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EFFECT OF FULL-FAT CORN GERM AND VITAMIN E ON FINISHING PERFORMANCE AND CARCASS CHARACTERISTICS OF BEEF HEIFERS

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Summary

Eight hundred eighty-eight crossbred beef heifers weighing 837 lb were used in a 105-day finishing study to evaluate full-fat corn germ as a lipid source and added vitamin E in finishing diets containing steam-flaked corn. Treatments were arranged in a 2 × 4 factorial and consisted of finishing diets formulated to provide no added fat (Control), 4% tallow (Tallow), or 10% or 15% full fat corn germ on a dry matter basis (10%FFG and 15%FFG, respectively) with or without 2000 IU of additional vitamin E per heifer daily. No fat × vitamin E interaction was detected. Fat addition decreased ($P<0.01$) dry matter intake and tended ($P<0.09$) to improve gain efficiency, but marbling score and the number of carcasses grading USDA Choice were decreased by fat additions ($P<0.01$). Tallow and 10%FFG yielded similar finishing performance and carcass characteristics. Increasing full fat corn germ led to linear decreases ($P<0.05$) in dry matter intake, average daily gain, final body weight, and hot carcass weight, as well as marbling score and the number of carcasses grading USDA Choice. Gain efficiency was increased by addition of full fat corn germ at 10% of the diet, but not at 15% of the diet. Addition of full fat corn germ to the diet tended (linear, $P<0.06$) to decrease the incidence of liver abscesses. Addition of vitamin E did not affect finishing performance ($P>0.12$). This study suggests that full fat corn germ can serve as a supplemental lipid source for finishing cattle. Responses to 10% full fat corn germ were similar to those obtained when an equal amount of fat from tallow was incorporated into the diet.

Introduction

Full-fat corn germ is a byproduct of corn wet milling and traditionally has been used for corn oil production. Full-fat corn germ contains approximately 45% lipid and 12% crude protein on a dry matter basis and has been used successfully as a fat source in finishing diets containing dry-rolled corn. Vitamin E is a fat-soluble vitamin that serves as an antioxidant, is involved in lipid metabolism, and has been shown to increase the shelf life of red meat. Our objectives were to evaluate the effects of full-fat corn germ as a lipid source in finishing diets containing steam-flaked corn as well as the effects of added vitamin E in finishing diets containing various concentrations of added fat on finishing performance and carcass characteristics.

Experimental Procedures

Eight hundred eighty-eight crossbred beef heifers weighing 837 lb were processed over 8 days. Processing included vaccination against respiratory and clostridial diseases and implanting with Revelor H®. Immediately following processing, heifers were randomly assigned to dirt-surfaced pens so that each pen contained between 14 and 23 heifers each, depending on pen size. Pen served as the experimental unit, and pens were blocked by date of implanting. Dietary treatments (Table 1) consisted of finishing diets formulated to provide no added fat (Control), 4% tallow

(Tallow), or 10% or 15% full fat corn germ on a dry matter basis (10%FFG and 15%FFG, respectively) with or without 2000 IU of additional vitamin E per heifer daily. Treatments were assigned randomly to pens within each block. A total of 48 pens were used, providing six pens per treatment. Heifers were maintained on the control diet until all heifers were processed, upon which time heifers were weighed and their respective dietary treatments were initiated. Diets were fed once daily and were offered for ad libitum consumption. At the end of the 105-day finishing period, each pen of heifers was weighed and transported to a commercial slaughter facility. Hot carcass weights and the incidence of liver abscesses were recorded at time of slaughter. Other carcass traits were measured following a 24-hour chill.

