Effects of Roasting on Ammonia-N Release of Field Peas

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Introduction

Field pea production grew last year in North Dakota by 250% over 2003 with acreage increasing from 160,000 to 280,000 (North Dakota Agricultural Statistics Service). The primary market for field peas remains human consumption, however, with expanding production there is opportunity in the feed market. Field peas are palatable and a good source of nutrition for ruminants, containing 20 to 27% crude protein (DM basis) with energy (88% TDN), similar to corn and wheat.

NRC (Nutrient Requirements of Dairy Cattle, 2001) indicates that 80% of pea protein is rumen-degradable protein (RDP). Heating proteins reduces the susceptibility of the protein to ruminal degradation (Tagari et al., 1986). Cleale and others (1987) suppressed ruminal degradation of soybean meal by non-enzymatic browning using in vitro ammonia release as the response criterion. The focus of this study was to increase the rumen-undegradable protein (RUP) or bypass protein of dry-roasted and temper-roasted (water + heat) field peas. Application for such a product has potential in the dairy industry in particular where meeting nutritional requirements in lactating cows is a challenge.

Procedures

Roasting Procedure

Field pea (1 kg) was placed on a metal tray then placed in a single-belt conveyor, air-impingement oven (Lincoln, USA) for processing. Dry peas were roasted at 250°F (121°C) and 300°F (149°C) for 2, 4, 6, 8, 10, 12 and 14 minutes. The control treatment was raw (0 roasting time) peas. This procedure could be described as dry roasting process.

Tempered samples were soaked in water for 30 minutes before roasting application. Subsequently peas were roasted at 250°F (121°C) and 300°F (149°C) for 14 minutes. This process could be described as a temper-roasted treatment.

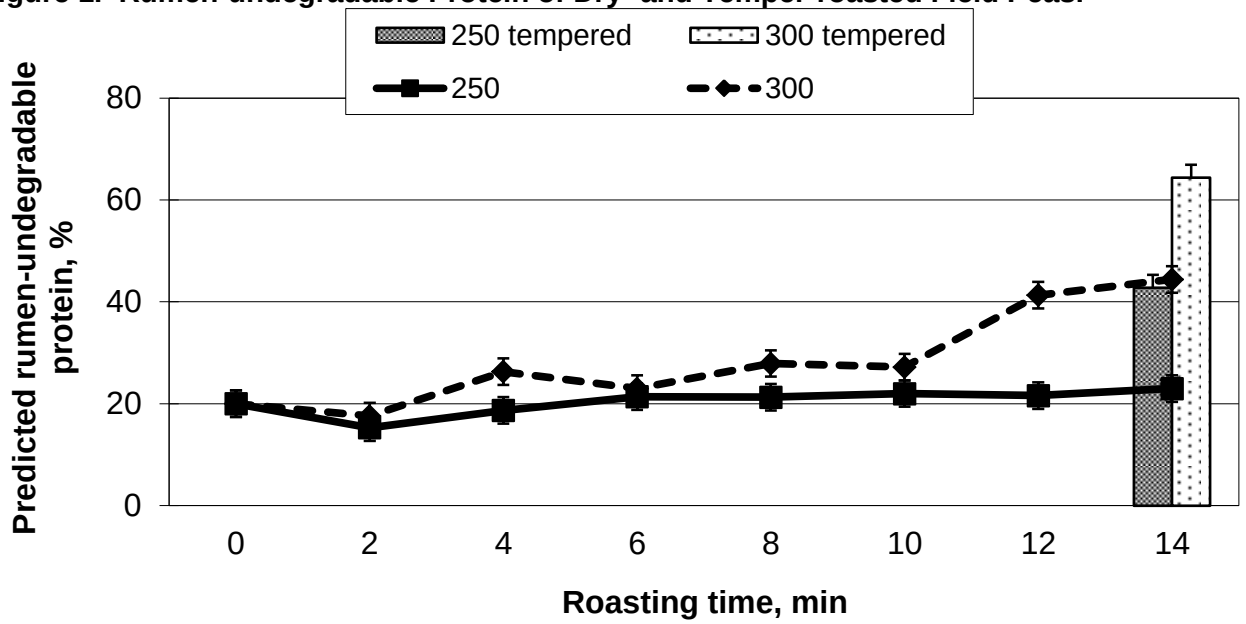
Ammonia-N release procedure

Twenty milligrams of pea N was incubated with buffered ruminal fluid for 18 hours at 103°F (39° C). At 18 hours, fermentation was stopped with the addition of $HgCl_2$. Ammonia analysis of the supernatant was completed and ammonia percentage of N incubated calculated. Raw peas were assumed to have 20% RUP or bypass protein. RUP of dry-roasted and temper-roasted peas were calculated based on relative reduction of ammonia release compared to raw peas.

Results

The effects of field pea roasting time and temperature on RUP levels are shown in figure 1. Temperature was the treatment and time of roasting was the variable. There was a temperature x time interaction (*P = <0.001)*. RUP levels on the 250° treatment were not different than the control treatment. Roasting dry peas at 250° from 2-14 minutes did not affect estimated RUP compared to raw peas (0 min). However, roasting peas at 300° for 12-14 minutes increased (P = <0.001) estimated RUP compared to raw peas; roasting less than 12 min at 300° did not affect RUP. The separation in means when comparing the two treatments was the cause of the interaction. Tempering peas or increasing their moisture content prior to the roasting had an effect on RUP. The 250° and 300° tempered peas was higher (*P* = <0.001) in bypass protein compared to dry-roasted peas.

Figure 1. Rumen-undegradable Protein of Dry- and Temper-roasted Field Peas.



Implications

Dry roasting field peas at 300° F for 12-14 minutes increased average bypass protein to 44% of total protein. No effect was observed by roasting at 250° F. These temperatures were selected because they simulate levels that commercial feed roasters are capable of reaching. Tempering peas in water and roasting for 14 minutes increased bypass protein to 64% of total protein. Further research would be beneficial to pinpoint the roasting variables of time, temperature and tempering (moisture) to gain information on how these effect RUP or bypass protein of field peas.

Literature Cited

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