



CASE STUDY: Dairies using self-described ultra-high stocking density grazing in Pennsylvania and New York¹

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ABSTRACT

Proponents of ultra-high stocking density (UHSD) grazing emphasize increased forage-use efficiency and soil improvement by grazing mature forage with stocking densities up to 560,425 kg/ha of beef cattle on small paddocks with rest periods up to 125 d. However, it is unclear whether this management technique is appropriate for dairy farms in the northeastern United States. A case study was conducted to characterize management practices and forage and soil quality on dairy farms using self-described UHSD grazing. Data collected on 4 organic dairy farms in Pennsylvania and New York practicing UHSD grazing included pasture and soil nutrient analyses, stocking density, botanical composition, and pasture stratification. Herds were mixed breed with milk yields ranging from 11.9 to 17.7 kg/d per cow. Stocking density ranged from 49,421 to 377,912 kg/ha with 30 to 49 d of forage rest. Forage consumed was 46 and 45% of total available in 2012 and 2013, respectively. Within the available forage

that was eaten, cows consumed 75% of forage from layers 33 cm and higher and 49% from below 33 cm. Across years, forage CP, NDF, and NE_i averaged 24%, 44.7%, and 1.43 Mcal/kg, respectively. The increase in forage quality during 2012 was likely a result of forage being less mature at each successive grazing. Soil mineral content and pH were within recommended levels. Grazing dairies in Pennsylvania and New York have taken a modified approach to UHSD grazing by using forages more mature than recommended in management-intensive grazing systems by allowing longer periods of forage rest.

Key words: ultra-high stocking density, dairy, grazing, forage quality

INTRODUCTION

Management intensive grazing (MiG) is a flexible form of rotational grazing where the goal is to maintain the pasture sward in a productive vegetative state throughout the grazing season (Blaser, 1986) while providing optimal forage production and use per unit of area (Heckman et al., 2007). A variation of MiG that has recently gained interest on grazing farms is referred to as ultra-high stocking den-

sity (UHSD) grazing. This grazing approach uses high stocking density (BW/units area; up to 560,000 kg/ha) to graze small areas of mature forage (Salatin, 2008) for short durations and is characterized with long forage recovery periods (25 to 150 d; Hancock, 2010; Lemus, 2011). Anecdotal observations of increased profitability (via increased carrying capacity), improved animal performance, improved forage species diversity, and increased soil quality (improved soil OM, improved microbial action, greater water-holding capacity; Earl and Jones, 1996; Judy, 2008; Salatin, 2008) have been promoted with the implementation of UHSD grazing using beef cattle. The idea of greater economic sustainability by increasing the number of animals grazing with little fixed cost investments (fencing and water), while simultaneously improving the condition of the land (Savory, 1983), is appealing to all sectors of livestock graziers. However, much of the current information on UHSD grazing systems refers to beef cattle in semi-arid rangeland environments (Savory and Parsons, 1980; Holechek et al., 2000). Several dairy farmers in the northeastern United States have implemented components of UHSD

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grazing systems that were initially promoted for beef cattle. However, nutrient requirements of dairy cattle differ from beef cattle (NRC, 2000; 2001), and grazing management varies widely among farms. As a result, anecdotal outcomes from adopting UHSD grazing on dairy farms have ranged from self-described success to failures with severe losses in milk production, animal health, and farm profitability. Currently, there are no established science-based guidelines to assist dairy farmers and their farm consultants in adopting UHSD grazing. Therefore, the objective of this case study was to characterize management practices and forage and soil quality parameters on grazing dairy farms in Pennsylvania and New York that are using self-described UHSD grazing management.

MATERIALS AND METHODS

Four organically certified dairy farms (3 in Pennsylvania and 1 in New York) participated in this study. The dairy farmers selected were self-described UHSD graziers and were initially surveyed to capture their experience and management practices. In June 2012, one pasture on each farm was identified to be the sample pasture. The pastures selected had been managed under UHSD grazing before this grazing season and were representative of pastureland on each farm. Farm and pasture management information was gathered using a detailed survey given to each farmer to describe intended grazing management practices and animal production.

