

EFFECT OF LEVEL OF PROTEIN SUPPLEMENTATION
ON INTAKE AND UTILIZATION OF MEDIUM QUALITY
PRAIRIE HAY BY HEIFERS

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Story in Brief

Fifteen crossbred heifers (481 lb) were utilized in three simultaneous 5 x 5 Latin squares to determine the effect of level of protein supplementation on intake and digestibility of medium quality prairie hay (5.2 percent CP). Prairie hay, harvested in July, was fed free choice. Soybean meal (SBM) was fed at 0, .3, .6, .9 and 1.5 lb per day. A mineral-vitamin mix was fed daily.

As level of protein supplementation increased, a curvilinear increase ($P < .01$) in prairie hay intake, dry matter intake and apparent crude protein digestibility occurred. Moreover, there was a curvilinear increase ($P < .05$) in dry matter digestibility and a linear increase ($P < .01$) in acid detergent fiber digestibility. Daily hay intakes were 10.4, 11.2, 13.1, 13.6 and 15.0 lb per day on the 0, .3, .6, .9 and 1.5 lb of SBM supplement, respectively, with digestible dry matter intakes being 4.38, 5.13, 6.82, 7.24 and 8.64 lb per day on the same treatments.

Introduction

Protein supplementation has been previously shown to increase consumption and digestibility of low-quality forages by ruminants. Protein meals often are used as supplements for beef cattle grazing or being fed low quality forages. Recently, several Oklahoma trials have shown beneficial weight responses to low levels of protein supplements by stocker cattle grazing pastures in July to October. While protein supplementation has been shown to improve several response parameters, very limited data are available concerning the effects of increasing levels of protein on intake and digestibility parameters over a range of protein intakes when low to medium quality forages are fed. The objective of this research was to assess the effect of graded levels of protein intake on the consumption and utilization of medium quality prairie hay fed to heifer calves.

Materials and Methods

Fifteen Angus x Hereford crossbred heifers (481 lb) were blocked into three groups based upon hay intake determined during a preliminary period. Three simultaneous 5 x 5 Latin squares were used. The soybean meal (treatment) levels were 0, .3, .6, .9 and 1.5 lb per day (as fed basis), plus .18 lb of a mineral mix composed of (DM basis) 42.3 percent dicalcium phosphate, 17.9 percent KCl, 28.1 percent TM salt, 11.2 percent Na₂SO₄ and 0.57 percent Vitamin A.

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Medium quality prairie hay (5.2 percent crude protein, 47.9 percent acid detergent fiber, DM basis) was fed free choice in all treatments. The hay was harvested during July from a prairie meadow. Approximately 200 g of cottonseed hulls labeled with chromic oxide as an indigestible marker were fed twice daily to obtain digestibility.

After seven days of adaptation in each period, fecal samples were taken twice daily (am and pm) for four days. Prairie hay (fed and rejected) was weighed daily to determine intake and sampled on days 7-10. Samples were composited, dried and ground for analyses. Body weight also was recorded the last day of each period.

Results and Discussion

As the level of soybean meal supplementation increased, there was a curvilinear increase ($P < .01$) in prairie hay intake and total dry matter intake (Table 1). Linear, quadratic and quartic terms were significant ($P < .01$) for both factors. Dry matter digestibilities also showed a curvilinear improvement as supplemental protein levels increased with

Table 1. Daily intake of prairie hay and soybean and digestibility parameters.

Item	Soybean meal per day, lb ^a					SE
	0	.3	.6	.9	1.5	
Hay intake, lb ^{bc}	10.4	11.2	13.1	13.6	15.0	.19
Hay intake, % bd wt ^{bh}	1.88	2.03	2.36	2.44	2.68	--
Soybean meal intake, lb ^b	0	.27	.53	.80	1.33	0
Dry matter intake, lb ^{bcg}	11.3	12.4	14.6	15.3	17.3	.19
Dry matter dig, % ^{bd}	38.7	41.4	46.9	47.3	50.0	1.29
Digestible dry matter intake, lb ^b	4.38	5.13	6.82	7.24	8.64	--
Apparent CP dig, % ^{be}	17.5	29.5	38.5	41.7	48.3	1.37
Acid detergent fiber dig, % ^{bf}	33.5	35.7	40.9	40.8	43.9	1.56

^a As fed basis.

^b Dry matter basis.

^c Significant linear ($P < .01$), quadratic ($P < .01$) and quartic ($P < .01$) terms.

^d Significant linear ($P < .01$) and quadratic ($P < .05$) terms.

^e Significant linear ($P < .01$) terms.

