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Improving the Longevity of Dairy Cattle: An Important Initiative for the Swiss Dairy Industry

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April 29th, 2022

Abstract

Swiss dairy cattle rarely live a productive life of longer than 5 years- sometimes even less, and therefore fail to reach their maximum lactation potential. They are often prematurely culled due to udder diseases, fertility problems, lameness, or the farmer's need to make room for a calving heifer. However, farmers rarely record the real reasons for removing a cow from the herd, due to a sense of pressure and obligation to produce and a lack of universal standards regarding longevity to assist in this decision. This is a monumental problem, from both an environmental and animal welfare point of view, especially because dairy is widely consumed in Switzerland. Therefore, this paper seeks to find ways to improve longevity and to investigate if the methods on both a Bio Suisse and Biodynamic farm, as opposed to an intensive, high-producing farm, assist in lengthening the life of a dairy cow. This study was done using a wide variety of existing gray and academic literature, and personal interviews with a cattle health researcher and Swiss dairy farmers. It was found that there was no direct correlation between organic farming and the increased longevity of dairy cows, due to a lack of previous research and data. However, there is a likelihood that the prioritization of animal welfare and environmental sustainability on organic farms contributes and supports a longer productive life for dairy cattle.

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Introduction

The dairy sector is the most important agricultural sector in Switzerland. According to the Swiss Federal Council (2021), “around 195,000 tonnes of cheese was produced in 2019 and the Swiss consume over 20 kg of cheese per person per year” (p. 1). Dairy production is deeply rooted in Swiss culture and has existed for centuries. Swiss farmers rely on livestock farming because 70% of the land is not arable, meaning it is unsuitable to grow crops for human consumption. However, according to the Federal Office for the Environment (2018), “agriculture accounted for 12.9% of Switzerland’s total greenhouse gas emissions in 2017, with more than one third of all agricultural emissions caused by dairy cattle, mainly in the form of methane from enteric fermentation” (p. 64). This is a natural digestion process in grazing animals or ruminants, such as cattle, sheep, goats, and buffalo, that occurs when microbes in their digestive tract ferment food and release methane as a byproduct (Climate & Clean Air Coalition, 2014, p. 1).

The effects of climate change are worsening every day, and fundamental changes need to happen within animal husbandry and agriculture in order for these systems to become a part of the solution to planetary health instead of the problem. Therefore, how can the Swiss dairy industry be more sustainable, while still taking into account the pressure felt by dairy farmers to feed a growing population? There are many different definitions of sustainability, but for the purpose of this paper, it entails using the resources that are naturally available in Switzerland, instead of relying on global imports. This is a complex question and a sensitive topic for farmers when brought up in conversation, however, one possible place to start and an area of study that requires further research is increasing the longevity of Swiss dairy cows. This requires an investigation into the reasons why farmers cull their cows before they reach their maximum potential. According to De Vries & Marcondes (2019), culling is defined as the, “departure of

cows from the herd because of sale, slaughter, salvage or death” (p. 156). The main reasons for premature cattle culling, as well as the guidelines of Swiss organic dairy farms, and the relationship between climate change and animal husbandry will be explored within this paper. Ultimately, the research question is: do the guidelines and practices on an organic dairy farm, such as the prioritization of animal welfare or a roughage-based diet, contribute to an increased longevity of dairy cattle, and therefore, environmental sustainability, as opposed to conventional farming practices? The field research done at two different dairy farms- one Bio Suisse and the other Biodynamic, along with outside resources, will provide a unique perspective to answer this question.

Research Methodology

This paper takes a qualitative and comparative analysis research approach using a variety of secondary and primary sources. It is an investigation into the relationship between animal husbandry and climate change, and if increasing cow longevity is a possible solution to reduce the Swiss dairy sector’s environmental impact. To collect the data, peer-reviewed, scholarly databases such as PubMed, ProQuest, and ScienceDirect were used through the Denison University library website. The Food and Agriculture Organization (FAO) of the United Nations, as well as studies done at FiBL, a research institute for organic agriculture, provided gray literature which aided in forming a definition of longevity and an understanding of how organic animal farming can improve. Google Scholar was used to find resources related to phrases such as, “longevity in Swiss dairy cows,” or “biodynamic farming guidelines.” The “related articles” function was also utilized to deepen the search. These resources were then analyzed and compared to find opposing or shared theories.

