

Effect of Field Pea Replacement and *Yucca schidigera* extract on weaning transition growth and feedlot performance

D.G. Landblom¹ and J. Pennington²

¹Dickinson Research Extension Center, Dickinson, ND

²Dickinson State University, Dickinson, ND

Summary

The addition of *Yucca schidigera* (*Yucca s.*) extract to field pea/fiber-based weaning transition diets was conducted to determine the potential effect on weaning growth, feedlot performance, and carcass characteristics. Steroidal saponins found in *Yucca s.* extract has been shown to alter rumen function creating a potential for improved ammonia utilization leading to a subsequent improvement in microbial protein flow to the small intestine. Steer calves, early weaned in mid-September and averaging 450 pounds, were used in the investigation.

Weaning performance across all treatments evaluated was excellent and no statistical differences were identified. There was a trend toward improved growth and rate of gain when peas were fed alone ($P=.12$). Non-significant ADG was 3.08, 3.16, 3.25, and 3.0 lbs./head for the , respectively. Feed to gain efficiency was 3.92, 3.87, 3.78, and 4.20 pounds/pound of gain for the C, Y, P and Y+P, respectively. On average, steers in the investigation gained 131.2 pounds in the 42-day conditioning period at a feed cost of \$16.58/cwt.

Finishing growth performance and carcass measurement comparisons across treatments were very similar. Numerical differences were detected, however, none of the criteria measured differed significantly. There was a tendency for steers that received *Yucca s.* extract during the 42d receiving/transitioning period to have improved feed efficiency ($P=.11$). Feed efficiency measured was 5.63, 5.42, 5.51 and 5.36 lbs. of feed per pound of gain for the C, Y, P and Y+P, respectively.

Among carcass measurements there was a positive rib eye area (REA) response following feeding of *Yucca s.* extract during the 42d receiving/transitioning period. Rib eye area measured was 11.94, 12.42, 11.41 and 11.91 sq. in. for the C, Y, P and Y+P, respectively. With respect to carcass choice grade, steers that were fed either the C or Y+P transitioning supplements had the highest number of choice grading carcasses (67%). Supplements with either *Yucca s.* extract or peas alone resulted in lower final carcass grade than either the C or Y+P supplements. Compared to the group receiving a 15%

pea replacement, feeding 15% pea plus *Yucca s.* extract resulted in 11% more carcasses grading choice.

Introduction

Previous research with weaning transition diets at this center, in which field peas were used to replace a portion of fiber-based ingredients, has shown a trend toward improved carcass quality grade when transition diets included 20% field pea (Landblom et al. 2003).

Yucca s., contains a group of compounds identified as steroidal saponins, which have surface active properties and ammonia binding capability. In the the recent past, researchers have been interested in the use of *Yucca s.* extract in livestock production applications. Application of *Yucca s.* extract in high grain diets has improved rate of gain (Goodall et al., 1982). In other studies, *Yucca s.* extract was shown to decrease ruminal ammonia concentration, increase propionate concentration, improve organic matter digestibility, and in some instances improve animal performance (Grobner et al., 1982; Goetsch and Owens, 1985; Hristov et al., 1999; Hussain and Cheeke, 1995; Valdez et al., 1986; Wu et al., 1994). Hristov et al., (1999) was able to demonstrate that the antiprotozoal activity of yucca saponins could serve as an effective defaunating agent without compromising dry matter digestibility. Their work suggested that the inclusion of *Yucca s.* extract in higher protein diets may improve ammonia utilization in the rumen and, by reducing rumen protozoan populations, microbial protein flow to the small intestine may also improve.

Other research has shown early application of dietary energy in short term, 6 week, weaning transition and receiving calf diets has resulted in effective improvement in beef carcass quality (Drouillard et al., 2002; Farran et al., 2002).

The purpose of the present preliminary investigation is to determine whether the addition of *Yucca s.* extract will improve short-term weaning transition and subsequent finishing performance.