^g Total includes hay, SBM, minerals and 356 g (400 g as fed) of cottonseed hulls.

^h Based on full, not shrunk, weight avg. of 550 to 559 lb/treatment.

significant linear ($P < .01$) and quadratic ($P < .05$) terms. A similar response was noted in apparent crude protein digestibilities, with significant linear ($P < .01$) and quadratic ($P < .01$) terms. Corrections for metabolic fecal nitrogen would yield higher protein digestion coefficients and would increase the value noted on all treatments. Moreover, observed values were higher than expected for ration dry matter digestibilities on all protein supplement treatments (Figure 1), indicating the positive synergistic effect of increasing protein level on digestibility of hay. As noted, the magnitude of increase above expected or calculated values was similar for the three highest SBM levels. A linear increase ($P < .01$) occurred in acid detergent fiber digestibilities. Digestible dry matter intakes were 4.38, 5.13, 6.82, 7.24 and 8.64 lb per day for 0, .3, .6, .9 and 1.5 lb of soybean meal supplement, respectively, giving a nearly two-fold increase in digestible DM intake on the higher level of SBM vs. control treatment. Moreover, the increase in digestible dry matter intake closely paralleled that of SBM intake and dry matter digestibility (Figure 2).

This study indicates that feeding a high protein supplement improved both intake and digestibility of medium quality prairie hay. Higher levels of supplemental soybean meal should have been studied since response parameters continued to increase throughout the range tested. Individual situations should be evaluated on an economic basis. The responses noted might differ depending on quality and type of forage available, supplement composition and management procedures. Further studies are needed to evaluate such variables.

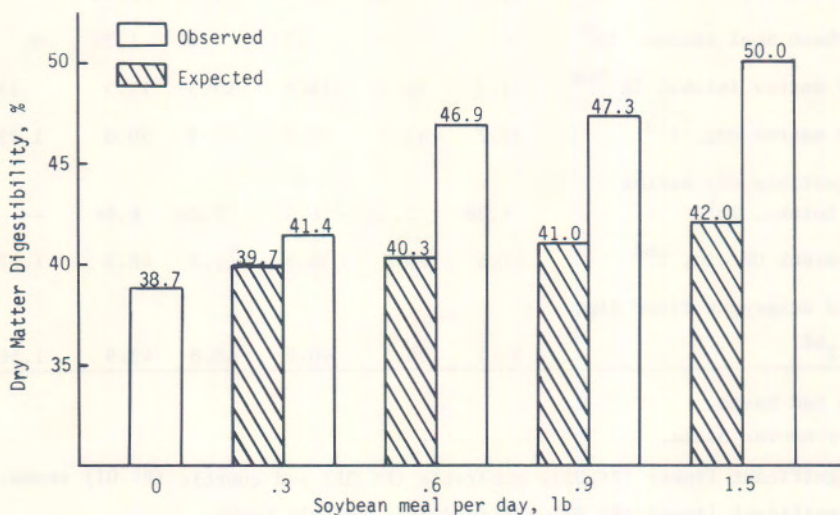


Figure 1. Comparison of observed versus expected diet dry matter digestibilities. Expected digestibilities are based upon values obtained for hay on the control treatment and 80% DM digestibility for the SBM supplement.

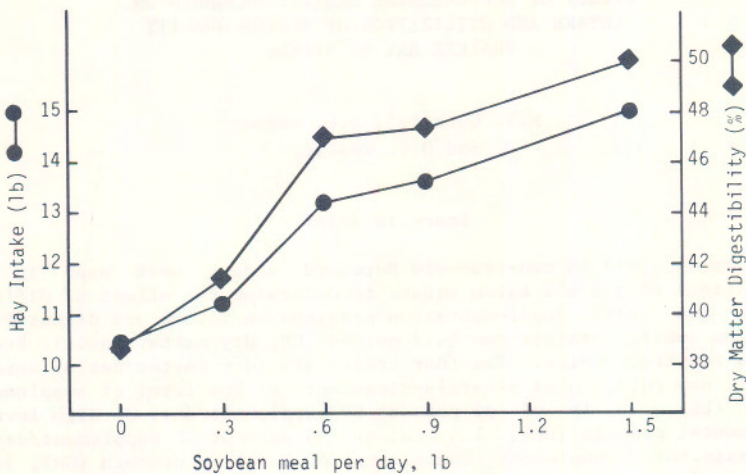


Figure 2. Mean hay intakes and dry matter digestibilities (standard error = .19 and 1.29, respectively) for heifers fed graded levels of soybean meal supplement.