Farm visits occurred each time the study pastures were grazed from June to November of 2012 and from April to June of 2013. Sampling encompassed 2 yr to capture data from all months throughout the grazing season, because project funding did not become available until June of 2012 and delayed the initiation of sampling early in the grazing season. Data collected during each farm visit, immediately before grazing, included number of cows grazing, measurements

of pregrazed forage height, canopy stratification, botanical composition, and samples for forage-quality analyses. Forage samples were plucked by hand to the approximate height the cows were grazing from representative spots within the pasture ($n = 20$), composited, and frozen before shipment to an independent laboratory for analysis of nutrient content (Dairy One Forage Analysis Laboratory, Ithaca, NY). Forage height was recorded on a diagonal transect of the sample pasture using a meter stick at 25 points. Stratification of the forage canopy was measured by the herbage-gripping stratification method described by Barthram et al. (2000) to estimate the vertical level at which cows were consuming the most forage and to document forage utilization. This method uses rubber-lined, narrow boards ($50 \times 5 \times 1$ cm) that are inserted into the sward at ground level and then clamped together capturing a section of forage that is then clipped off at ground level. This section of forage was placed on a template and cut every 7 cm, with the 0- to 5-cm section discarded because of contamination of forage sample with soils. The forage from each vertical level was dried in a forced-air oven at 60°C for 48 h and weighed for DM content. Five stratification clippings were taken from both pregrazed and postgrazed areas within the sampling pasture. Botanical composition was estimated twice during the 2012 grazing seasons for all farms, once for 2 farms in 2013, twice for 1 farm in 2013, and was not recorded for 1 farm in 2013. Botanical compositions of the pastures were estimated visually using the step-point method at 50 points within the sample pasture (Little and Frensham, 1993).

In May 2013, 6 soil cores (20 cm deep) were taken along a diagonal transect from within the sample pasture on each farm. The cores were composited, and a subsample was sent for nutrient analyses and OM content (Ag Analytical Lab, University Park, PA). Monthly historic (1981–2010) precipitation averages and total monthly accumulated precipita-

tion were acquired from the closest available National Climatic Center weather stations (www.ncdc.noaa.gov; accessed July 23, 2013), located 8 to 48 km from the Pennsylvania and New York farms that participated in this study.

Forage height, canopy stratification, botanical composition, and forage quality data were transferred to Microsoft Excel files and summarized. Forage quality was analyzed using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC), with month as fixed effect, farm as random, and least squares means reported. Differences in forage-quality measures were considered significant at $P < 0.05$.

RESULTS AND DISCUSSION

General Farm Information

Descriptions of farms used in this study as reported by the farmers in the survey given at the initiation of data collection in 2012 are presented in Table 1. All farms in this study were certified organic. It is important to note that certified organic dairy farmers may be more apt to adopt a grazing management strategy, such as UHSD, because of certification rules requiring animals to graze and emphasis on soil health. However, there are noncertified organic dairies that also have the same emphases; therefore, this grazing strategy is not limited to organic dairies. Total herd size ranged from 60 to 270 (mean = 178) mixed-breed dairy cows and milk yields ranged from 11.9 to 17.7 kg/d per cow. Cows spent an average of 20 h on pasture daily. Farm 1 milked once daily and farms 2, 3, and 4 milked twice daily. However, farm 2 reported switching to milking once daily when cows were grazed on more distant pastures (up to 2.40 km from parlor). Total pasture area on the farms ranged from 81 to 251 ha. Stored forages produced on the farms included grass and legume hay and grass and legume silages, haylages, and baleages. Three of the 4 farms reported feeding purchased molasses as an energy supplement, and farm

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