

Effect of raw or roasted whole soybean on early lactational performance of Iranian Holstein cows

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Introduction Whole soybeans (SB) are mostly used in feeding of dairy cows, but protein in raw SB is degraded readily by rumen microbes and cannot meet the high demand of rumen undegradable protein (RUP) in early lactation. Heat treatment of SB, especially roasting, reduces ruminal protein degradation and improves the nutrient balance for cows. However, there have been conflicting results regarding animal response to feeding heat treated SB. In many studies, increase in milk yield may be related to type of forage in the diet, as improved performance is usually achieved by diets with lucerne silage as the forage because of the high solubility of its protein, but mixed lucerne hay-maize silage as the primary forage source of diets that are used widely in tropical areas like Iran, was not tested. So, the main objective of this study was to investigate the performance responses of Iranian Holstein cows in early lactating to the feeding of Iranian roasted SB, raw SB and SBM in combination with lucerne hay-maize silage diets.

Materials and methods Fourteen multiparous Holstein cows were housed after calving in tie stall barns for 2 weeks for barn adjustment and collection of pre-trial data. At the onset of the 45-d trial, cows were grouped according to pre-trial milk yield and then randomly assigned from these subgroups to one of three experimental diets. Cows in each group were fed individually one of three experimental diets as totally mixed ration. The diets, which contained 120g/kg soybean meal (SBM) plus 82g/kg cottonseed (CS), 120g/kg raw SB plus 82g/kg cottonseed meal (CSM) and 120g/kg roasted SB plus 82g/kg CSM were formulated to be iso-nitrogenous and iso-caloric and meet NRC (NRC 2001) recommendations. Roasted SB were obtained by roasting seeds in a commercial roaster (exit temperature of seeds was about 140 - 145°C) and immediately placing, in covered wooden barrels for 45 min. Milk yield was recorded daily and samples were collected at each milking weekly. Milk samples were combined on an individual cow basis and analyzed for fat, protein, lactose by infra-red analyzer. Data were analyzed by ANOVA and repeated measures using the MIXED procedure of SAS.

Results Dry matter intake was significantly higher for cows fed roasted SB diet than for cows fed raw SB diet but there was no significant difference between SB plus CSM diets with SBM plus CS diet. Cows fed roasted SB consumed significantly higher RUP than the cows fed raw SB. Cows fed roasted SB produced 1.3 kg/d more milk throughout the study than cows fed raw SB and cows fed SB plus CSM diets produced 1.4 kg/d more milk than cows fed SBM plus CS diet. This corresponds to an increase in yield of 3.5% FCM to 1.2 and 1.3 kg/d, respectively. Milk fat concentration was similar among diets but milk fat yield was higher for cows fed roasted SB compared with cows fed raw SB (40.0 g/d) and cows fed SB plus CSM compared with SBM plus CS (40.0 g/d). Milk protein yield was similar for cows fed different diets. Milk protein concentration was the same for cows fed raw SB diet and roasted SB diet, but depressed by 1.8 g/kg for cows fed SB plus CSM diets compared with SBM plus CS diet (Table 1).

Table 1 Daily intake, milk yield and milk composition as affected by diet

Item	SBM + CS	Raw SB + CSM	Roasted SB + CSM	SEM	Contrast ¹	
					1	2
<i>P</i> values						
Intake						
DM, kg/d	22.3	22.0	23.3	0.29	0.01	NS ²
DM, % of BW	3.64	3.62	3.77	0.048	0.04	NS
RUP (calculated), kg/d	1.43	1.39	1.68	0.021	0.01	0.01
Yield, kg/d						
Milk	37.9	38.6	39.9	0.38	0.03	0.02
3.5% FCM	35.7	36.4	37.6	0.34	0.02	0.01
Fat	1.19	1.21	1.25	0.010	0.02	0.01
Protein	1.14	1.10	1.12	0.010	NS	NS
Fat, g/kg	31.6	31.2	31.4	1.34	NS	NS
Protein, g/kg	30.1	28.5	28.1	0.36	NS	0.01
Production efficiency ³	1.60	1.67	1.62	0.019	NS	NS

¹ Contrast includes 1) roasted SB vs. raw SB and 2) SB plus CSM vs. SBM plus CS; ² $P > 0.05$; ³ Production efficiency = average daily 3.5% FCM (kg/d)/ average daily DMI (kg/d).

Conclusion Feeding roasted SB treated to maximize RUP supply to the intestine supported higher milk and FCM production in early lactation cows fed lucerne hay and maize silage as the primary forage source of diet. Furthermore, the higher milk and 3.5% FCM production of cows fed SB plus CSM diets compared with cows fed SBM plus CS showed the CSM can act as a suitable protein source in SB included diets. Although it was reduced in some studies where dietary forage comprised solely or partly maize silage, there was no significant difference between diets in milk fat concentration in this experiment, and heat treatment applied to SB provided additional benefits over raw SB. Because of the inclusion of cottonseed (meal or whole seed) in all diets, it did not confound the SB diets.

Reference National Research Council (2001). Nutrient Requirements of Dairy Cattle. National Academy Press.