To collect primary sources, three interviews were conducted- two formal and one informal. The first two interviews consisted of meetings with Swiss dairy farmers and families to learn from their personal experiences and practices. The last interview was conducted with a researcher, in order to hear a completely different perspective in terms of the health of dairy cows and calves. The first formal, face-to-face interview, was conducted on March 26th, 2022 in Sonvilier, Switzerland with Doris Roth who operates a Bio Suisse dairy farm with her husband, Fabien Roth, his parents, and their children. I lived on the farm for two days to participate in daily activities and the interview was conducted before I left. In the same region, I conducted the second face-to-face interview a bit later in the day with David Rotzler who manages a Biodynamic dairy farm, Combe d'Humbert. I also spoke to his wife, Rahel Kilchsperger, who manages the fromagerie, or cheese shop, in their home. This interview was very informal because I followed David around to ask questions while he milked the cows. The third and final formal interview was conducted on April 14th, 2022 over zoom with Rennie C. Eppenstein who works in the Department of Livestock Sciences at FiBL. This interview was conducted over zoom because she was traveling for work. We communicated via email prior to the interview, so I sent her the questions to prepare and brainstorm ahead of time.

My study did not require many ethical considerations beforehand and therefore, the human subjects review process was expedited. However, a few farmers did not want to engage in conversation about sustainability or climate-conscious initiatives because they felt they were already receiving a lot of pressure from outsiders. Before recording any of the interviews, I made sure to ask for consent to receive approval and explained how the data could be assessed by the participants after the interview. On the two farms I visited, farmers were very open about their relationships with the animals and how they develop a caring, comfortable environment, while

still making a profit. One of the limitations of the study could be the lack of a perspective from a conventional farmer who does not participate in organic farming. It would have been helpful to have that interaction in order to better compare the two different production systems. Bias also could have been involved, seeing as Fabien Roth is the cousin of my homestay sister's stepmother, so that familial connection could have influenced Doris' responses during the interview. I am also a vegetarian who strongly supports animal rights, so my personal bias may have influenced the research.

Literature Review

I. Factors Influencing the Longevity of Dairy Cattle

One of the biggest challenges for farmers and researchers interested in promoting and increasing the health of dairy cows and calves, is the lack of a universal definition of longevity or a metric to measure it. According to Hu et al. (2021), definitions of the term can range from, "the number of days from first calving until culling or censoring," to, "the length of time during which an animal is able to stay producing in the herd and survive," to finally, "the individual farmer eliminating cows for low milk production" (p. 2). Another limitation is that most definitions do not take into account the early life of a cow, or the non-productive period, before its first calving. For the purpose of this paper, longevity will be defined in a productive sense, as the time from first calving (when the cow gives birth and can therefore give milk for the first time), until the last time recorded by milk control organizations.

A dairy cow could easily live 15-20 years, but in high milk-producing countries, such as the United States, the Netherlands, and Germany, dairy cows will only live a productive life of 2.5-4 years, after calving at 2 years of age, which brings the total lifespan to 4.5-6 years (De

Vries & Macondes, 2019, p. 155). According to the researcher Rennie C. Eppenstein, “in Switzerland, dairy cows will live 5.5 years on average and within these 5 years they have 3.5 lactations. Normally, the highest lactations are the 4th, 5th, and 6th lactations, when the milk yield is maximum. Therefore, we tend to cull cows before they even reach their maximum potential” (Personal Communication, April 14, 2022). This is problematic from an environmental, economic and welfare point of view. Based on the Farm Animal Welfare Council, referenced by Bruijnjs et al. (2012), “a 2-year increase in lifespan would be desirable and possible. This would create a lifespan of 8 years” (p. 193).

Within the literature, researchers such as Dallago et al. (2021), make a point of explaining the difference between involuntary culling of cows, which is typically due to disease or injury, and voluntary culling, which could depend on low milk production or the state of the market. However, according to De Vries & Marcondes (2019), this distinction does not hold great importance because there are a multitude of factors influencing culling decisions and oftentimes the primary reason for culling is not what is actually recorded (p.156). A farmer could report that a cow was culled because of fertility problems, when in reality, they are trying to hide underlying health issues that were not properly addressed. Surprisingly, old age rarely influences whether or not a cow will be culled in the modern dairy industry (M.Dallago et al., 2021, p. 2). The main reasons for culling which are mentioned consistently throughout the literature are udder health and disease, fertility problems, the tendency of farmers to replace cows with calving heifers, and lameness due to feet and leg issues.

Mastitis, inflammation of the udder tissue or mammary gland, is the most common and deadly disease in dairy cattle. It causes a decrease in milk production and a deterioration in the milk quality. According to Kaswar (2020), and many other researchers, “mastitis can be

prevented by taking adequate measures like maintaining udder hygiene, sanitizing the cow barn, and maintaining a milking schedule” (p.1). Other cow diseases include a retained placenta, which occurs when part or all of the placenta is still connected to the cow’s uterus within 12 hours of giving birth, and is a risk factor for metritis- the inflammation of the wall of the uterus caused by bacterial infections. Ketosis is another common disease which happens when a cow has a negative energy balance from having to use its own energy reserves to produce milk, which it is predisposed to do. This typically happens when the cow’s food ration is not sufficient. Finally, a displaced abomasum occurs when the “true” or fourth stomach of the cow fills with gas and rises to the top of abdomen, where it is displaced, preventing food from being digested (De Vries & Marcondes, 2019, p. 157). Study results vary when it comes to the likelihood of culling in relation to a specific disease, but for the most part, displaced abomasum is the second most common culling reason, followed by mastitis and ketosis, with reproductive issues being the first reason for premature culling.

