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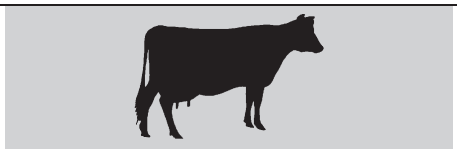

Performance of dairy cows administered probiotic in water troughs

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ABSTRACT

The purpose of this trial was to determine if a yeast product (YP; ProDairy, Donaghys, Christchurch, New Zealand) given in water troughs increased milk production or altered rumen pH and blood parameters. Multiparous cows (930) in a commercial herd were randomly assigned to 1 of 4 pens as they reached 30 DIM. Milk yield, fat, and protein were measured every other week for 11 wk. Two of the 4 pens received YP at the rate of 9 mL/cow per day. All 4 pens were fed the same diet (525 g/kg of DM, 186 g/kg of CP, 220 g/kg of ADF, 329 g/kg of NDF, 43.8 g/kg of fat, 188 g/kg of starch, 41.3 g/kg of lignin, and 81.9 g/kg of ash). Statistics were performed using PROC MIXED with random effects pens nested within treatment and the fixed effects of DIM, week, and parity. Average daily milk yield (43.1 and 44.8 kg, P = 0.042) for control and supplemented pens, respectively, were greater in YP pens. But milk fat (1.47 and 1.45 kg, P = 0.13) and milk protein (1.24 and 1.23 kg, P = 0.045) for control and supplemented pens, respectively, were lower in YP pens. Overall rumen pH (7.7 and 7.4, P = 0.044) and blood ketone bodies (0.73 and 0.64 mEq/L, P = 0.011) were also reduced in supplemented pens. Therefore, YP did increase milk yield and affect rumen pH and blood ketone bodies, but other conditions on the commercial dairy may have influenced the milk response to YP. Depending upon the ability of the dairy to manage a consistent water supply, the delivery of YP via water should be considered by nutritionists and managers. More research is needed to determine the influence of other factors on milk response to YP supplemented in the water supply.

Key words: probiotic, rumen pH, dairy cow performance

INTRODUCTION

Improvements in milk production, feed intake, rumen pH, and metabolic function with supplementation of yeast culture products have been inconclusive. Past studies have shown modest increases in milk yield, milk fat yield, DMI, rumen pH, and OM digestibility (Desnoyers et al., 2009; Poppy et al., 2012). However, these results may not be significant due to insufficient sample sizes and management effects, such as concentrate level of the diet, number of feedings or push-ups per day, length of time of TMR mixing, how cows are grouped, and so on (Piva et al., 1993; Desnoyers et al., 2009). Cows that are close to calving and in early stages of lactation have a greater response to yeast supplementation than mid- to late-lactation cows (Erdman and Sharma, 1989; Wohlt et al., 1998; Erasmus et al., 2005; Nocek et al., 2011). Inclusion of a yeast product into a TMR diet that is lower in NDF concentration showed a greater increase in milk yield (Desnoyers et al., 2009) and may alleviate milk fat depression (Erdman and Sharma, 1989) and decrease rumen pH and fiber digestion associated with subacute ruminal acidosis (Wallace 1994; Krause and Oetzel, 2006; Marden et al., 2008; Calsamiglia et al., 2012). Effects of feeding strategies, such as frequency of feeding and time since last feeding, on rumen pH are also moderated by feeding yeast products (Bach et al., 2007).

In addition to feeding and management effects on milk production and rumen function, it is also unknown how other feed ingredients may influence performance of the yeast product. As most yeast products are incorporated into a mix pellet and then added to a TMR, the acidity, moisture level, and oxidizing potential of other TMR ingredients may be altering the efficacy of yeast products (**YP**). Growth factors, pro-vitamins, or micronutrients and availability of

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these factors through different processing methods may influence their performance in the rumen (Nocek et al., 2011). Inclusion into TMR that is commonly 50% DM, fairly acidic (if based on corn silage), or processed into a pellet may change the functionality of the YP. Studies that focus on direct inclusion of a yeast product to the rumen (Harrison et al., 1988; Chung et al., 2011), in vitro continuous culture (Miller-Webster et al., 2002), or more stable feeding environment (water) may better represent results of yeast supplementation. Therefore, the purpose of the current study was to evaluate supplementation of a YP (ProDairy, Donaghys, Christchurch, New Zealand) containing a spectrum of yeast and bacterial extracts administered in water troughs on milk production, milk components, blood parameters, rumen pH, BCS, and fecal scores (**FS**).

