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Recent Advances in Alberta

Feed Research with Pulse Seed and Fractions

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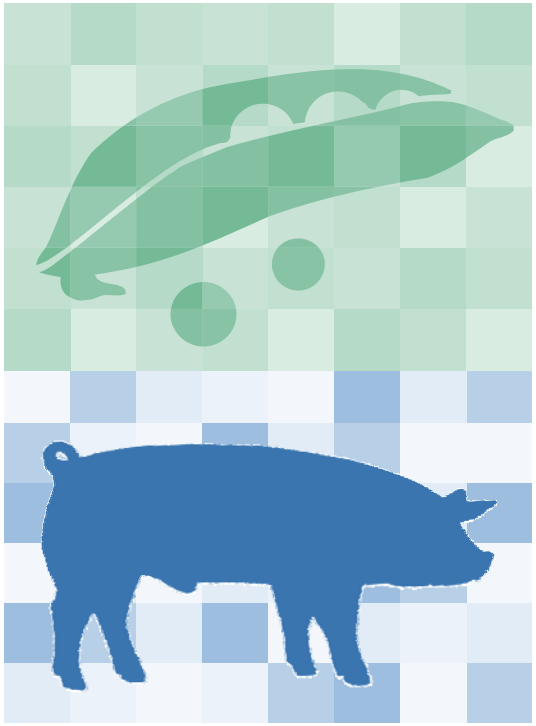

Agriculture and Rural Development

Executive Summary

This document summarizes nine feed research experiments, conducted in Alberta, where zero-tannin (ZT) faba bean, lupin and field pea were fed to weaned or grower-finisher pigs. Five of these studies looked at raw, ground grain while four examined air-classified protein and starch fractions.

Our first study sought to establish nutrient digestibility coefficients for ZT faba bean. Apparent total tract (ATTD) energy digestibility, digestible energy (DE) and net energy (NE) content were 88.5%, and 3.47 and 2.27 Mcal/kg (as fed), respectively. Apparent ileal digestibility was 85.9, 76.1, and 74.1% and SID AA content was 1.54, 0.70, and 0.16% (as fed), for lysine, threonine, and methionine, respectively.

Experiments two and three demonstrated that ZT faba bean (Snowbird) is nutritionally equivalent to locally-grown field pea or imported soybean meal as a supplemental protein source in hog diets. We confirmed that there are no detrimental effects of feeding either pulse grain on carcass traits, the lean yield of primal cuts or pork quality.

Our fourth study showed that ZT faba bean can be successfully included at levels up to 40% in weaner pig diets as a replacement for iimported soybean meal.

Lupin is the second highest N-fixing legume crop after faba bean. Lupin kernel meal has potential to replace imported soybean meal in swine diets (42 vs. 46% protein). Our fifth study, tested the increasing dietary inclusion (0, 10 ,20, 30%) of high and low protein lupin in weaner pig diets. We concluded that lupin kernel meal can replace imported soybean meal in nursery diets. We underestimated the net energy content of low protein lupin, yet overestimated the nutrient digestibility of high protein lupin.

The next four studies evaluated feeding the air-classified protein and starch fractions to swine. First, we established the nutrient digestibility coefficients for the protein and starch fractions of ZT faba bean and field pea and compared them to soy protein concentrate and cornstarch. The NE value was 3.16, 2.96, 2.91 Mcal/kg for faba bean, field pea and soy protein concentrate, respectively. The NE value was 2.66, 2.65, 2.59 Mcal/kg for faba bean, field pea and corn starch, respectively. The SID of Lys was 95.5, 92.6, 88.7% for faba bean, field pea, and soy protein, respectively. Second, we tested feeding the air-classified protein concentrates of ZT faba bean and field pea replacing a combination of specialty proteins (soy protein concentrate, fishmeal and corn gluten meal) commonly used in North American nursery diets. The growth of weaner pigs fed the air-classified pulse fractions was similar between pulses or against those fed the combination of specialty proteins.

Our last two studies focused on feeding pulse starches. We found that ileal starch digestion tended to be higher for an extruded wheat diet vs. the extruded faba bean diets, while total tract digestibility of starch and energy was higher for the extruded faba bean starch diets than the extruded wheat grain diet. The *in vivo* kinetics of starch and energy digestion differed between extruded wheat grain and the faba bean starch diets.

