

Hydroponic Fodder Systems for Dairy Cattle?

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Introduction and Objective

There is renewed interest in hydroponic fodder systems for dairy, livestock or poultry operations. The thought of putting one pound of seed into a hydroponic system producing 10 times its weight in fodder is appealing. However, the actual dry matter weight of the original grain to the fodder produced may or may not increase. Research reviews are very inconsistent in any dry matter production or animal performance benefits. The aim of this analysis is to assist producers weigh the high production costs of hydroponic fodder systems relative to any real or perceived nutritional benefits gained from feeding hydroponic fodder.

Hydroponic Fodder System Analyses

In analyzing hydroponic fodder, the first step was to analyze the **dry matter exchange** in sprouting the seed. Barley seed in the amount of 5.5 pounds was put into each tray around 88% dry matter (DM). This seed yielded 55 lbs of fodder when harvested at 12% DM or 6.6 lbs of DM. This equated to a 36% DM increase. Other samples have shown more than 10% DM losses. Feed analysis shows the barley fodder protein increases 2%-4% from the barley grain seed as a percent of dry matter. Total digestible nutrients (TDN) as a percent of dry matter can decrease 10% from the barley grain. Thus, it is important to evaluate this DM exchange that occurs as total dry matter weight changes of protein and TDN. This may yield much different results than only looking at percent dry matter changes.

The second step is analyzing the **fixed investment cost** of purchasing a fodder system. The system has a cost of \$2,795 for a 16 tray unit. Given a 30 year useful life of the trays, depreciation is \$93.17 per year; interest at 4% is \$111.80 per year; and repairs are estimated at \$10 per year for a sum total of \$214.97 per unit per year. This unit will have 42 turns per year (7 day growth cycle is one turn) and each unit has 16 trays. Each tray will yield 6.6 lbs. of DM per turn (weekly) or 4,435.2 lbs DM annually which is 2.22 tons of DM. Thus, the \$214.97 annual investment cost divided by 4,435 lbs. of DM gives a fixed investment cost of \$0.0485 per pound of dry matter produced.

The third step is analyzing the **labor needs**. Assume nine minutes of labor is needed per tray per turn valued at \$10 per hour or \$1.50 per tray divided by 6.6 lbs. DM equals a labor cost of \$0.23 per lb. DM produced. With nine minutes per tray per turn, the 16 tray unit would utilize 2.4 hours per week or 20.57 minutes per day. Fodder feeding

and delivery costs may add to this. Labor cost is > 50% of the total cost.

The fourth step is analyzing **seed costs**. Assume barley seed for feed grade use is at \$6.75 per bushel or 0.14 per lb. as fed. Quality seed is critical and mold growth needs to be eliminated. The tray uses 5.5 pounds or \$0.78 worth of barley to yield 6.6 lbs. of dry matter. This seed equates to \$0.12 per pound of dry matter.

The last step is analyzing **other associated costs** with the system. There may be a water cost to some systems but the system illustrated is recycling much of the water to heifer calves so thus only incurring minimum watering costs. Some systems use added lights or heat. The system illustrated only adds \$0.005 in electricity/other cost per pound of dry matter. Some systems use buildings that have a cost for either building or an alternative use. Those investments would need to be divided by the total lbs. of forage dry matter produced annually and then added to the other per lb. dry matter costs. The system illustrated was put into a building that had no other use. Use of a mold inhibitor to treat the seed if necessary could be another associated cost that may add \$0.15 per day total.

Summary

In sum, per lb. of dry matter produced, the fodder system had a \$0.045 cost for investment; \$0.23 cost for labor; \$0.12 cost for seed; and \$0.01 cost for water, electrical and other for a total cost of \$0.40 per lb. of dry matter produced. This fodder cost can be compared to feeding good quality hay for \$0.107 per lb. of dry matter for good quality hay that has 13% less TDN. So, unless significant benefits can be gained due to the increased digestibility of the fodder, this system is a costly method of producing feed for dairy producers.

However, hydroponic sprouts may still have good application in organic, intensive, small-scale livestock with high value outputs or in areas with extremely high land or alternative feed prices. Organic dairies needing to feed very high forage levels year round that can produce their own seed for reasonable costs and have excess labor available, may have reason to experiment further with the hydroponic fodder system. Research data on dairy cows is limited to determine definitively whether or not the feeding characteristics of the fodder changes production or body condition enough to warrant the additional cost.

Due to changes in the nutritive characteristics of the fodder (less starch, more sugars, vitamins and lysine) monogastrics such as people, horses, swine and poultry may have more benefit. In the end analysis, it is ultimately animal performance relative to the alternative costs that determines profitability and usefulness. With a cost 3 to 5

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times that of the original barley grain or other readily available feed sources, increased animal performance of

that magnitude is highly unlikely, but more research seems necessary.

Table 1. Fodder System Analysis Partial Budget Spreadsheet Analyzer.

| Hydronponic Fodder System Analysis | | | | | | | | |
|--|------------------|--|---|------------|-----------------------|-----------------|--------------------|---------------|
| Fixed Cost Analysis | | | Dry Matter Exchange Analysis | | | | | |
| System Cost | \$2,795.00 | | Seed/Tray | 5.5 lbs | 88% DM : 4.84 lbs DM | | | |
| Years of Life | 30 | | Fodder/Day | 55 lbs | 12.0% DM : 6.6 lbs DM | | | |
| Depreciation | \$ 93.17 | | | | 36% DM Increase | | | |
| 4.0% Interest | \$ 111.80 | | Nutritional Changes | | | | | |
| Repairs | \$ 10.00 | | Crude Protein Fodder | 16.6% | | | | |
| Taxes | \$ - | | Crude Protein Barley | 12.8% | | | | |
| Insurance | \$ - | | | | 4.0% Crude Protein | | | |
| Total Fixed Costs Annually | \$ 214.97 | | | | | | | |
| Cost Per lb. of Dry Matter Produced Analysis | | | TDN Fodder Forage 73% | | | | | |
| turns/yr (7 day growth) | 42 | | TDN Barley Seed 83% | | | | | |
| trays/unit | 16 | | TDN Change from Seed -10% TDN | | | | | |
| lbs DM yeild/tray/tum | 6.6 | | TDN Alfalfa 60% | | | | | |
| lbs DM/unit | 4435.2 | | TDN Alfalfa Difference 13% Fodder has higher TDN than "good" quality alfalfa hay | | | | | |
| Tons DM/Unit | 2.2176 | | | | | | | |
| Investment Cost/lb DM | \$ 0.0485 | | | | | | | |
| Labor 9 min/tray*\$10/hr*K5 | \$ 0.23 | | Price | lbs | Type | Value/lb | Value/lb/DM | |
| Water Costs: 28 gallons per tray | \$ 0.005 | | \$6.75 | 48 lbs | mkt barley = | \$0.141 | \$0.160 | feed grade |
| Seed Costs per lb. of dry matter | \$ 0.12 | | \$15.00 | 48 lbs | test barley = | \$0.313 | \$0.355 | tested barley |
| Increased Electrical/Other Cost | \$ 0.005 | | \$175 | 2000 lbs | alfalfa hay = | \$0.088 | \$0.107 | alfalfa hay |
| Total Cost/lb. of dry matter* | \$ 0.40 | | \$8.00 | 56 lbs | mkt com = | \$0.143 | \$0.169 | corn |
| *does not include building costs to house the system and only includes minimal additional lighting | | | | | | | | |