Procedures

Seventy-two crossbred steers were allotted to one of four treatments, with three pen replicates per

treatment, in a completely randomized design. In the design, pen served as the experimental unit. Ingredient composition and inclusion level for each of the test supplements is shown in Table 1. In the formulation, field peas replaced either 0 or 15% of fiber-based ingredients. *Yucca s.* extract was added to half of the supplements to provide for 35mg/lb of finished feed. The supplements, therefore, were 0% Pea and *Yucca s.* (C), 15% Pea (P), 35mg *Yucca s.* (Y) and 15% Pea + 35mg *Yucca s.* (P+Y). Diets fed were complete pelleted formulations that replaced chopped hay on a daily basis until 50% or more of the calves' intake was from the test supplements. Steers and residual feed in bunks were weighed weekly during the 6 week postweaning transition period. Weekly feed residue was removed and not refed. Steers were weighted on two consecutive days at the start and end of the study to determine initial and final weight. At the end of the 42-day transition period, all steers were shipped to Decatur County Feed Yard, Oberlin, Kansas, where Microbeef Technologies' electronic cattle management (ECM) system is utilized to determine finishing end point and final harvest.

Results

Seventy-two crossbred steer calves averaging 185d and weighing 450 pounds were early weaned and offered fiber-based weaning supplements that contained either a 15% pea replacement, *Yucca s.* extract, or a combination of 15% field peas and *Yucca s.* extract to evaluate 42d effectiveness of the supplements when transitioning calves from native pasture to a commercial feed yard environment. Supplement composition is shown in Table 1 and 42d transitioning response to the experimental supplements is shown in Table 2.

Steer growth performance across treatments, among the early weaned calves, was excellent tending to favor the inclusion of *Yucca s.* extract without peas in the Y treatment. Numerical, non significant, differences for average daily gain (P=.12) were 3.08, 3.16, 3.25, and 3.0 pounds per day for C, P, Y and P+Y, respectively. No differences were measured for feed intake (P=.50) or feed efficiency (P=.50). Feed cost per head (P=.70) and feed cost per pound of gain (P=.70) did not differ and were nearly identical across treatments.

Upon completion of the 42d transition period, the steers were transported to Decatur County Feed Yard, Oberlin, Kansas where they were fed to final harvest. Finishing growth performance and carcass measurement comparisons are shown in Table 3. Numerical differences were detected between treatments for finishing performance and carcass measurements, however, none of the criteria measured

differed significantly. There was a tendency for steers that received *Yucca s.* extract during the 42d receiving/transitioning period to have improved feed efficiency. Feed efficiency measured was 5.63, 5.42, 5.51 and 5.36 lbs. of feed per pound of gain for the C, Y, P and Y+P, respectively.

Carcass measurements, as shown in Table 3, were not different for most carcass characteristics evaluated. There was, however, a positive rib eye area (REA) response following feeding of *Yucca s.* extract during the 42d receiving/transitioning period. Rib eye area measured was 11.94, 12.42, 11.41 and 11.91 sq. in. for the C, Y, P and Y+P, respectively. There was no difference in the number of choice grading carcasses between the C and Y+P groups. Compared to steers that received a 15% pea replacement for fiber-based ingredients, feeding 15% peas plus 35mg/lb. of *Yucca s.* extract resulted in 11% more steers grading choice.

Literature Cited

- Drouillard, J.S., E.J. Good, C.M. Gordon, T.J. Kessen, J.J. Sulpizio, S.P. Montgomery, and J.J. Sindt.** 2002. Flaxseed and flaxseed products for cattle: effects on health, growth performance, carcass quality, and sensory attributes. Proceedings of the 59th Annual Flax Institute of the United States, North Dakota State University, Fargo, ND.
- Farran, T.B., J.S. Drouillard, D.A. Blasi, M.F. spire, J.J. Sindt, S.P. Montgomery, C.M. Coetzer, H.J. LaBrune, J.E. Minton, J.J. Higgins, and T.H. Elsasser.** 2002. Immune response in feeder cattle fed different sources of lipid. Proceedings of the 2002 Kansas State University Cattlemen's Day, pp. 5-9.
- Goetsch, A.L. and F.N. Owens.** 1985. Effects of sarsaponin on digestion and passage rates in cattle fed medium to low concentrate. J. Dairy Sci 68:2377-2384.
- Goodall, S.R., P. Braddy, D. Horton, and B. Beckner.** 1982. Steam flaked versus high moisture corn rations with and without sarsaponin for finishing steers. In Proc. West. Sect. Am. Soc. Anim. Sci. 33:45-46.
- Grobner, M.A., D.E. Johnson, S.R. Goodall, and D.A. Benz.** 1982. Sarsaponin effects on in vitro continuous flow fermentation of a high grain diet. In: Proc. West. Sect. Am Soc Anim. Sci. 33:64-65.