Starches have structural properties that affect their rate of digestion and the animal response to their absorption. We evaluated feeding air-classified ZT faba bean and field pea starch in comparison to unmodified potato, tapioca, wheat or corn starch as the primary source of dietary energy for young pigs. Faba bean starch proved to be more slowly digested than pea starch, and both rated slower in digestibility than grain starch (corn, wheat). We concluded that pulse starches have unique functional properties with the potential to support more adequate lean deposition rates in hogs than cereal grains

The nutritional value of zero-tannin faba bean for grower-finisher pigs

Ruurd T. Zijlstra[1] Ken Lopetinsky[2] and Eduardo Beltranena[1,2]

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Objective

This objective of this study was to determine the nutrient profile of zero-tannin (ZT) faba bean and evaluate effects of dietary inclusion on growth performance and carcass characteristics of grower-finisher pigs.

Our Approach

The study was broken up into two separate experiments. Experiment 1 was a digestibility trial where we sought to measure apparent total tract energy digestibility and ileal amino acid (AA) digestibility. Twelve 55-kg barrows surgically fitted with an ileal cannula were fed either a 96%-faba bean diet or a 62%-faba bean diet containing cornstarch twice daily at 3 x maintenance digestible energy (DE) intake. After a 6-d acclimation, faeces were collected for 2 d and ileal digesta for 2 d.

Experiment 2 looked at the performance of 100 grower pigs fed either a soybean or faba bean-based diet from 35 to 115 kg liveweight. Diets were formulated to contain balanced levels of NE and SID AA between treatments using the information generated in experiment 1. Pigs were weighed, feed intake was measured, and carcass measurements were obtained.

What we Observed

In experiment one, faba bean contained (as fed) 27.5% crude protein (CP), 1.75% lysine, 0.88% threonine, and 0.21% methionine. Apparent ileal digestibility was 85.9, 76.1, and 74.1%, and SID AA content was 1.54, 0.70, and 0.16% (as fed), for lysine, threonine, and methionine, respectively. Apparent total tract energy digestibility, and digestible energy and NE content were 88.5%, and 3.47 and 2.27 Mcal/kg (as fed), respectively.

In experiment 2, there was no difference in average daily feed intake (ADFI, 2.58 vs. 2.56 kg/d) or average daily gain (ADG, 0.96 vs. 0.98 kg/d) between faba bean and soybean meal diets over the 35 to 115 kg weight range. Feed efficiency was 0.02 higher for soybean meal than faba bean in the grower phase ($P < 0.05$).

In terms of carcass characteristics, back fat thickness did not differ between treatments, although loin depth was 4.0 mm thicker for soybean meal compared to faba bean ($P < 0.05$).

Implications

Zero-tannin faba bean has a nutrient profile which lends itself well to serving as a protein supplement in grower-finisher pig rations. Our study suggests ZT faba bean ADFI or ADG of grower-finisher pigs at inclusion rates up to 30%.

Reduced feed efficiency in the grower phase together with reduced lean thickness for pigs fed faba bean suggests dietary AA supply might have been limiting for the faba bean diets early in the study.

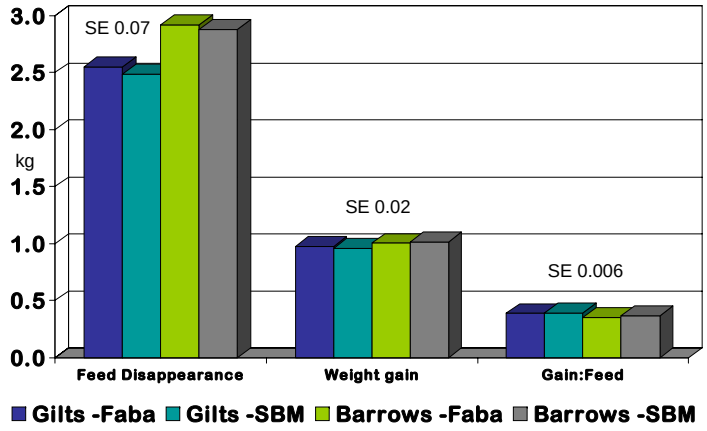


Figure 1. Effect of soybean meal vs. ZT faba bean on performance of gilts and barrows

