

Relative value of field peas as an alternative to corn distillers dried grain with solubles (DDGS) in beef heifer growing diets

Michael Undi, Tim Long and Kevin Sedivec

Field peas can effectively replace corn DDGS in growing heifer diets; however, the high price of field peas often limits utilization of field peas. This study was conducted to determine a price point at which field peas would competitively replace corn DDGS in growing heifer diets formulated to produce similar heifer performance. Field peas can economically replace corn DDGS in growing heifer diets when the price of field peas is less than or equal to 84% of the price of corn DDGS. Within a speculative price range of field peas of \$267 to \$367/t (\$8 to \$11/bushel) and corn DDGS at \$250/t, field peas are not an attractive alternative to corn DDGS in beef heifer growing diets.

Summary

Corn distillers' dry grains with solubles (DDGS) is one of the most common supplements for cattle in North Dakota. Utilization of corn DDGS is affected by availability and pricing, thus, there is a need to evaluate alternative feed ingredients. This study was conducted to determine a price point at which field peas can competitively replace corn DDGS in diets of growing heifers. The study was conducted with growing heifers that were fed corn DDGS-based and field pea-based diets formulated to produce similar heifer performance. The response allowed a comparative ration cost analysis to be conducted without the need to account for differences in animal performance. Compared to corn DDGS, approximately 43% more field peas by weight were required in a field pea-based diet to meet nutrient requirements of growing heifers. At this level of incorpora-

tion, field peas would economically replace corn DDGS when the price of field peas is less than or equal to 84% of the price of corn DDGS. At the current speculative price of field peas of \$267 to \$367/t (\$8 to \$11/bushel) and corn DDGS at \$250/t, field peas are not an attractive alternative to corn DDGS in beef heifer growing diets.

Introduction

Corn distillers' dry grains with solubles (DDGS) is one of the most common supplements used across the Great Plains region of the United States (Troyer et al., 2020). Corn DDGS compares favorably with supplements such as soybean meal and canola meal as a good source of protein, fat, phosphorus, and readily digestible fiber. Continued utilization of corn DDGS in cattle rations will likely be affected by availability and pricing. Being a coproduct of ethanol production, corn DDGS availability and pricing will be influenced by fuel prices since ethanol is used as a gasoline additive and alternative fuel

in vehicles. Thus, fluctuation in gasoline prices will increase demand for alternative feed ingredients that can replace corn DDGS in livestock diets.

Field peas are a palatable source of protein and energy, which makes them a valuable livestock feed (Anderson et al., 2007). In field pea growing areas, such as North Dakota and Montana, utilization of field peas in livestock diets presents a realistic, on-farm value-adding opportunity for field pea growers (Lardy et al., 2009). Compared to other feedstuffs, the price of field peas is likely to be a major factor in determining utilization of field peas in cattle rations (Anderson et al., 2007). However, identifying a price for field peas as livestock feed presents quite a challenge since field peas are normally priced for human food and pet food markets (Troyer et al. 2020). Situations that result in excess production of field peas, resulting in lower prices of field peas, might offer opportunities for utilizing field peas in cattle diets. This study was conducted to determine a competitive price point for field peas relative to corn DDGS for inclusion into diets of growing heifers.

Experimental Procedures

Animal handling and care procedures were approved by the North Dakota State University Animal Care and Use Committee.

The study extended over two years. Starting in the fall of each year, 162 growing Angus heifers (2020/2021, body weight = 688 ± 88 lb; 2021/2022, 525 ± 71 lb) were divided into two groups of similar

average body weight (BW), and the groups were randomly assigned to six dry lot pens. Three groups of heifers (27 heifers/pen) were then assigned randomly to a total mixed ration (TMR) containing supplemental field peas or corn DDGS (Table 1). The diets were formulated to be isocaloric and isonitrogenous and to meet nutrient requirements of growing heifers. The diets were fed as a TMR using cane molasses to minimize ingredient separation from forages. Field peas were coarse-rolled through a roller mill before incorporation into the TMR.

Heifers were fed once daily at approximately 09:00 each day, and feed bunks were targeted to be empty of feed by 16:00. Amount of feed delivered to bunks each week was based on bunk clearance from the previous week. Heifers had *ad libitum* access to fresh water, mineral supplement, and salt blocks. Heifer performance was assessed from the average of two-day body weights taken at the start and end of the study.

