



Feeding Zero-Tannin Fababeans to Hogs



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Take Home Message:

Alberta pork producers can now feel confident about feeding locally grown ZT fababeans (Snowbird) in full substitution for field pea or imported soybean in hog diets. Our results show that feeding ZT fababeans (Snowbird) as the sole source of supplemental protein in hog diets had no detrimental effects on animal performance, carcass traits, separable pork yield or quality.

Zero-tannin (ZT) fababeans are an emerging pulse crop gaining popularity in Alberta (Figure 1). It shows good potential to replace locally grown field pea or imported soybean meal in pig diets.

Old fababeans were limited in their use in swine diets. A high content of anti-nutritional factors, mainly tannins, limited their dietary inclusion. However, the new zero-tannin (<1%) white-flowered varieties, such as Snowbird (Figure 2), may be a better feed alternative to some field pea varieties. ZT fababeans average 28% crude protein compared to 23% in field pea.

Fababeans prefer cool, moist growing conditions. It is best suited to the Parkland and Peace River regions of Alberta. It grows well on deep medium-textured soils that have a good water-holding capacity. Fababeans, however, do not tolerate hot, dry weather well. Hot, dry conditions cause droopy plants and reduce flower and seed set.



Figure 1. Zero-tannin Snowbird fababeans

Where fababeans truly shine is in their ability to host nitrogen-fixing bacteria in their root system. Fixing nitrogen in the soil reduces the subsequent need to apply chemical nitrogen fertilizer to rotational crops in the following year. In contrast to pea, fababeans allow nitrogen fixing beyond blooming until the plant dries. Thus, fababeans are possibly the best legume rotational crop to use with grains for producers having mixed farms (pigs, crops) in Black and Grey Wooded soil zones of central and north-western Alberta where, with adequate rainfall, they out-yield field pea.

Alberta Agriculture is leading the agronomic and feed testing of ZT fababeans. We previously reported that grower-finisher pigs performed well when fed 30% fababeans in substitution for soybean (*Western Hog Journal Fall 2004, Vol. 26, No. 2, pages 39 – 45*). However, a comparison to western Canadian grown pea has not been made.

The objectives of this study, therefore, were:

- To compare the performance and carcass characteristics of barrows and gilts fed Snowbird, zero-tannin fababeans to those fed locally-grown field pea or imported soybean meal, and
- To compare pork quality on a subsample of hogs fed the test diets

The Growout Hog Study

Approximately 1000 crossbred pigs (Fast Pigs, SK), one-half castrates and one-half gilts were part of this winter study conducted at the Drumloche Research Barn, near Irma, managed by Gowans Feed Consulting. The pigs originated from the Lewisville herd (8 km away) within the Alberta Pig Company production system.

The gilts and barrows were housed (~21 per pen) by gender in fully-slatted rectangular pens equipped with a single, two-opposing feeding places, wet/dry (Crystalsprings™) feeder and a single bowl drinker. The test room was also equipped with the FeedLogic™ robotic feed delivery and weighing system. The pigs were group-weighted by pen every two weeks and the amount of feed dropped in each pen feeder each time was electronically weighed by difference and tracked.

Table 1 shows the ingredient composition and calculated nutrient analysis of the phase test diets. The soybean meal in the control diet was fully replaced by fababeans or field pea or partially replaced (50:50) by fababeans. The diets were formulated based on net energy and exceeded NRC values for other nutrients.

Most hogs were shipped for slaughter to Britco in Langley, BC. A subsample of 96 hogs, 24 per week over four weeks, were shipped to Sturgeon Valley Pork for slaughter instead. The overnight chilled, right-half carcasses were then shipped to AAFC Lacombe for dissection and pork quality measurements (results not available yet). Except for the weighing the pigs and feed, the pigs in this trial were cared for and slaughtered following typical commercial practices for growing-finishing hogs.

Results

Table 2 summarizes the main effect of dietary protein source on growth performance and carcass characteristics. Daily feed disappearance, weight gain and feed:gain were similar among treatment diets. Carcass weight, backfat and loin depth, yield and index were also not different among dietary treatments.

Table 3 summarizes the main effect of dietary supplemental protein source on an array of pork quality measurements conducted 72h post-slaughter. Diet only affected the colour (Japanese scale), pH and drip loss measured in the loin eye (L. thoracis muscle). Pork from pigs fed 50% ZT fababeans and 50% SBM was slightly darker (0.37 points) than that of pigs fed either SBM alone or field pea. Muscle pH for pigs fed field pea was lower (0.065 points) than for pigs fed ZT fababeans or 50% ZT fababeans and 50% SBM. Drip loss in chops from pigs fed ZT fababeans or 50% ZT fababeans and 50% SBM was lower (1.18 percentage points) than that of pigs fed SBM alone or field pea.



