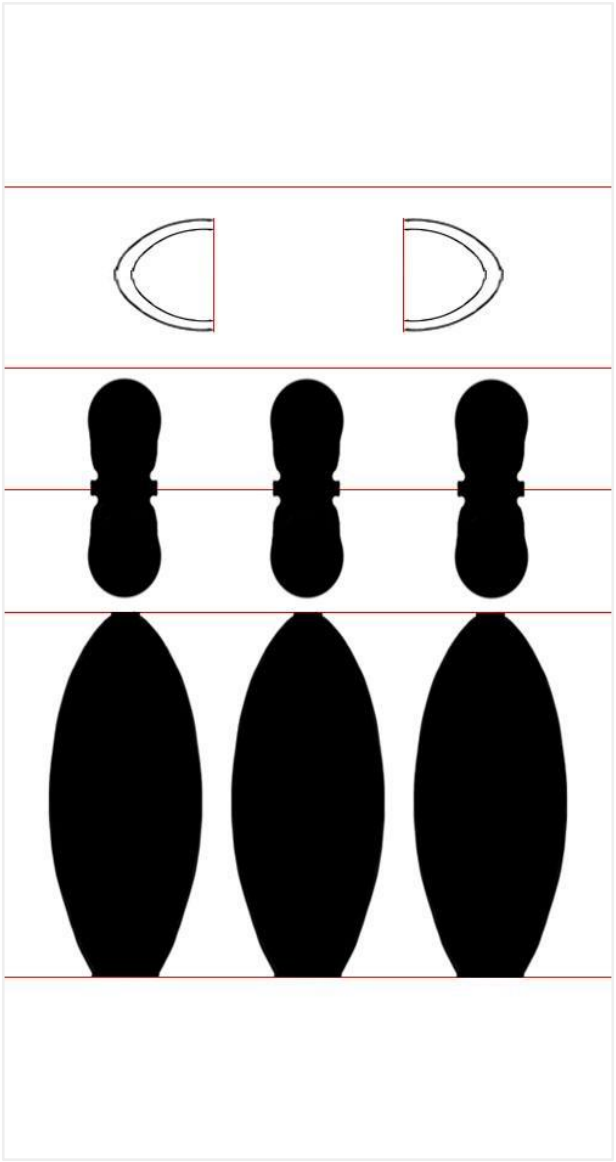
Syringe	Pricing per Quantity	Link
	£60 : 800 £47.5 : 500 £10 : 100 £2 : 5	Raymed
	$146.93 : 1000 $88.90 : 800	Vitality Medical
	$109.96 : 800 $27.89 : 200 $0.14 : 1	Vitality Medical
Pipet	**Pricing per Quantity**	**Link**
	$6 : 100	Amazon
	$11,200 : 120,000 $470 : 5,000	VWR

	$62 : 500	
	$170 : 2,500 $19 : 250	Lab Depot Inc.
Glass Washer	Price + bottles per hour	Link
	$1797.00 600BPH	Katom

Appendix S

Syringe Storage Cutout

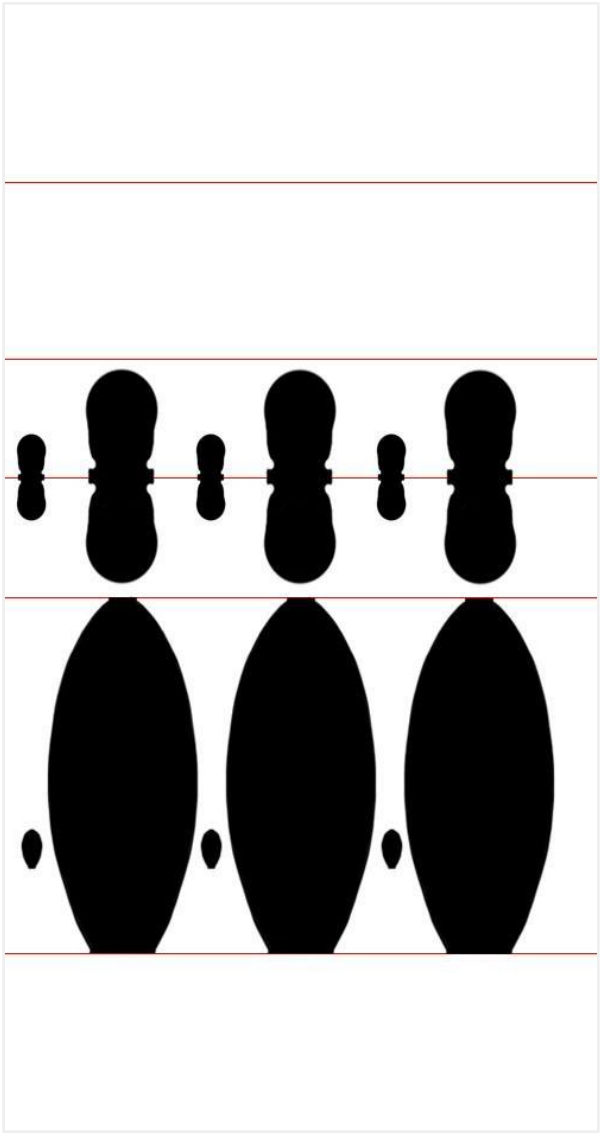
For the following image, black lines denote sections that should be removed, while red lines denote places to fold.