Comparative Economic Analysis

Comparative economic analysis was conducted under two scenarios: a) comparing ration costs resulting from inclusion of corn DDGS or field peas into corn DDGS-based and field peas-based diets at similar corn DDGS and field peas price points, and b) identifying a price point at which field peas would competitively replace corn DDGS in growing heifer diets. To compare ration costs resulting from inclusion of corn DDGS or field peas at similar price points, ration costs were generated in Microsoft Excel (Microsoft, Redmond, WA) over a common price range of \$200 to \$363/t for both corn DDGS and field peas. Identifying a price point at which field peas would competitively replace corn DDGS in growing heifer diets was accomplished by calculating corresponding price points of corn DDGS and field peas that would produce rations with similar ration costs.

Comparative economic analysis of rations was conducted with two

assumptions. First, the price of corn DDGS and field peas would fluctuate from \$200 to \$363/t depending on market supply and demand for these commodities. This range was selected to encompass price fluctuations of both corn DDGS and field peas. Second, the decision to utilize these ingredients in diets would depend on the total commodity price including the cost of transportation. At the time of analysis, corn grain, hay, and silage were priced at \$250, \$80, and \$31/t, respectively. Corn DDGS was priced to fluctuate from \$220 to \$400/t since USDA Agricultural Marketing Service suggests a range of 80% to 100% or more the price of corn (Buckner et al., 2008). The price of silage was based on local production and was estimated from corn production. Identifying a price for field peas as livestock feed presents quite a challenge since field peas are normally priced for human food and pet food markets (Troyer et al. 2020). At the time of this study, we speculated, through conversations with field pea producers, that the

Table 1. Ingredients and chemical composition of total mixed rations fed to growing heifers.

Ingredients, % as fed	Year			
	2020/2021		2021/2022	
	Corn DDGS	Field peas	Corn DDGS	Field peas
Hay	37.9	36.7	42.3	43.1
Corn silage	40.7	40.6	41.3	39.6
Corn grain	14.4	13.8	9.1	8.3
Peas	-	5.8	-	6.2
DDGS	3.9	-	4.5	-
Cm30 ¹	3.1	3.1	2.8	2.8
Chemical composition, % DM				
CP	12.2	12.3	13.4	13.6
Net energy for gain, Mcal/lb	0.32	0.30	0.29	0.28
Neutral detergent fiber	42.9	42.1	47.7	44.7
Acid detergent	29.4	29.0	32.1	31.3
Ether extract	2.9	2.0	3.2	2.7
Calcium	0.82	0.86	1.2	1.1
Phosphorus	0.27	0.27	0.35	0.29
Magnesium	0.35	0.21	0.30	0.28
Potassium	1.57	1.43	1.88	1.86
Sulfur	0.24	0.19	0.23	0.20

¹Core Max 30 liquid protein supplement (30% CP, 0.1% CF, 11.3 to 13.5% Ca, 0.08% P, 4.4 to 5.4% salt, 2% K, 5.5 ppm Se, 50,000 IU/LB Vit A., 8% total sugars, 33.0% moisture).

price of field peas was in the range of \$267 and \$367/t (\$8 to \$11/bushel).

All ingredient prices were expressed in US tons (t). Ration costs (\$/head/day), which were utilized as the basis for comparative economic analysis, were calculated from daily ingredient intake and ingredient prices. Ingredient intake was calculated from feed delivered (lb/head/d) and diet composition. During the two-year study, an average of 4.2% DDGS and 6% field peas were required in the corn DDGS-based and field peas-based diets, respectively (Table 1). At a feed intake of approximately 29 lb/day for corn DDGS-based and field peas-based diets, 1.23 and 1.76 lb/day of corn DDGS and field peas were included in the respective diets.

Results and Discussion

Diets offered to heifers in this study were formulated to be isonitrogenous and isocaloric (Table 1). In 2020, approximately 3.9% and 5.8% of DDGS and field peas, respectively, were required to produce diets containing 12% CP and net energy for gain (NEg) of 0.32 Mcal/lb. In 2021, approximately 4.5% and 6.2% of DDGS and field peas, respectively, was required to produce diets containing 13.5% CP and NEg of 0.27 Mcal/lb.

Dry matter intake (DMI) was not influenced by treatment ($P = 0.72$) and averaged 17.6 lb/d (Table 2). When expressed as a percentage of body weight (BW), DMI was not influenced ($P = 0.38$) by treatment, with intakes of 2.6% for both treatments. Heifers were well balanced between

treatments for initial BW, which were similar ($P = 0.255$) between treatments. Final BW and average daily gain were not influenced ($P \geq 0.05$) by treatment, which was expected since diets were formulated to be isocaloric and isonitrogenous. Heifer performance was similar when 1.23 lb/d and 1.76 lb/d of corn DDGS and field peas, respectively, were incorporated into corn DDGS-based and field peas-based diets. Similar animal response between treatments allowed comparative ration cost analysis without the need to account for animal performance.