Figure 2. Snowbird fababeans is a zero-tannin, white-flowered variety

Table 4 summarizes the main effect of dietary supplemental protein source on separable lean, fat and bone in pork primal cuts. Diet did not affect the proportion of lean, fat or bone in each of the four leanest primal cuts (picnic, butt, loin, ham), all combined, adding the bacon piece and side ribs or the dissected lean as a proportion of carcass side weight.

Typical differences between genders were evident (data not shown) on growth performance, carcass characteristics, pork quality and separable pork.

Table 1 (bottom) shows the study feed cost and gross income per hog after feed cost was subtracted (Jan 23 – May 08, 2006). Feed cost per kilo gained averaged \$0.39. Gross income per hog after feed cost averaged \$56.68. Feed cost per kilo gained was the lowest for hogs fed the field pea diet and highest for the hogs fed the soybean meal diet. However, income over feed cost was the same for the fababeans, 50:50 and pea treatments. Despite similar hog growth performance compared to field pea, higher fababeans yield may result in more pork produced per area of cultivated land.

Implications

These results indicate that locally grown ZT fababeans can fully or partially replace field pea or imported soybean meal as dietary supplemental protein source without negative effects on hog performance, carcass characteristics and pork yield. Feeding ZT fababeans had a small benefit on pork quality, which will be of interest to pork exporters.

Table 1. Test phase diets offered to hogs (31 - 118kg liveweight)

	<u>Grower 1</u>				<u>Grower 2</u>				<u>Grower 3</u>				<u>Finisher</u>			
	<u>SBM</u>	<u>Faba</u>	<u>/SBM</u>	<u>Pea</u>	<u>SBM</u>	<u>Faba</u>	<u>/SBM</u>	<u>Pea</u>	<u>SBM</u>	<u>Faba</u>	<u>/SBM</u>	<u>Pea</u>	<u>SBM</u>	<u>Faba</u>	<u>/SBM</u>	<u>Pea</u>
Wheat	78.5	60.7	69.7	57.1	79.6	62.2	71.0	59.2	83.3	68.7	75.3	65.4	69.3	60.3	64.5	52.1
Barley													18.8	17.6	18.4	23.8
Fababean		33.0	16.5			32.0	16.0			27.4	15.0			19.0	10.0	
Soybean meal	16.6		8.7		15.0		7.4		13.0		5.9		8.9		4.1	
Peas				37.0				35.5				31.0				21.0
Canola meal					1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tallow	2.21	2.22	2.22	1.83	2.12	2.16	2.14	1.78	0.76	0.78	0.77	0.47				
Limestone	1.33	1.29	1.31	1.29	1.28	1.23	1.26	1.24	1.21	1.18	1.20	1.18	1.20	1.18	1.19	1.17
Salt	0.42	0.44	0.43	0.41	0.42	0.44	0.43	0.41	0.41	0.43	0.42	0.40	0.40	0.41	0.41	0.39
Mono-Cal	0.33	0.48	0.40	0.47	0.13	0.27	0.20	0.26	0.00	0.10	0.04	0.09	0.14	0.22	0.19	0.24
Vit & TM micro	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.07	0.07	0.07	0.07
Amino acids	0.53	0.77	0.64	0.77	0.38	0.56	0.46	0.56	0.23	0.34	0.28	0.34	0.15	0.21	0.18	0.21
NE, Mcal/kg	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.4	2.4	2.4	2.4	2.35	2.35	2.35	2.35
TID lys:NE, g/Mcal	4.0	4.0	4.0	4.0	3.6	3.6	3.6	3.6	3.2	3.2	3.2	3.2	2.7	2.7	2.7	2.7
Ca, %	0.7	0.7	0.7	0.7	0.65	0.65	0.65	0.65	0.6	0.6	0.6	0.6	0.55	0.55	0.55	0.55
Av P, %	0.3	0.3	0.3	0.3	0.26	0.26	0.26	0.26	0.24	0.23	0.23	0.23	0.19	0.19	0.19	0.19

Table 2. Growth performance and carcass characteristics of hogs fed zero-tannin, Snowbird fababean in substitution for field pea or soybean meal (31 – 108 kg liveweight)