According to De Vries & Marcondes, “non-pregnant cows had a four times greater risk of culling compared with pregnant cows” (p. 158). Culling is also more likely if cows exclusively give birth to males. However, difficulties with calving are typically caused by underlying health issues or preceding diseases, such as metritis or a retained placenta, and therefore it is crucial for farmers to prevent these health problems ahead of time if they want a productive herd. One of the main tactics used by farmers to maintain high levels of milk production within their herd is replacing mature cows with heifers, or young cows, that are typically more genetically advanced. The farmers will buy semen and they will have to decide to inseminate the cow with milk or beef breed. The idea behind inseminating with milk breed is always replacement. The creation and introduction of sexed semen has also increased the likelihood of replacement heifers, because

this new technology allows beef producers to breed calves of their desired sex to fit herd and market needs (Andersen & Thomas, 2020).

Many farmers believe that dairy heifers should be raised for the specific purpose of replacing cows, however they may also feel pressure to continue replacing if their culling rate is unexpectedly high (M.Dallago et al., p. 13). According to a study done by De Vries & Marcondes, “dairy advisors and dairy farmers are aware that short productive lifespans are increasingly the result of too many heifers on dairy farms that lead to removal of cows in order to make space for calving heifers” (p. 161). However, even with this awareness and knowledge, the decision is ultimately an economic one, and the reasons for a high replacement rate are difficult to disentangle. According to Eppenstein, there will always be the question of, “could farmers with a high replacement rate just decide to lower it and would this automatically increase the longevity of the dairy cow or are these cows actually sick and need replacing?” (Personal Communication, 2022). Therefore, decision-support tools are needed to understand if replacement is *actually* necessary.

Lameness, an abnormal stance or walk of a cow, is another common reason for culling. M.Dallago et al. (2021) found, “the occurrence of lameness is lower in cows on pasture compared to indoor-housed cows and its prevalence is 3-4 times higher than that estimated by farmers” (p. 12). Farm housing with concrete floors is a risk factor for lameness, whereas grazing on pastures is associated with hoof health. Housing and management of farms are two of the biggest factors when it comes to increasing cow longevity. Lameness also leads to a decrease in reproductive performance, as well as milk production, which could be the reason for culling reported by the farmer (M. Dallago et al., p. 12). This evident physical problem in dairy cattle causes concern among the public in terms of animal welfare, which is one of the priorities of Bio

Suisse and biodynamic farming. For the purpose of this paper, animal welfare will be defined in terms of the goal of the science behind it. According to Eppenstein, this entails, “reducing the negative impact of the animal husbandry industry on the animals, so as to improve health, reduce stress, and basically take away everything perceived as negative for their wellbeing” (Personal Communication, 2022).

II. Bio Suisse and Biodynamic Farming Guidelines

Bio Suisse is an association of Swiss organic farmers whose rights and products are advocated for by producers. On the other hand, for consumers, it is an organization that focuses on promoting high quality, sustainably made food. This method of farming takes a holistic approach in which the most important guiding principles are: promote biodiversity, no use of chemical synthetic pesticides and fertilizers, maintain health of soil, give animals appropriate feed and time outdoors, and no use of genetically-modified organisms (GMOs) or animals (Bio Suisse, n.d.). Since the beginning of 2022, a new rule has been implemented in which bio dairy farmers can only give their cows feed with 5% concentrates- grain and soya, (previously this was 10%), and 95% of the diet must be roughage- hay, silage or grass. This requires farmers to use what they have to produce their own feed in Switzerland, instead of importing from abroad, which in turn is more sustainable. According to Eppenstein, “Biodynamic farming works hand in hand with Bio Suisse, only with more restrictions to reflect their own mindset” (Personal Communication, 2022).

According to the Biodynamic Association (2020), “Biodynamics is a holistic, ecological, and ethical approach to farming, gardening, food, and nutrition, based on the work of philosopher and scientist, Rudolf Steiner” (“What is Biodynamics?” section). A biodynamic farm is seen as a living organism in which all elements are taken into consideration- the compost,

animals, plants, climate, and even the spirit of the place. In terms of animal welfare, raising healthy animals is more than just preventing physical pain, it is also the farmer's duty to allow them to flourish and lead a natural life. One of the ways that Biodynamic farmers allow dairy cattle to live their natural lives is by keeping their horns intact, whereas in Bio Suisse farming, cattle may be dehorned if the farmer's stables are not large enough to avoid injuries to the animals and the people looking after them (Bio Suisse, 2020).