- Hristov, A.N., T.A. McAllister, F.H. Van Herk, K.J. Cheng, C.J. Newbold, and P.R. Chase.** 1999. Effect of *Yucca schidigera* on ruminal fermentation and nutrient digestion in heifers. J. Anim. Sci. Vol. 77:2554-2563.
- Hussain, I. and P.R. Cheeke.** 1995. Effect of dietary *Yucca schidigera* extract on rumen and blood profiles of steers fed concentrate- or roughage-based diets. Anim. Feed Sci. Technol. 51:231-242.
- Landblom, D.G., D.K. Olson, W.W. Poland, K. Helmuth, and G.P. Lardy.** 2003. Field peas as an ingredient in calf weaning transition diets. Interim Progress Report. In 2003 Dickinson Research Extension Center Annual Report.
- Valdez, R.R., L.J. Bush, A.L. Goetsch, and F.N. Owens.** 1986. Effect of steroidal saponins on ruminal fermentation and on production of lactating dairy cows. J. Dairy Sci. 69:1568-1575.

Table 1. Experimental supplement formulation and calculated analysis.

	C ontrol	0% Pea + Yucca	15% Pea	15% Pea + Yucca
Corn	10.0	10.0	10.0	10.0
Peas	0.0	0.0	15.0	15.0
Soyhulls	39.421	39.421	37.656	37.656
Wheat Midds	24.56	24.56	18.818	18.818
Barley Malt Sprouts	20.0	20.0	12.5	12.5
Molasses	5.0	5.0	5.0	5.0
Limestone	0.30	0.30	0.30	0.30
Dical	0.1	0.1	0.1	0.1
Salt	0.5	0.5	0.5	0.5
<i>Yucca schidigera</i> Extract	0.0	^a	0.0	^a
TM Premix	0.075	0.075	0.075	0.075
Vitamin A & D Premix	0.025	0.025	0.025	0.025
Decoquinatate	0.0269	0.0269	0.0269	0.0269
Total	100.0	100.0	100.0	100.0
Analysis, %				
Crude Protein	16.5	16.5	16.2	16.2
TDN	69.3	69.3	69.9	69.9
C. Fiber	18.0	18.0	17.9	17.9
Fat	2.4	2.4	2.4	2.4
Degradable Protein	71.4	71.4	72.0	72.0
Nem, Mcal/lb.	.73	.73	.74	.74
Neg, Mcal/lb.	.46	.46	.47	.47

^a *Yucca schidigera* extracted inclusion was 35mg/lb of finished feed.

Table 2. Field pea weaning transition diets with and without *Yucca schidigera* extract.

	0% Pea	0% Pea+ <i>Yucca s.</i>	15% Pea	15% Pea+ <i>Yucca s.</i>	P-Value
Growth:					
No. Steers	18	18	17 ^a	18	
Days Fed	42	42	42	42	
Start Wt., lb.	453.4	445.8	461.9	443.2	
End Wt., lb.	583.8	582.2	594.8	569.2	
Gain, lb.	129.7	136.43	132.9	126.0	0.12
ADG, lb.	3.08	3.25	3.16	3.0	0.12
Intake, Effic., & Cost:					
Fd/Hd, lb.	507.3	515.0	514.0	528.6	0.50
Fd/Hd/Da, lb.	12.07	12.30	12.25	12.60	0.50
Feed:Gain	3.92	3.78	3.87	4.20	0.50
Fd Cost/Hd, \$	21.67	22.08	22.01	21.24	0.70
Fd Cost/Cwt Gain, \$	16.70	16.18	16.56	16.86	0.70

^a One steer died.

Table 3. Finishing performance and carcass measurements following 42d transition with and without field peas and *Yucca schidigera* extract.

	0% Pea	0% Pea+ <i>Yucca s.</i>	15% Pea	15% Pea+ <i>Yucca s.</i>	P-Value
Finishing Performance:					
Receiving Wt., lb.	574.9	570.8	586.5	565.4	0.78
Harvest Wt., lb.	1174.3	1172.2	1198.3	1167.0	0.82
Days on Feed	175.9	184.2	190.3	184.2	0.60
Gain, lb.	599.4	601.4	611.8	601.6	
ADG, lb.	3.39	3.27	3.21	3.29	0.43
F:G	5.63	5.42	5.51	5.36	0.11
Carcass Measurements:					
Hot Carcass Wt., lb.	727.6	728.1	748.7	730.4	0.77
REA, sq. in.	11.94	12.42	11.41	11.91	0.10
YG	3.34	3.18	3.37	3.26	0.64
QG	3.28	6.33	3.95	3.50	0.19
Percent Choice, %	67	61	56	67	