	<u>SBM</u>	<u>Faba</u>	<u>Faba / SBM</u>	<u>Pea</u>
Initial weight, kg	31.8	31.0	31.8	30.7
5-wk end weight, kg	65.9	65.1	65.9	65.0
Daily weight gain, kg	0.983	0.968	0.981	0.978
Daily feed disappearance, kg	2.19	2.22	2.24	2.21
Feed:gain, kg:kg	2.23	2.29	2.29	2.26
11-wk end weight, kg	108.6	108.6	108.9	107.8
Daily weight gain, kg	1.008	1.035	1.018	1.011
Daily feed disappearance, kg	3.07	3.06	3.08	3.05
Feed:gain, kg:kg	3.05	2.96	3.02	3.01
0 – 11 wk overall				
Daily feed disappearance, kg	2.595	2.621	2.623	2.623
Daily weight gain, kg	1.002	1.007	1.007	1.006
Feed:gain, kg:kg	2.626	2.611	2.627	2.626
Carcass wt, kg	94.63	93.85	94.63	94.76
Carcass fat ² , mm	20.86	20.07	20.63	20.50
Carcass lean ² , mm	65.23	65.68	65.24	64.55
Carcass yield %	59.89	60.25	60.00	59.99
Carcass index	110.47	110.96	110.45	110.57
Feed cost, \$/kg gained	0.400	0.396	0.386	0.384
Income over feed cost \$/pig	55.8	57.0	57.0	57.0

²Destron grading system

Table 3. Pork quality traits (*Longissimus thoracis* muscle) 72h post-slaughter of hogs fed ZT Snowbird fababean in substitution for field pea or soybean meal (31 – 108 kg liveweight)

	SBM	Faba	Faba / SBM	Pea
n, carcass sides	24	24	24	24
Minolta ^z L*	53.40	52.25	52.05	53.78
Minolta ^z a*	8.02	7.55	7.97	8.08
Minolta ^z b*	5.30	4.68	4.84	5.31
Minolta ^z C	9.63	8.90	9.34	9.70
Minolta ^z Hue angle	33.38	31.67	30.91	33.09
AAFC colour ^y score	3.06	2.98	3.25	2.99
AAFC structure ^y score	2.98	3.00	3.10	3.01
NPPC colour ^y score	3.02	3.15	3.21	3.01
NPPC firmness ^y score	3.27	3.17	3.25	2.88
Japanese colour score	3.02 a	3.17 ab	3.40 b	3.04 a
Muscle pH	5.51 ab	5.56 a	5.55 a	5.49 b
Moisture, g/100g	73.72	73.78	73.71	73.81
Fat content ^x , g/100g	3.02	3.01	2.97	2.99
Shear weight ^w , kg	5.11	5.22	5.27	4.94
Ribeye area ^v , cm ²	45.46	45.31	46.16	46.06
Ribeye max. length ^v , cm	9.95	9.94	9.90	9.97
Ribeye max. width ^v , cm	6.16	6.03	6.26	6.11
¾ fat ^v , cm	1.68	1.72	1.74	1.86
7cm fat ^v , cm	1.59	1.58	1.68	1.78
Muscle depth ^v , cm	6.24	6.15	6.31	6.17
NPPC marbling ^v score	2.67	2.60	2.42	2.48
Drip loss, %	6.12 a	4.83 b	4.87 b	5.94 a
Durometer ^u , units	67.47	67.31	68.73	71.53

^zAverage of three measurements

^yAverage of two trained observers

^xAverage of two intramuscular Soxtec fat extractions

^wAverage of two measurements for each of two chops

^vBetween the 3rd and 4th last rib (grading site) based on image analyses

^uType D. Average of three measurements after the maximum and minimum measurements were discarded

^sMeans within a row showing different superscript letter differ ($P < 0.05$)

Table 4. Separable lean, fat and bone in pork primal cuts of hogs fed ZT Snowbird fababeans in substitution for field pea or soybean meal

	<u>SBM</u>	<u>Faba</u>	<u>Faba / SBM</u>	<u>Pea</u>
n, sides	24	24	24	24
Picnic				
Lean, g/kg	642	637	636	637
Fat, g/kg	272	274	278	276
Bone, g/kg	083	087	083	083
Butt				
Lean, g/kg	591	587	582	579
Fat, g/kg	361	361	369	370
Bone, g/kg	045	046	046	047
Loin				
Lean, g/kg	555	545	548	533
Fat, g/kg	321	328	325	341
Bone, g/kg	121	124	123	125
Ham				
Lean, g/kg	615	611	610	608
Fat, g/kg	237	240	244	245
Bone, g/kg	085	085	084	084
Weight of the leanest four primal cuts, kg	31.148	30.99	31.10	30.92
Lean in the four leanest cuts, %	61.10	59.40	60.51	59.30
Fat in the four leanest 4 cuts, %	29.16	30.57	29.70	30.94
Bone in the four leanest 4 cuts, %	9.48	9.70	9.58	9.40
Pork yield of the four leanest cuts + bacon piece + side ribs, kg	24.350	23.83	24.08	23.64
Lean as % of carcass side	56.86	55.70	56.26	55.23

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