According to researchers at FiBL, specifically Spengler Neff (2016), "if we look at an animal with two symmetrical placed horns on its head, we know that it is a ruminant with a differentiated metabolic system, four stomachs, and a long intestine. Digestion and metabolism play a central role in its life" (p. 2). Along with a recognizable identity, cows also have horns to establish a system of hierarchy among the herd, groom themselves and others, and perform species-specific social behavior. According to David Rotzler, he does not dehorn his cattle because he views this action as mutilation (Personal Communication, March 26, 2022). An investigation will be made throughout the analysis section of this paper to determine if animal welfare actions such as David's impact the longevity of swiss dairy cattle and how this sector can be more environmentally sustainable.

Analysis: Improving the Longevity of Dairy Cattle

I. Universalizing Longevity Terms and Definitions

A standardized approach for defining and measuring longevity is necessary if it is to become a priority for the dairy industry now and in the future. There is also great variation in what farmers believe to be an optimum or targeted longevity. Schuster et al. (2020) recommend making a distinction between length of productive life (LPL), herd life (HL), stayability, and

survivability. They define LPL as, “the length of time in the lactating herd, calculated as the number of days between first calving and culling or death,” while herd life should be defined as, “the entire time an animal spends in the herd, measured as the number of days between birth and culling or death” (p. 3). In terms of survivability, this should be referenced as a cow’s ability to remain in the herd until a specific point in time, while the term, “stayability,” should be used to refer to a cow’s ability to avoid culling. If these terms are used interchangeably, it is unclear whether longevity in dairy cattle refers to productive life, total life span or a cow’s ability to survive up to a certain point in time (Schuster et al., 2020, p. 3). Production data, such as milk yield, is also followed more closely than longevity values when evaluating farm management which highlights a need for clear animal health standards.

At the same time, it is important to remember that an increased longevity does not always correlate with improved cow welfare. According to Schuster et al. (2020), longer life of dairy cattle may, “represent problems in the herd, such as poor reproductive performance, resulting in open (non-pregnant) cows being continuously inseminated late into lactation or an inability to successfully rear replacements” (p. 4). A shorter longevity could indicate that the farmer is more productive because he believes in the value of a younger herd, and therefore sells older cows for dairy purposes. Therefore, Schuster et al. argue that a more realistic goal for the dairy industry would be to *optimize* longevity, or LPL, instead of increasing it (p. 12). This could be achieved by using genomic testing (the study of all an animal’s genes) to breed heifers with a better genetic makeup that correlates with a longer life. Producers should concentrate on helping each cow reach their “phenotypic maximum potential” (Schuster et al., 2020, p. 12). According to the National Human Genome Research Institute, “ ‘Phenotype’ simply refers to an organism’s observable traits, such as the presence or absence of a disease. But it’s important to remember

that phenotypes are equally, or even sometimes more greatly influenced by environmental effects than genetic effects” (“Narration” Section). Therefore, the heifer’s full potential could be reached if farmers use optimal management strategies on their farms. In order for an animal’s specific traits to flourish, the environment must contribute to its needs.

II. Management Practices (Housing & Hygiene)

According to Schuster et al. (2020), “current housing and environmental conditions of cows are vastly different from their original habitats, and these seemingly ‘unnatural’ conditions have been suggested as a contributing factor affecting longevity” (p. 7). The two most commonly used indoor housing systems for cattle are tie-stalls, in which they are kept tethered to be milked in a stall, and loose housing, which uses cubicle systems or free-stalls, so the cows are not tied and can be milked with an automatic system or in a milk parlor (Rushen, 2017, p. 2). There are pros and cons to both systems. Tie-stalls allow easy access to food and water, but limit the space the cow can move and their social interactions, while loose housing gives the cow plenty of space to move around, but they may need to compete for an area to lie down or for food. One of the most important aspects of dairy cattle management, in regards to animal welfare, is giving the cow enough access to natural sunlight and fresh air (Rushen, 2017, p. 7).

David’s farm uses tie-stalls to keep each cow at her place with a post-and-rail feeding design, but his small herd has time outside in the summer to roam free and socialize, and they only go to the barn to be milked (Personal Communication, March 26, 2022). His barn is also very old fashioned and made entirely out of wood, unlike large industrial farms which typically use the tie-stall feeding system. Doris’ farm on the other hand, uses a loose housing system with the head lock feeder design, which can help reduce aggression when the cows are eating hay, to ensure that socially subordinate cows get access to food (Rushen, 2017, p. 15). Her cows are then

funneled into a separate area to be milked by an automatic system, which holds a small container of food as an incentive for the cow to enjoy while she is giving milk (Personal Communication, 2022).

