

INCREASING HIGH QUALITY HOMEGROWN FEEDS FOR THE ORGANIC DAIRY FACT SHEET SERIES

Fodder Systems on the Certified Organic Dairy Farm

Introduction

Fodder systems have been used on livestock farms throughout the globe since the 1600s. Recently, there has been renewed interest in “fodder” as a certified organic livestock feed in the U.S., due to high grain prices and the desire to provide fresh feed to animals throughout the year. Therefore, drawing from a review of lay and scientific literature, this fact sheet gives an overview of fodder systems and production aspects to consider regarding this practice.

What is Fodder?

The dictionary definition of fodder is: “something fed to domestic animals; especially coarse food for cattle, horses, or sheep” (Merriam-Webster, 2016), so the term is typically applied broadly to include all livestock feeds. However, “fodder” and “fodder systems” of recent interest (and the focus of this fact sheet) refer to hydroponically sprouted grains. In these fodder systems, grains—typically, barley—are soaked for about 8 to 12 hours and then placed in trays and grown under a constant temperature (typically between 60°F and 70°F) with or without artificial light for a period of 6 to 8 days. The resulting sprouts form a mat of shoots and roots that are cut to appropriate sizes and fed fresh to cattle and other livestock.

Fodder is desirable due to its increase in vitamins and high digestibility due to chemical changes that occur when the seed is converted to sprouts; complex compounds within the endosperm of the grain are broken down into simple compounds. Through this process, there is an increase in vitamins A, E, and beta carotene. For example, one study showed a 700%+ increase in vitamin E in fodder from grain (Cuddeford, 1989); however, animal nutritionists suggest to exercise caution about these numbers—while these numbers indicate a significant increase, based on dairy cow intake requirements, they may not be high from a biological perspective (Soder, 2016).

Fodder production has been particularly important in regions around the world where other forage options like pasture, hay, silage, etc. is extremely limited. Globally, regions like the Middle East and other areas that have faced and/or are facing persistently dry and droughty conditions are increasingly relying on these systems to be able to meet cattle intake needs. Therefore, much of the contemporary research on fodder systems have been conducted within these areas (Al-Karaki et al., 2012; 2011; El-Deeba et al., 2009; Fazaeli et al. 2012; 2011; Naik et al. 2015; 2014). Our review of the scientific literature revealed few studies on hydroponically sprouted grains within certified organic livestock production systems (Hafla et al., 2014; Heins et al., 2015; Roque et al., 2014; Soder, 2014).

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Fodder Systems on Organic Dairy Farms

In recent years, organic dairy farmers have considered adding fodder systems to their operations for a number of reasons, including the expense and availability of certified organic grain, compelling dairy farmers to look for less expensive and consistent supplies of high quality feeds. Erratic weather conditions, especially prolonged droughty periods, have also encouraged some farmers to adopt these systems to have better control over dependable feed supplies for their livestock.

Currently, the National Organic Program excludes sprouted grains from hydroponic production rules and, therefore, fodder systems are allowed (USDA NOP, 2010). However, since fodder is considered a supplemental feed, it is not counted as helping to meet the requirement of providing livestock with a minimum 30% of dry matter intake from pasture as specified by the Pasture Rule and may not be allowed by some processors' grass fed labels.

Why Consider Fodder?

There are a number of reasons that farmers adopt fodder systems (Soder, 2016), including the following.

- **Highly digestible feed.** The act of sprouting the grains activates enzymes that change the starch, protein, and lipids of the grain into simpler forms; for example, the starches change to sugars which are much more digestible. Roque et al. (2014) showed increased degradation rates for fodder when compared to other concentrates, suggesting a higher throughput and therefore a possible increase in total milk production due to higher feed intakes over time.
- **Favorable nutritional composition.** In addition to increasing the digestibility, some studies showed that the act of sprouting grains increased vitamins A, E, C and B-complex as well as greater enzymes (Naik et al., 2015; Finney, 2008). However, Soder (2016) suggests that these increases may not be biologically significant; enzymatic processes and their contributions to the diets need more research to be fully understood. Several studies (Hillier et al., 1969; Naik et al., 2015; Sneath and McIntosh, 2003; Tudor et al., 1985) showed increases in crude protein and fiber, but these increases were attributed to concentrating the nutrients in this feed. Heins (2015) showed slight increases in Omega-3 in sprouted barley grains as compared to other feedstocks.
- **Year round forage.** The provision of fresh forage is available year round. If done properly, hydroponically sprouted grains can be provided during the winter or non-grazing months in addition to the grazing season.
- **Feel good feed.** It is considered a “feel good feed,” as described by researcher Dr. Kathy Soder (2016). Farmers highlighted in several lay articles (American Agriculturalist, 2013; Anderson, 2009; Fysken, 2014; Graze, 2013) said that their cows found it palatable and left little if no waste.
- **Attractive to droughty and land-limited areas.** Fodder produces a high yield in a small space which is particularly attractive to land-limited operations (Naik, et al., 2015). It can also provide a consistent feed supply that is not weather dependent; for areas that experience prolonged dry and droughty conditions for which pasture is a limited option, fodder is a very attractive option. One research project (Al-Karaki and Al-Momani, 2011) showed a much lower water requirement for fodder systems than for field crops; fodder required only about 2 to 3% of the water requirements of field crops and barley fodder as shown to have the best water use efficiency when compared to other sprouted grains.