Appendix T

Separate Pipets Storage Cutout

For the following image, black lines denote sections that should be removed, while red lines denote places to fold.



Appendix U

List of Bacteria Used to Make Cheese

Table 2 Microbial composition of starters used in the manufacture of major cheese groups

Starter composition[a]	*Cheese group*
Lactococcus lactis ssp. *lactis*	Cheddar, Colby, Gouda, Edam, Monterey
Lactococcus lactis ssp. *cremoris*	
Lactococcus lactis ssp. *lactis*	Cream, Neufchatel, Cottage
Lactococcus lactis ssp. *cremoris*	
Lactococcus lactis ssp. *lactis* biovar. *diacetylactis*	
Leuconostoc mesenteroides ssp. cremoris	
Lactococcus lactis ssp. *lactis* biovar. *diacetylactis*	Swiss, Emmental, Gruyere, Samso, Fontina
Leuconostoc lactis ssp. *cremoris*	
Lactobacillus delbrueckii ssp. *bulgaricus*	
Lactobacillus delbrueckii ssp. *lactis*	
Lactobacillus casei ssp. *casei*	
Lactobacillus helveticus	
Streptococcus thermophilus	
Propionibacterium freudenreichii	
Propionibacterium shermanii	
Lactococcus lactis ssp. *lactis*	Italian cheeses: Mozzarella, Provolone, Romano
Streptococcus thermophilus	
Lactobacillus delbrueckii ssp. *bulgaricus*	
Lactobacillus delbrueckii ssp. *lactis*	
Lactobacillus helveticus	
Lactococcus lactis ssp. *lactis*	Blue-veined cheeses: Roquefort, Bleu, Stilton, Gorgonzola
Lactococcus lactis ssp. *cremoris*	
Penicillium roqueforti	
Brevibacterium linens	
Streptococcus thermophilus	Brick, Limburger, Muenster, Trappist, Port Salut, St. Paulin, Bel Paese, Tilsit
Lactobacillus delbrueckii ssp. *lactis*	
Brevibacterium linens	
Lactococcus lactis ssp. *lactis*	Camembert, Brie
Lactococcus lactis ssp. *cremoris*	
Streptococcus thermophilus	
Penicillium candidum	
Penicillium caseicolum	
Penicillium camemberti	

[a]In some cheeses, two or more starters may be used.
Adapted from Chandan, R.C., Kapoor, R., 2011a. Principles of cheese technology. In: Chandan, R.C., Kilara, A. (Eds.), Dairy Ingredients for Food Processing. Wiley Blackwell, Ames, IA, pp. 225–265 (Chapter 10).

Appendix V

Additional Pipet Replacements

Measuring spoon attached to cap:

This suggestion would be for an integrated measuring spoon that would take the place of the pipette within the bottle's cap. This spoon would have to be made longer that it is wide to fit within the bottles. Additionally, it would be held by the cap as any section between the cupped area and the cap would be covered with culture. The reason we did not use this idea as one of our main ones was a concern about how easy it would actually be to fill the spoon without spilling.

Measuring spoon:

This measuring spoon would be included separately from the bottles, likely packaged in a way similar to the syringe. The benefit of this idea over the integrated measuring spoon is that there would be no restrictions in the size or shape of the spoon unlike the previous one. However, this idea still relies heavily on the user being able to pour the cultures into the spoon steadily.

Ketchup style cap:

This idea is to create a cap for the bottles cultures that will allow the cheesemakers to squeeze the cultures out like one might use a ketchup bottle. For this idea the material that the bottles themselves are made of would have to change to be a soft, squeezable plastic. This is because the cultures would only squeeze through the cap if a compressive force is applied to the bottle. This idea would require Agroscope to find a way to manufacture these style caps.