The other important environmental aspects that need to be monitored to keep a dairy herd healthy are barn cleanliness and design (sharp turns), stall design (size), flooring type and slipperiness, and bedding type and quality. According to Rushen (2017), "insufficient bedding in both tie-stalls and free-stalls can increase the prevalence of teat damage, lower milk yield, and reduce the longevity of the cows" (p. 7). Finding the best type of bedding to fit the needs of the herd can be difficult seeing as straw is not always cheap or easy to obtain, and bedding made of organic material can increase the risk of mastitis. This is why some farmers have turned to rubber mats, so their cows are not forced to lie on concrete. Keeping the barn clean is also one of David and Doris' biggest priorities. They are both consistently sweeping or hosing down the floors, and David keeps the tails of his cows tied up, so they do not fall in excreted matter (Personal Communication, 2022).

One aspect of animal welfare that is currently being explored within organic agriculture is keeping the cow and her calf together for longer. Typically, the modern dairy industry separates the two of them soon after calving (about 24 hours). According to Rushen (2017),

This is done primarily to save milk, since the calves can be fed with milk replacers. To some, it is unthinkable to keep the calf and the cow together, and there are some claims that early separation reduces the risk of transmission of diseases from the cow to the calf (p. 22).

On Doris' farm, there was a cow who was in distress because she was separated from her calf, who was being kept in the stall next to her. From an outsider's perspective who is not familiar

with the dairy industry, watching a cow go through this separation is difficult and feels unjust. As a result, there is growing public concern about separating these “babies” from their mothers. However, the stress of the mother could be worse when you finally have to separate the two of them and the main drawback for dairy farmers is the economic loss that results from giving the mother’s milk to the calf instead of selling it (Levitt, 2019). The consideration of this new system by the organic dairy sector indicates the important role the public holds in influencing animal welfare decisions. However, the benefits (and if they outweigh the cons) of keeping a cow and her calf together needs further research to support it.

Overall, if society wants to improve animal welfare, then it is much more important to focus on maintaining good udder health and tackling lameness and fertility problems of cattle, rather than prioritizing keeping a cow and her calf together. According to Vaarst & Roderick (2019), in terms of the most common reasons for premature culling,

There is no general evidence that the figures are better for organic cows, but the high significance of animal welfare in organic standards requires farmers to pay particular attention to this problem. This is further reinforced by the fact that realizing a long productive lifespan integrates higher animal welfare with environmental and production efficiency (p. 2).

Despite the fact that there is no direct correlation found in previous research between a longer life expectancy of dairy cattle and organic farming, the fact that ethical animal husbandry is seen as the centerpiece of a successful organic farm indicates that the wellbeing of the animals comes first. Especially because the cattle provide manure which feeds and enriches the soil, increasing its fertility (Demeter, “Farm Organism” section). Therefore, their longer, healthier life is beneficial from an economic and environmental standpoint.

III. Attitudes and Belief Systems of Farmers in Relation to Culling Rates

During the interview with Eppenstein, she emphasized the importance of the farmer's attachment to their cows in terms of influencing longevity. She said, "I've met farmers who say, 'once my cow has a second udder infection, I will cull her,' and others who, without even looking at the records, know the birth date of each cow, their name, and the mother, so they will try everything before culling" (Personal Communication, 2022). David's attachment to his cows is obvious from the moment you step into his barn. Each cow has a plaque with her name on it, birth date, and date of calving. He only has 14 cows on 20 hectares of land, so he developed a special relationship with each one. Doris Roth feels the same sense of attachment to her cows, despite the fact that she has 65 hectares of land and does not milk them by hand. She makes sure to thank each cow after they give milk and always has a favorite. According to Eppenstein, "in general, on smaller dairy farms, farmers are very attached to their cows and this impacts how much the farmer is willing to invest to keep them alive" (Personal Communication, 2022). This point is supported by a study done by Rilanto et al. (2022), in which farm managers of 116 dairy herds on large-scale commercial dairy farms in Estonia were asked about their satisfaction, attitudes, and personality traits to determine the association between longevity and dairy cow culling (p. 31).

A questionnaire was sent out to the farm managers, including a cover letter explaining the point of the study. There were multiple themes of the questionnaire that ranged from "respondents demography and experience," to, "empathy and attitudes towards cattle." A Ten Item Personality Inventory (TIPI) scoring was also included to evaluate personality traits of the participants. They would respond to statements such as, "I am satisfied with my role in herd culling management," based on a scale of 1-7, 1 being completely agree and 7 being completely

disagree. Interviews with farm managers were held before sending out the questionnaire, to ensure that the statements were easy to understand (Rilanto et al., 2022, p. 32). According to the authors, their results revealed,

Dissatisfaction with cow culling rates and longevity, prioritizing high milk yields over longevity and a production-oriented management style were the characteristics of farm managers that had highest cow culling rates and poorest longevity in their farms. Due to large herd sizes and replacing human work with technology, there is reduced interaction between humans and animals (p. 37).

