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Integrating Crop and Livestock Systems with Pulses and Cereal-Pulse Intercrops -Animal Studies-

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Abstract

The basis of this project is the integration of annual forage and beef production. The objectives of the animal studies are to determine the production potential of cattle grazing annual forages in the summer and to determine the feeding value of oat-pea intercrop hay for beef cattle. Progress was made in 1997 toward the establishment of grazing paddocks that will support summer grazing studies. In the next two years, these paddocks will be used to assess the grazing potential of various cereal-pulse combinations. Pulses will include field pea and lentil, while cereals will include oat and barley. Eighty, crossbred heifer calves were used in a feedlot study to access the feeding value of oat-pea intercrop hay. Diets were formulated to contain either 40% oat-pea hay or 31% oat and 9% mixed hay. The remainder of each diet consisted of corn silage, corn grain, mineral supplement and salt. Dietary treatment did not affect body weights ($P > .35$), average daily gain ($P = .51$) or final body condition ($P = .67$). Although heifers fed oat-pea hay consumed less feed (29.6 vs 30.5; $P < .03$), feed efficiency was not affected by dietary treatment ($P = .74$). Pregnancy rate averaged 95% of heifers exposed and was not affected by dietary treatment. Based on these limited data, we conclude that oat-pea hay can be used to replaced oat hay that must be supplemented with dietary protein.

Introduction

Prices received for agricultural commodities are often low compared to the high costs of production. This results in relatively low net returns per acre for the amount of capital invested. As governmental control of agricultural production recedes, producers are given greater flexibility in the development of unique farming plans. As crop producers contemplate possible cropping decisions, crop rotations involving annual forages are gaining in popularity among diversified operations that manage both crop and cattle enterprises.

Annual forage production provides the basis for establishing an integrated system of crop and cattle production. Annual forages offer crop

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producers a wider variety of alternative crops that can be included in a rotating crop sequence. In addition to diversified operations, when cattle and crops are produced in close proximity, local livestock can create a readily-available market for excess forage production. In these areas, livestock may be used in the management of crop residues (e.g. straw, chaff). Increased use of reduced-tillage production systems has drawn attention to the importance of establishing appropriate residue management protocols.

Cattle enterprises can also potentially benefit from the integration of crop-livestock systems. Increased forage production would expand the feed base available within the production region. Annual forages can be grazed directly in the field during or after the growing season; or harvested, stored and fed to cattle in drylot. In addition, crop residues and aftermath are viable feed resources for cattle at times when nutrient requirements for production are minimized (e.g. dry cows during mid pregnancy, wintering of yearling cattle destined for summer grazing).

Annually seeded forages have potential for increasing net returns to crop acres by providing feed for livestock production. An integrated system would be mutually beneficial to crop and livestock production. Thus, a project was initiated to evaluate potential of integrating cattle and annual forage production. Annual forage production consisted of pulses (large-seeded legumes) and cereal-pulse intercrops. The objectives of the animal studies were to determine (1) differences in beef production potential while grazing cereal/pulse combinations during the summer and (2) the feeding value for beef cattle of forage harvested from a seeding of cereal-pulse intercrop.

Materials and Methods

Objective 1. Twenty-six, 2.5-acre paddocks were established to support summer grazing of annual forages in subsequent years. Paddocks were divided into two, 13-paddock groups. One group (west) was completely fenced in 1997. The other group of paddocks will be fenced in the summer of 1998. Ground within the fenced group was broken in the fall of 1997 and soil prepared for seeding in the spring of 1998.

In 1998, the fenced block (12 of 13 paddocks) will be blocked into two, 6-paddock groups. One group will be seeded to pea, oat or oat-pea intercrop (2 paddocks/treatment). The other group will be seeded to lentil, barley or barley-lentil intercrop (2 paddocks/treatment). These pastures will be grazed in the summer of 1998 (three yearling heifers/paddock), while the second block is prepared for seeding in 1999. The paddocks seeded to pea/oat combinations will be grazed first (mid June to mid July), followed by the paddocks seeded to the barley-lentil combinations (mid July to mid August). This seeding/grazing sequence will be repeated in the second block of paddocks in 1999.

Objective 2. Eighty, crossbred heifer calves were randomly allotted into 4 pens (20 heifers/pen). Pens were then assigned one of two dietary treatments (Table 1). Both treatments contained roughly 31.1% corn silage, 10.5% corn grain, 2.5% mineral supplement and 0.6% salt. One dietary treatment contained 43.5% oat hay and 11.9% mixed (grass/alfalfa) hay, while the other treatment contained 54.9% oat-pea intercrop hay. Dry matter and crude protein concentrations of feed ingredients are presented in table 2. Heifers were weighed at the beginning and the end of the feeding period. Body condition scores were recorded at the end of the feeding period. Heifers were fed from 22 January until 26 March (63 days on feed). Pregnancy was determined by ultrasound on 07 July, 21 July and 25 August. Based upon ultrasound information, heifers were classified as conceiving to an AI breeding, as conceiving to a subsequent natural service or as being

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open (not pregnant at final ultrasound date).