When both corn DDGS and field peas were priced \$200/t, ration costs were greater for the field peas-based diet relative to the DDGS-based diet (Table 3). When the price of corn DDGS and field peas increased to

Table 2. Performance of growing heifers consuming field peas-based or corn DDGS-based total mixed rations.

	Diet (D) ¹		SE	Year (Y)		SE	P-value		
	DDGS	FP		2020/21	2021/22		D	Y	D x Y
DMI, lb/d	17.6	17.6	0.12	17.6	17.2	0.12	0.72	0.003	0.97
DMI, % BW	2.6	2.6	0.03	2.5	2.7	0.03	0.38	<0.001	0.25
Initial BW, lb	657	649	7.9	689	615	7.9	0.26	<0.001	0.13
Final BW, lb	732	728	8.1	764	696	8.1	0.57	<0.001	0.34
ADG, lb/d	1.72	1.69	0.04	1.86	1.56	0.04	0.41	<0.001	0.79

¹Corn DDGS and field peas.

Table 3. Relative ration costs (\$/head/day) when corn DDGS and field peas are priced at similar and different price points.

Common ingredient price ¹ (\$/t)	Ration cost (\$/head/day)		Cost difference (DDGS – FP)	Ingredient price ² (\$/t)		Ration cost (\$/head/day)	Relative FP price (% DDGS price)
	DDGS-based diet	FP-based diet		Corn DDGS	Field peas		
200	1.34	1.36	-0.02	200	176	1.34	88
218	1.35	1.38	-0.03	218	189	1.35	87
236	1.36	1.40	-0.04	236	200	1.36	85
254	1.37	1.41	-0.04	254	211	1.37	83
272	1.39	1.43	-0.04	272	229	1.39	84
290	1.40	1.44	-0.04	290	241	1.40	83
308	1.41	1.46	-0.05	308	254	1.41	82
327	1.42	1.48	-0.06	327	268	1.42	82
345	1.43	1.49	-0.06	345	280	1.43	81
363	1.44	1.51	-0.07	363	291	1.44	80

¹Corn DDGS and field peas at the same price.

²Prices used: hay, \$80/t; silage, \$31/t; corn grain, \$250/t; and Cm30, \$319/t.

\$363/t, ration costs increased to \$1.44 and \$1.51/head/day for corn DDGS-based and field peas-based diets, respectively. As the price of corn DDGS and field peas increased, contribution of hay, silage, and corn grain to total ration costs decreased, reflecting the greater contribution of field peas to the field peas-based ration. Inclusion of field peas into livestock diets will likely increase total feed costs due to the relatively high price of field peas. The relative value of field peas in diets for growing heifers was mainly driven by the level of incorporation of field peas into the diet and the price of field peas. When compared to a corn DDGS-based diet, a field peas-based diet that met nutrient requirements of growing heifers required approximately 43% more field peas. Moreover, the price of field peas would have to be consistently lower than the price of corn DDGS for the corn DDGS-based and field peas-based diets to produce similar ration costs. The relative price of field peas decreased from 88% to 80% as the price of corn DDGS increased from \$200 to \$363/t. On average, corn DDGS-based and field peas-based diets produced diets with similar ration costs when field peas were priced at approximately 84% of the price of corn DDGS (Table 3). At the current price of \$250/t for corn DDGS, field peas, priced at \$267 to \$367/t, would not be a competitive supplement for use in heifer rations.

Results from this study support studies that have shown a competitive economic advantage of corn DDGS relative to feeds such as dry-rolled corn (Buckner et al., 2008) or field peas (Troyer et al. 2020). Inclusion of corn DDGS in the diet resulted in higher profits relative to a dry-rolled corn-based diet (Buckner et al., 2008). A recent economic evaluation of field peas and corn DDGS as a supplement for heifers grazing crested wheatgrass (Troyer et al. 2020) showed that field peas can be utilized as a supplement when the peas are competitively priced at 90% of the price of corn DDGS. Due to lower costs relative to feeds such as wheat, barley, corn, canola meal, and soybean meal, feed co-products such as DDGS will likely continue to be common and cost-effective ingredients in beef and dairy diets. Situations that result in excess production of field peas, resulting in drastically lower prices of field peas, might offer opportunities for competitively priced field peas for use in cattle diets.

Field peas can competitively replace corn DDGS in cattle diets when the price of field peas is less than or equal to 84% of the price of corn DDGS. At the current price of field peas of \$267 to \$367/t (\$8 to \$11/bushel) and corn DDGS at \$250/t, field peas are not an attractive alternative to corn DDGS in beef heifer growing diets.

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