Farmers were not dissatisfied with culling rates because they felt they were too high, but because they lacked control over the decision. They expressed an interest in performing more voluntary culling, in which they had the power to choose which cows were removed from the herd. In addition, Rilanto et al. (2022) found that farm managers see the benefits in improving longevity as it indicates a high level of welfare and health, however they ultimately fail to prioritize it over a high milk yield.

This provokes the question, why do dairy farmers resist changing their goals or priorities to reflect the needs of the environment and the animals? According to Rilanto et al. (2022), “economic and social pressure might motivate farmers to invest into the high production capacity in their farms and to prioritize this over cow resilience” (p. 39). This behavior is reasonable, seeing as farmers have to keep up with society’s consumption habits, which are always increasing. In that sense, farmers tend to think about their work on a day to day basis, instead of the long term effects of their production. They also need to have a genuine desire to invest in this physically demanding work, seeing as they have limited freedom due to milking duties twice a

day and at the same time, low incomes (Contzen et al., 2021, p. 1). A second factor, aside from pressure, could be tradition.

Doris, with her background in biodynamics, had to work hard to convince her husband and his family to switch to Bio Suisse farming (Personal Communication, March 26, 2022). In the beginning, her husband was resistant because he was taught a different system of agriculture in school, one which focused on profit and production efficiency. Typically, in this system, the interests of the animal and the farmer diverge, and therefore the animal could experience overcrowding, production-related diseases, and behavioral restrictions (Bruijnis et al., 2012). Fabien was eventually convinced because of the ethical standards and health of animals promoted by Bio Suisse. When Doris first married into the Roth family, she was not allowed to work on the farm for a long time. She was expected to stay home to perform household tasks and take care of their children (Personal Communication, 2022). Doris' resilient, yet nurturing nature proved to be helpful in tackling this obstacle and now she takes part in every step of the dairy production process. Fabien and his family's behavior could reflect the attitudes of a patriarchal society within farming, in which the men in charge are reluctant to change what generations before them started.

IV. The Impact of Climate Change on Animal Husbandry and Vice-Versa

The warming of the earth's climate has and will continue to have a significant impact on the future of animal husbandry. According to Eppenstein, cows are very heat sensitive animals, therefore, the threat of heat stress is a massive issue in terms of cattle health (Personal Communication, 2022). However, the sensitivity of the cow will depend on its breed, milk yield, and the farm management. According to Herbut et al. (2018), "heat stress is defined as the sum of external forces acting on an animal that causes an increase in body temperature and evokes a

physiological response” (p. 2). Heat stress is associated with high temperatures and humidity in an animal’s environment that interferes with the cow’s process of metabolic heat production. This added heat (which is released into the animal’s surroundings), occurs due to the cow’s digestion of food in the rumen. The consequences of heat stress include reduced milk production and reproductive disorders and may continue to affect cows from summer into autumn. According to Herbut et al. (2018), “it is essential to dissipate excess body heat to prevent the animal from entering into a stage of hyperthermia which could have fatal results” (p. 2). Therefore, hyperthermia, or overheating, is another factor that could decrease the longevity of dairy cattle if not properly addressed. It is important for farmers to protect cows on pasture from direct radiation, while at the same time, providing proper ventilation in barns. A solution, noted by Eppenstein, that is becoming more popular is night pasture in which farmers keep their cows in the barn during the hottest parts of the day and allow them to graze at night. Since 70% of Switzerland is grasslands, not including the Alpine region, it is important to know if these grasslands are being used effectively by the organic dairy sector, based on an evaluation of its environmental impact.

LCA, or life cycle assessment, is a tool used to assess agricultural processes and products with two main goals: the consideration of all (if any) environmental impact categories and the consideration of the full life cycle of the object, from extraction to disposal, instead of just looking at what happens on the farm (Nemecek & Alig, 2016, p. 2). Researchers, Nemecek & Alig (2016), performed a study that evaluated the environmental performance of Swiss farms by using the LCA method. They compared a more intensive barn feeding system of 24 cows, with a full grazing system of 28 cows, from the years of 2008 to 2010. Due to the fact that the grazing herd was fed grass, meaning less concentrates (as mentioned previously in this paper), this

system showed less ecotoxicity, or the impact of toxic chemicals on natural ecosystems. This is because no pesticides were used on arable land to produce feed (p. 8). This system also produced less deforestation because only a small amount of soybean meal was used. Typically, rainforests in Brazil or Argentina are cut down to produce Soya to import to other countries. According to Nemecek & Alig (2016), “the full-grazing herd also had a higher biodiversity potential, since grazing creates more heterogeneity in grassland than cutting” (p. 8). According to the Biodynamic Federation Demeter International (BFDI)- a non-profit organization representing over 7,000 Biodynamic farmers, the grazing of cows can actually help to maintain animal habitats, such as bees and birds.