In 1998, heifer calves will be blocked by weight and allotted within weight group into 12 feedlot pens (6 to 8 heifers/pen). Four dietary treatments will be formulated and randomly allotted to pens within weight block. Treatments will consist of an oat hay, oat-pea intercrop hay or alfalfa hay supplemented with a corn/soybean oil meal grain mixture. A fourth treatment will also be included where the soybean oil meal and a portion of the corn in the oat hay treatment will be replaced by field pea grain. Lower-quality grass hay, vitamins and minerals will be used to balance diets to meet the needs of heifers for growth using ad libitum intake and a target-weight (at breeding) management scheme. Heifer weights, condition and feed disappearance will be recorded every 28 days. Heifers will be fed for a minimum of 56 days and a maximum of 84 days. Similar dietary treatments will be used in a separate feeding experiment utilizing heifers in 1999.

Results

There were no differences in initial (=657.5 lb; P=.38) or final (=808.4 lb; P=.61) body weight, final body condition score (=6.7; P=.67) or total (=151 lb; P=.51) or average daily (=2.4 lb; P=.51) gain. Although heifers fed oat-pea intercrop hay consumed less feed (29.6 vs 30.5 lb/d; P<.03), feed efficiencies (gain/feed, =0.0797; P=.74) were not different. It took approximately 13.2 lb of feed to produce a pound of gain regardless of dietary composition. The proportion of heifers that conceived to an AI breeding (45%) or subsequent natural service (50%) or were open (5%) was not affected by dietary treatment.

Conclusions

Based on these limited data, oat-pea hay can be used to replaced oat hay that must be supplemented with dietary protein This conclusion is based upon the assumption that diets are formulated to be equal in dietary crude protein. When cereal-pulse intercrop hay has a higher protein concentration than oat hay, use of a cereal-pulse intercrop hay can reduce the need for supplemental protein in typical beef cattle diets.

Table 1. Diet composition[a] for oat and oat-pea hay heifer feeding study.

	OAT[b]	O/P[b]
Ingredients		
Corn Silage	31.1	31.2
Oat Hay	43.5	--

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Mixed Hay[c]	11.9	--
Oat-pea Hay[d]	--	54.9
Corn Grain	10.4	10.6
Supplement[c]	2.5	2.6
White Salt	0.6	0.6
Composition		
Dry matter, %	64.6	64.2
Crude protein, %DM	10.4	10.3

[a]DM basis
[b]OAT and O/P are dietary treatments that contained oat and oat-pea intercrop hay, respectively.
[c]Alfalfa-grass hay.
[d]Field oat-pea intercrop hay.
[e]Vigortone Feedlot No, 411B (Bovatec® containing product), Vigortone Ag Products, Inc., Cedar Rapids, IA.

Table 2. Dry matter and crude protein concentrations of feed ingredients used in oat and oat-pea hay heifer feeding study.

	DM[a]	CP[a]
Ingredients		
Corn Silage	39.8	9.1

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Oat Hay	90.3	10.2
Mixed Hay[b]	88.5	15.6
Oat-pea Hay[c]	88.8	11.2
Corn Grain	87.4	12.7
Supplement[d]	100.0	0.0
White Salt	100.0	0.0

[a] DM and CP refer to dry matter and crude protein (on dry matter basis) concentrations.
[b] Alfalfa-grass hay.
[c] Field oat-pea intercrop hay.
[d] Vigortone Feedlot No, 411B (Bovatec® containing product), Vigortone Ag Products, Inc., Cedar Rapids, IA.

Table 3. Animal performance for oat and oat-pea hay heifer feeding study.

	OAT[a]	O/P[a]	SE
Weights, lb			
Initial	651.4	663.7	7.72
Final	806.8	810.2	4.00
Total gain	155.5	146.5	8.02
Daily gain	2.47	2.33	0.13
Body Condition[b] (final)	6.6	6.8	0.21

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DMI[c], lb/d	29.6[x]	30.5[y]	.11
Efficiency			
Gain/feed	0.081	0.079	0.0044
Feed/gain	12.9	13.4	--
Pregnancy data, %			
Conceiving to AI	47.5	42.5	--
Conceiving to bulls	45.0	55.0	--
Total	92.5	97.5	--

[a] OAT and O/P are dietary treatments that contained oat and oat-pea intercrop hay, respectively.

[b] Body condition is a measure of fat cover indicating energy reserves, based on 9-point scale (1 = very thin and 9 = obese).

[c] DMI = dry matter intake.

[x,y] Means within a row differ (P < .03).

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