MATERIALS AND METHODS

All procedures involving animals were approved by the Animal Care and Use Committee of the University of California, Davis.

Animals and Experimental Design

Multiparous cows (930) in a commercial herd were randomly assigned to 1 of 2 treatments (2 pens/treatment) as they reached 30 DIM. Two of the 4 pens received YP in 4 water troughs per pen at the rate of 9 mL/d per cow beginning August 1, 2011, through October 13, 2011 (11 wk). The other 2 pens received the dairy TMR without YP (control). The commercial dairy moved cows into and out of the pens according to their herd protocol during the study. That is, cows were moved from the pen after being confirmed pregnant (average of 132 + 66 DIM). Once cows were moved, they did not return to the pen. Cows were housed in a freestall barn that contained 2 pens on each side with 220 headlocks per pen. The same number and location of water troughs were available in each pen and pens were identical in layout. Control cows were not able to access water in treated cow pens and feed and water space accessibility was equal in all pens. Water meters were installed in all water troughs to estimate water intake by pen.

Dispenser nozzles from Donaghys were used with 2-L bottles that were tethered to rebar cages around the water trough floats to prevent cow interference. Dispensers were refilled and replaced every other day and any residual was emptied into the water trough. All 4 pens were fed the same TMR, with a control pen and a treated pen delivered from the same mixer wagon loads. Cows were fed 3 times in a 24-h period. Diets were formulated by the dairy herd nutritionist using CPM Dairy software (Cornell-Penn-Miner, version 3.0.1, published by Cornell University, Ithaca, NY; University of Pennsylvania, Philadelphia, PA; Miner Institute, Chazy, NY; and University of Maryland, College Park, cooperating).

Measurements

Ration samples were collected from each pen once a week for nutrient analyses. Three empty feed tubs were placed in feed bunks just before the mixer wagon dropping a load. Tubs (approximately 8 to10 kg of TMR, as fed, per tub) were then collected and its contents were mixed on a large, clean cement floor. The TMR pile was then quartered and opposite quarters were mixed and collected into a quart resealable bag for nutrient analyses by Analab (Agriking, Fulton, IL). Ration samples were analyzed for DM, ADF, NDF, CP, fat, ash, and lignin using wet chemistry analyses (AOAC, 1990; methods 935.29, 973.18, 2002.04, 990.03, 920.39, 942.05, 973.18, respectively), starch using near-infrared spectometry based on predictive equations developed at Analab, and mineral analyses (Ca, P, Mg, K, S, Na, Cl, Fe, Cu, Mn, and Zn) using an inductively coupled plasma-mass spectrophotometry (American Association for Analytical Chemists reference methods 985.01 for Ca, P, Mg, K, Na, Fe, Cu, Mn and Zn, 923.01 for S, and 915.01 for Cl).

The DMI was estimated from daily group feed delivery weights from the mixer wagon and recorded using the FeedWatch feed management software (Valley Agricultural Software, Tulare, CA) for each pen. Dry matter intakes were corrected for residual feed, which was collected and weighed every other day and recorded using FeedWatch. Then, total corrected DMI was divided by numbers of cows in the pen that day to estimate individual cow DMI.

Water intake was measured using water meters installed at each water trough within each pen. Meters were read once a week on 2 consecutive days to obtain an estimate of water intake over 7 d and 24 h, respectively. On 2 occasions the water troughs did leak, but the troughs were repaired as soon as the leaks were identified. On those 2 occasions, data were corrected by comparing 24-h and 7-d intakes and eliminating values that were out of the range of possibility (approximately 95–170 L/d per cow; Murphy et al., 1983).

Rumen pH was measured on 6 fistulated cows with indwelling pH meters (Kahn Animal Health, Auckland, NZ) in the rumen that recorded pH and rumen temperature every 10 min. Cows were allocated 3 to a control pen and 3 to a treated pen. Meters were retrieved once a week to download data and perform calibration for pH 4 and 7 at 40°C in a water bath. Data (pH) used in the statistical analyses did not include calibration data or any pH data recorded when temperatures were outside the range of 36 to 42°C.

Milk yield, fat, and protein, were measured every 2 wk (wk 0, 2, 4, 6, 8, and 10) using Tulare County Dairy Herd Improvement Association milk testers and milk samples were analyzed by the Tulare County Dairy Herd Improvement Association (Bentley Instruments ChemSpec 150, Chaska, MN). Body condition scores (1–5 scale; Wildman et al., 1982) and FS (1–4 scale; Ireland-Perry and Stallings, 1993) were estimated by 2