The downsides of this system are its lower efficiency, seeing as the barn feeding system produced 8,900 kg of milk, while the full grazing system produced 6,100 kg of milk, and higher methane emissions which contributes to global warming. According to Leiber et al. (2019), “the more a ruminant production system is based on roughages and avoids concentrates, the higher the methane emission is per unit of product” (p. 2). Therefore, the biggest challenge for organic dairy production will be to utilize regionally available feedstuffs, while still maintaining low greenhouse gas emissions and prioritizing animal welfare. The BFDI argues that if cows are kept and fed in an appropriate way, they can help to protect the climate. David ensures this by feeding his cows with only hay and grass in summer, instead of crops, therefore, the arable land is not used for animal food (Personal Communication, 2022). This requires no land use change, or “the conversion of pasture or forest land to cropland” (BFDI, n.d., “land use as a climate killer” section). According to the FAO, 18% of annual greenhouse gas emissions are caused by land use change (same section of Biodynamic Federation website). Ultimately, grassland-based and pasture-based systems are more environmentally friendly than intensive barn-feeding systems,

however, they must achieve higher levels of productivity if they are to be regarded as sustainable for the future.

Conclusion

According to Dallago et al. (2021), “the adoption of management practices and technologies to improve cow health and longevity is essential to achieve a profitable dairy industry in the future, which is a key factor in achieving sustainability” (p. 13). Despite arguments such as this one, there has not been an active effort among dairy farmers to prevent the most common, well-known reasons for premature culling, such as poor udder health, fertility problems, lameness, and a high replacement rate. This could be because of economic pressure, a resistance to change tradition, a lack of data to prove the advantages of the organic dairy sector with regard to longevity, or a disregard for cows as sentient beings. To make matters worse, from an outsider’s perspective, cows are seen as “climate killers,” due to the fact that they produce a high amount of methane during digestion, which has a stronger impact on the climate than carbon dioxide emissions. However, David emphasizes that cows existed before climate change or the problem of carbon dioxide in the atmosphere.

He argues, “you have to see the milk cow as a whole system, one that is delicate and complicated. You do not just have the cow which is producing climate gas, you also have the land around which is fixing climate gasses, and therefore we try to treat it correctly” (Personal Communication, 2022). Experienced organic farmers, like Doris and David, view agriculture as a larger system which requires balance between productivity and sustainability. Therefore, they aim to take climate-conscious steps everyday. These include: using manure and compost to build up humus (healthy soil) where carbon dioxide is stored, instead of using heavy machinery which erodes the soil, using smaller tractors that require less diesel, and spreading liquid manure across

their grasslands to act as organic fertilizer (Personal Communication, 2022). They are also both aware of the size of their herd in regards to their available space, so they never have a large number of cows producing at one time. However, are these actions enough?

According to Eppenstein, “it is not possible to keep the current production level in Switzerland and also be sustainable because it relies on huge imports, just like the rest of Europe and the United States. Measures to make animal production more efficient and reduce food waste are important, but true sustainability requires more massive changes” (Personal Communication, 2022). There are still large amounts of concentrates fed to organic cattle, which requires the transport of soya on a large scale across the globe, however even if imports of animal feed are forbidden, animal products can still be imported. Therefore, society needs to reevaluate its priorities to realize that the current lifestyle and consumption levels are unsustainable. In order to make an impact, a massive reduction of meat and dairy products is necessary and crops that are made for humans cannot be fed to animals. Enough food needs to be produced to feed 7.9 billion people, but if this is not done sustainably by farmers, and consumers are not conscious of their eating habits, there will be no opportunities for future generations to give back to the earth.

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ISP Work Journal

Frances McMillan

March 2022

- 13/03/22: ISP final proposal topic outlines an interest in climate-smart agriculture inspired by the FAO
- 25/03/22: Travel to Sonvilier for the weekend for interviews, stay one night at the Roth farm
- 26/03/22: Interviews with Doris Roth and David Rotzler
 - Questions used:
 - How/ why did you decide to become a dairy farmer? Do you work on a family-owned farm?
 - What does a typical day look like?
 - Do you like doing this work?
 - Do you feel attached to your herd?
 - Do you feel pressure to feed people and at the same time, do it in an ethical way?
 - Would you consider yourself a climate-conscious farmer?
 - What kind of climate conscious initiatives have you implemented on your farm?
 - Have you heard of the initiative "Klimafreundliche Milch" or literally "climate-friendly milk"?
 - What do you think is preventing farmers from making a change in caring for the environment?
- 27/03/22: Transcribed interview with David based off voice recordings and reviewed notes I typed during my interview with Doris
- 28/03/22: Collected sources and took notes
- 29/03/22: Started interactive work research log to collect info about interviewees