The effect of feeding zero-tannin faba bean, field pea or soybean meal: Growth performance and carcass traits of hogs

Eduardo Beltranena[1,4], Wayne Robertson[2], Malachy Young[3] and Ruurd Zijlstra[4]

[1]Alberta Agriculture and Rural Development, [2]Agriculture and Agri-Food Canada, [3]Gowans Feed Consulting, [4]University of Alberta

Objective

The objective of this study was to compare the animal performance and carcass characteristics of barrows and gilts fed zero-tannin (ZT) faba bean (Snowbird) to those fed locally-grown field pea or imported soybean meal.

Our Approach

Approximately 1000 crossbred pigs were part of this commercial scale growth trial conducted at the Drumloche Research Barn, near Irma, AB. Pigs were housed by gender, 21 per pen, in fully-slatted rectangular pens equipped with a two-space, wet/dry 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-weighed every two weeks and the amount of feed dropped in each pen feeder each time was electronically weighed by difference and tracked. The soybean meal in the control diet was fully replaced by faba bean or field pea or partially replaced (50:50) by faba bean. The majority of hogs were shipped for slaughter to Britco in Langley, BC.

What we Observed

We observed differences between genders in growth performance and carcass characteristics, but these were within expected ranges. There were no differences however in daily feed disappearance, weight gain, gain:feed ratio, loin or backfat depth, yield or carcass index between test diets.

Implications

The results of this study suggest that locally grown ZT faba bean can fully or partially replace field pea or soybean meal as dietary supplemental protein source without negative effects on hog performance and carcass characteristics.

Feed cost per kg of weight gain was lowest for hogs fed field peas and highest for those fed soybean meal, however income over feed cost was the same for the ZT faba bean, the 50:50 and pea diets. Based on these results, we estimate that growing ZT faba bean would result in more pork (407 kg) produced and higher income ($569) per cultivated land hectare, on average, compared to field pea.

Snowbird ZT faba bean, planted in Alberta's Black or Grey Wooded soils, has the potential to increase kg of pork produced and income per unit of cultivated land compared to field pea in years with adequate rainfall.

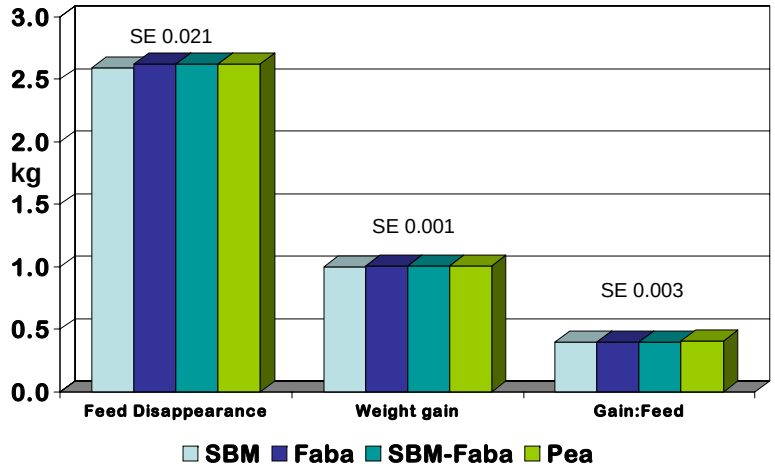


Figure 2. Effect of partial or complete substitution of soybean meal for ZT faba bean or field pea on growth performance

The effect of feeding zero-tannin faba bean, field pea or soybean meal: Pork yield in primal cuts and loin quality

Eduardo Beltranena[1,4], Wayne Robertson[2], Malachy Young[3] and Ruurd Zijlstra[4]

[1]Alberta Agriculture and Rural Development, [2]Agriculture and Agri-Food Canada, [3]Gowans Feed Consulting, [4]University of Alberta

Background and Objective

In a previously described, experiment we looked at the impact of feeding ZT faba bean (Snowbird) as a full replacement for field pea or as a half or full replacement for soybean meal. In this related study we looked at the effect that these different diets had on pork yield of the primal cuts and loin quality traits.