Results and Discussion

The effects of fat addition and full-fat corn germ on finishing performance and carcass characteristics are shown in Table 2. Fat addition decreased ($P<0.01$) dry matter intake and tended ($P<0.09$) to improve gain efficiency when compared to Control, although marbling score and the percentage of carcasses grading USDA Choice were decreased ($P<0.01$) in response to supplemental fat. Whether this was an effect of decreased feed intake or an effect of fat on marbling is not known. Tallow and 10%FFG yielded similar finishing performance and carcass characteristics, suggesting that including full-fat corn germ at 10% in finishing diets can effectively replace 4.2% tallow as a fat source. Increasing full fat corn germ decreased dry matter intake (linear, $P<0.01$), daily gains (linear, $P<0.03$), final body weight (linear, $P<0.02$), hot carcass weight (linear, $P<0.02$), as well as marbling score (linear, $P<0.01$) and the number of carcasses grading USDA Choice (linear, $P<0.01$). Gain efficiency was improved when 10% full fat corn germ was added to the diet, but this benefit was lost when it was added at 15% of the diet (quadratic, $P<0.03$). Increasing full fat corn germ tended (linear, $P<0.06$) to reduce the incidence of liver abscesses. Decreases in liver abscesses could be a result of decreased feed intake, or possibly some antimicrobial property of full-fat corn germ that suppressed the growth of bacteria responsible for liver abscesses.

The addition of vitamin E did not affect finishing performance, but it did marginally increase ($P<0.04$) the number of carcasses grading USDA Select and decrease ($P<0.05$) the number of carcasses grading USDA Standard (Table 3). This effect on carcass quality might have been due to the anti-oxidant property of vitamin E.

This study suggests that full fat corn germ can serve as a supplemental fat source for finishing cattle. Responses were similar to those obtained when an equal amount of fat from tallow was incorporated into the diet. Furthermore, providing finishing cattle an additional 2,000 IU of vitamin E daily does not affect finishing performance but may marginally affect carcass characteristics.

Table 1. Experimental Diets (% of Dry Matter)

	Treatment			
Item	Control	Tallow	10%FFG	15%FFG
Steam-flaked corn	48.6	43.6	38.8	33.9
Wet corn gluten feed	35.2	35.2	35.2	35.2
Alfalfa hay	4.1	4.1	4.1	4.1
Full-fat corn germ	-	-	10.5	15.7
Tallow	-	4.2	-	-
Corn steep liquor	8.0	8.0	8.0	8.0
Dehulled soybean meal	2.0	2.8	1.3	1.0
Limestone	1.7	1.7	1.7	1.7
Salt	0.30	0.30	0.30	0.30
Vitamin/mineral premix[a]	0.10	0.10	0.10	0.10
RTM premix[b]	+	+	+	+
Crude protein, analyzed	16.2	16.2	16.3	16.3
Crude fat, calculated	3.2	7.0	7.7	10.0

[a]Formulated to provide 0.1 ppm cobalt, 10 ppm copper, 0.6 ppm iodine, 0.2 ppm iron, 60 ppm manganese, 0.3 ppm selenium, 60 ppm zinc, 1,000 IU/lb vitamin A, and either no vitamin E or 2,000 IU of vitamin E daily.

[b]Fed at 0.44 lb per heifer daily (dry matter basis) and provided 300 mg/day Rumensin®, 90 mg/day Tylan®, and 0.5 mg/day melengestrol acetate.

Table 2. Finishing Performance and Carcass Characteristics of Heifers Fed Diets Containing No Added Fat (Control), 4% Tallow (Tallow), or 10 and 15% Full fat Corn Germ (10%FFG and 15%FFG, respectively)