April 2022

- 03/04/22: Prep for ISP session, went in with the main goal of narrowing my topic
- 04/04/22: Individual ISP session with Dr. Golaz, she encouraged me to pick a topic that was in-line with my previous interviews and farm visits
- 06/04/22: Adjusts project interest to concentrate on animal welfare and its relationship to cow longevity
 - Emailed Rennie C. Eppenstein after discovering the FiBL website and her work
 - Continued collection of sources and took notes
- 08/04/22: Set up a zoom link and drafted interview questions in preparation for interview with Eppenstein
- 09/04/22-11/04/22: Collected sources and took notes
- 14/04/22: Interview with Rennie C. Eppenstein
 - Questions used:
 - Could you tell me a bit about yourself, such as your background and how you started working for FiBL, specifically in the department of livestock sciences?
 - Do you feel that you have a strong connection to animals?
 - Do you think there is a correlation between animal welfare and healthier products for consumers? (for example- if a cow is happier, does that contribute to a better product)
 - Are you passionate about your current projects?
 - Could you tell me a bit about the ongoing project you are a part of which focuses on increasing the longevity of Swiss dairy cows? What kind of research methods have you used? Where do you see it going in the future?
 - How do you measure the longevity of a cow and how can it be improved?
 - What are some of the management or housing strategies that can prevent the occurrence of health problems in cattle, leading to involuntary culling?
 - Is there a specific grazing system that has helped cows stay healthy and prevent diseases?
 - Have you noticed an obvious difference in animal welfare, specifically cattle, in Switzerland vs. the United States (factory farming) and has this contributed to milk yield?
 - What can high-milk producing countries, such as the United States, do to be more sustainable?

- Are the majority of dairy farms in Switzerland bio or biodynamic? Do these types of farms treat their cows better?
 - How do you think Swiss dairy farmers can be more sustainable, while still feeding a growing population?
 - What is the relationship between climate change and keeping dairy cows healthy/ clean? (increased exposure to sunlight, dry season vs. rainy season)
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- 15/04/22: Transcribed interview
 - 18/04/22: Started the writing stage- introduction and research methodology
 - 19/04/22: Continued taking notes and collecting sources, working at the Geneva Graduate Institute library
 - Started literature review section of paper
 - 20/04/22: Continued literature review
 - Took notes and found sources
 - 21/04/22: Finished literature review, continued to take notes and find sources, started analysis section of the ISP
 - 22/04/22: Worked on analysis section of ISP→ wrote 15 pages
 - 23/04/22: Continued working on analysis section, found sources and took notes
 - 24/04/22-25/04/22: N/A
 - 26/04/22: Took notes and found sources, continued working on analysis section
 - 27/04/22: Wrote Conclusion
 - 28/04/22: Edited my ISP
 - 29/04/22: Turned in my ISP

SIT Study Abroad: Switzerland
ISP INTERACTIVE RESEARCH |
INTERACTIVE LOG
(3 interviews are required: 2 formal + 1 informal)

Name Frances McMillan Semester 2022

Organization	Key contacts	Address	telephone	Brief description of your interactive research	Date(s) & time	Formal/informal interview
Bio Suisse Dairy Farm	Fabien and Doris Roth	Les Places 176 2615 Sonvilier	+42 032 941 117	-Stayed with the Roth family for one night to get to know them and explore the farm -Interviewed Doris by asking her a series of questions that were pre-planned while recording the interview and taking notes.	March 26th, 2022 12:00 pm	Formal
Combe d'Humbert Bio-Dynamic Farm	David Rotzler and Rahel Kilchsperger	Combe d'Humbert 4 2615 Sonvilier	+42 032 941 12 47	-Visited this farm the same weekend I stayed with the Roth family -I interviewed David while he was milking the cows, so it was very informal -Used similar questions as previous interview -Visited the family's cheese shop in their home	March 26th, 2022 5:30 pm	Informal

The Research Institute of Organic Agriculture (FiBL)	Rennie C. Eppenstein	FiBL Switzerland Ackerstrasse 113 CH-5070 Frick	+41 (0)62 865-6366	-I emailed Rennie because I saw on FiBL's website that her main area of focus is the health of dairy cows and cattle -She is currently working on a project with FiBL that focuses on improving the longevity of Swiss dairy cows -I interview Rennie over Zoom and sent her my list of questions ahead of time, so she could prepare -I was able to use the information I gathered previously from my farm visits to adjust my questions during the interview	April 14th, 2022 3:00 pm	Formal
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