Before You Jump In: Challenges with Fodder Systems

As with every system, there are some considerations with producing hydroponically sprouted grains that should be carefully considered and weighed against the benefits of fodder before adopting these systems. They include the following.

- **Cost.** The initial capital expense of these systems (especially pre-fabricated purchased systems) can be prohibitive and, in general, the cost to produce fodder on a per pound of dry matter basis is high. A recent economic study showed that fodder costs \$0.40 per pound of dry matter to produce as compared to \$0.11 per pound of dry matter for good quality hay (Tranel, 2013). When compared on a dry matter basis, one study found that sprouts cost two to five times more than the original grain (Sneath and McIntosh, 2003). This suggests that significant benefits must be realized to warrant the cost of these systems, especially in areas that are readily able to produce high quality and high quantities of pasture and stored forages. Several researchers (Soder, 2014; 2016; Kerr, 2014; Sneath and McIntosh, 2003) suggest that when evaluating these fodder to other feed sources, care should be taken to compare dry matter to dry matter rather than tons of as fed because of the high water content (80% or higher) in fodder.
- **Mold.** A primary drawback of fodder systems is the high potential for mold growth. Almost every study reviewed mentioned mold as a drawback to fodder systems. The warm temperatures and high moisture content needed to provide excellent growing conditions for sprouted grains are, unfortunately, also prime conditions for growing mold. Moldy fodder can mean a loss of feed, ill or even dead animals, so having back up plans for a feed replacement and in case of a mold outbreak was mentioned and/or recommended in a number of articles (Sneath and McIntosh, 2003; Kerr, 2014; Willsey, 2014; DuShane, 2014). Sanitation is key to curtailing incidence of mold; and farms adopting fodder systems must ensure that sanitation and disinfection products are approved by their organic certifier prior to use.
- **Dry Matter Loss.** The majority of studies evaluating fodder systems showed dry matter losses when grains are converted to sprouts (Abdullah, 2001; Akbağ, et al., 2014; Dung et al., 2005; 2010; Fazaeli, 2011; Hafla et al., 2014). The fresh weight of fodder does increase so there will be increases on an as fed basis but this is due to the high water content in the fodder. Dry matter losses—which range from 7% to 47% in the literature—in hydroponically sprouted grains are due to utilization of starch stored in the seed during the first week of growth; essentially, the plants use up stored carbohydrates from the seed during the sprouting process, reducing dry matter when compared to the original grain.
- **Labor Requirements.** Some studies have shown that labor requirements can be high, requiring at least one to four hours daily, depending on the system (Tranel, 2013; Soder, 2014; Kerr, 2014; DuShane, 2014). Labor needs include cleaning and sanitizing the seed trays, seeding and harvesting the sprouts, and cutting and feeding the mat.
- **Potential for rumen acidosis.** The act of sprouting activates enzymes that change the starches in the grain over to sugar which does increase digestibility of this feed. However, too much sugar (through too much fodder fed or fed too quickly) can lead to acidosis (Hafla et al., 2014).

In Summary

Hydroponically sprouted grains have potential as quality, fresh livestock feedstocks, especially in regions prone to pervasive dry, drought-prone weather and/or on farms that are land and/or water limited. However, potential drawbacks—particularly system costs, potential for mold problems, and dry matter losses—must be carefully considered and weighed against the benefits of fodder before adopting these systems.

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Citations used to develop this fact sheet appear below and may also be found in the “Literature Review: Hydroponically Sprouted Grains Systems on Organic Dairy Farms” at: www.uvm.edu/extension/cropsoil/organic-farming.

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