	Treatment					Contrast[a]			
Item	Control	Tallow	10%FFG	15%FFG	SEM	1[b]	2[c]	3[d]	4[e]
Number of heifers	220	222	224	222	-	-	-	-	-
Number of pens	12	12	12	12	-	-	-	-	-
Initial weight, lb	826	826	822	822	6.6	0.76	0.70	0.67	0.91
Final weight, lb[f]	1130	1130	1131	1106	6.3	0.25	0.88	0.02	0.04
Dry matter intake, lb/day	19.5	18.6	18.7	18.0	0.17	< 0.01	0.76	< 0.01	0.37
Average daily gain, lb	2.84	2.83	2.88	2.65	0.053	0.34	0.54	0.03	0.02
Gain:feed	0.146	0.152	0.154	0.147	0.0026	0.09	0.62	0.47	0.03
Hot carcass weight, lb	725	724	725	709	4.0	0.25	0.88	0.02	0.04
Dressing percentage[g]	64.3	64.3	64.3	63.9	0.16	0.63	0.83	0.19	0.12
Fat thickness, inch	0.54	0.56	0.57	0.52	0.017	0.77	0.79	0.58	0.09
Longissimus muscle area, inch^2	13.6	13.5	13.5	13.4	0.15	0.71	0.73	0.58	0.95
Kidney, pelvic, & heart fat, %	2.4	2.3	2.4	2.4	0.03	0.35	0.06	0.33	0.13
Liver abscesses, %	8.6	8.3	4.1	3.4	2.00	0.15	0.15	0.06	0.70
Yield grade 1, %	8	13	11	11	2.2	0.11	0.58	0.23	0.60
Yield grade 2, %	35	30	23	37	3.8	0.21	0.17	0.79	0.01
Yield grade 3, %	48	43	50	43	3.7	0.52	0.14	0.49	0.25
Yield grade 4, %	9	12	15	8	2.1	0.19	0.42	0.83	0.02
Yield grade 5, %	0	2	1	1	0.5	0.12	0.24	0.41	0.54
Marbling score[h]	Sl^{95}	Sl^{67}	Sl^{78}	Sl^{62}	5.3	< 0.01	0.13	< 0.01	0.40
USDA Prime, %	1	1	1	0	0.4	0.19	1.00	0.13	0.83
USDA Choice, %	42	30	35	30	3.3	0.01	0.29	0.01	0.55
USDA Select, %	54	60	56	60	3.1	0.19	0.43	0.25	0.88
USDA Standard, %	3	9	8	10	1.8	0.03	0.45	0.02	0.62
Dark cutters, %	0	0.3	0.6	1.3	0.63	0.15	0.68	0.07	0.83

[a]Probability that effects observed were due to random chance.
[b]1 = Control vs. fat.
[c]2 = 10%FFG vs. Tallow.
[d]3 = Linear effect of full fat corn germ.
[e]4 = Quadratic effect of full fat corn germ.
[f]Final weight = hot carcass weight ÷ common dressing percentage of 64.10%.
[g]Calculated as hot carcass weight ÷ (live weight × 0.96).
[h]Sl = Slight.

Table 3. Finishing Performance and Carcass Characteristics of Heifers Fed Diets Containing No Additional Vitamin E or 2,000 IU of Added Vitamin E Per Heifer Daily

	Treatment			
Item	No Vitamin E	Added Vitamin E	SEM	P-value[a]
Number of heifers	448	440	-	-
Number of pens	24	24	-	-
Initial weight, lb	824	824	4.8	0.98
Final weight, lb[b]	1120	1128	4.6	0.18
Dry matter intake, lb/day	18.6	18.8	0.12	0.42
Average daily gain, lb	2.76	2.84	0.039	0.12
Gain:feed	0.148	0.151	0.0019	0.18
Hot carcass weight, lb	718	723	2.9	0.18
Dressing percentage[c]	64.1	64.3	0.12	0.43
Fat thickness, inch	0.55	0.55	0.012	0.91
Longissimus muscle area, inch^2	13.4	13.6	0.11	0.41
Kidney, pelvic, & heart fat, %	2.4	2.4	0.02	0.37
Liver abscesses, %	7.8	4.5	1.45	0.10
Yield grade 1, %	12	10	1.6	0.39
Yield grade 2, %	30	33	2.8	0.56
Yield grade 3, %	44	47	2.7	0.40
Yield grade 4, %	13	9	1.5	0.09
Yield grade 5, %	1	1	0.4	0.72
Marbling score[d]	Sl^{78}	Sl^{73}	3.8	0.36
USDA Prime, %	1	0	0.3	0.32
USDA Choice, %	36	33	2.4	0.31
USDA Select, %	54	61	2.3	0.04
USDA Standard, %	9	6	1.3	0.05
Dark cutters, %	0.2	0.8	0.45	0.33

[a]Probability that effects observed were due to random chance.
[b]Final weight = hot carcass weight ÷ common dressing percentage of 64.10%.
[c]Calculated as hot carcass weight ÷ (live weight × 0.96).
[d]Sl = Slight.