The purpose of this study was to ensure that feeding ZT faba bean would not adversely affect pork quality and thereby jeopardize current and potential export markets.

Our Approach

Of the 1000 hogs that were part of the overall study, a sub-sample of 96 hogs, 24 per week, were slaughtered at Sturgeon Valley Pork in St. Albert, AB.

After chilling overnight, one side from each carcass was shipped to the Agriculture and Agri-Food Canada (AAFC) Lacombe Research Centre to determine yield of primal cuts and to evaluate pork loin quality.

What we Observed

Dietary treatment did not affect proportions of lean, fat and bone in any of the four primal cuts (the picnic, the butt, the loin or the ham), the four primal cuts combined, or the four primal cuts plus the bacon piece and side ribs. Feeding ZT faba bean thus resulted in similar proportions of lean, fat and bone in primal cuts when it replaced field pea or soybean meal in the diet.

The diets fed had mostly no effect in loin quality traits except for the Japanese colour scores, loin ultimate pH and drip loss. Loin muscle from hogs fed the diet containing half ZT faba bean and half soybean meal was slightly darker than that of hogs fed field pea or soybean meal. The loin muscle colour of hogs fed ZT faba bean as full replacement for soybean meal or field pea was intermediate to the other diet treatments. Loin muscles from hogs fed either of the diets containing ZT faba bean had higher ultimate pH and lower drip loss compared to diets containing exclusively peas or soybean meal.

Implications

This study suggests that in addition to negligible differences in pig performance, pork from hogs fed ZT faba bean was slightly darker, retained more water (juiciness) and had lower drip loss compared to pork from hogs fed either field pea or soybean meal.

This further demonstrates the feasibility of using ZT faba bean as a supplemental protein source in hog diets, displacing more costly or imported protein supplements.

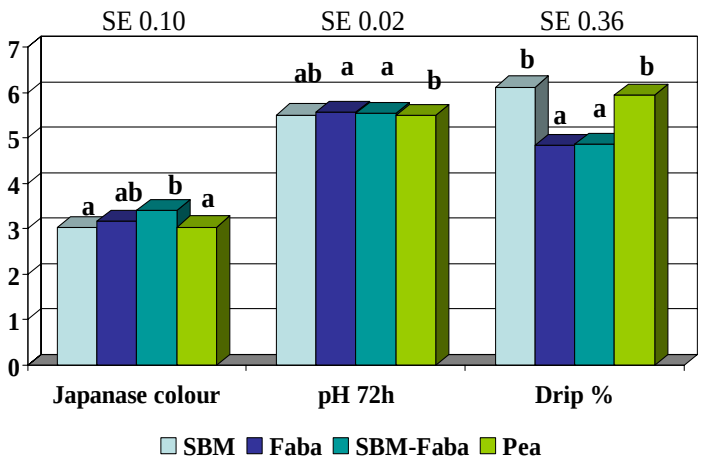


Figure 3. Effect of partial or complete substitution of soybean meal for ZT faba bean or field pea on carcass quality parameters

Zero-tannin faba bean can fully replace soybean meal in late nursery diets

Eduardo Beltranena[1,2] and Ruurd T. Zijlstra[2]

[1]Alberta Agriculture and Rural Development, [2]University of Alberta

Background and Objective

Prior to this study, it was not known whether weaner pigs (10-23 kg) could tolerate high dietary inclusion levels of faba bean. Although, tannins have been reduced in modern faba bean varieties, we suspected that other anti-nutritional factors might be present that could impair digestion in weaner pigs. Legumes, in general, have complex carbohydrates that can cause digestive upset in young animals. We hypothesized that weaner pigs might develop a progressive tolerance as their digestive capacity increases with age. If this was true, we might expect to see an initial reduction in performance, but gradual improvements after a few weeks of feeding.

The objective of this study was to investigate the effect of graded substitutions of ZT faba bean for soybean meal in late nursery diets on pig performance.

Our Approach

We tested the inclusion of 0, 10, 20, 30 and 40% ZT faba bean in nursery diets by partially or entirely substituting imported soybean meal in the diet. We targeted the late nursery stage since at this stage specialty, highly digestible ingredients are phased out of the diet due to cost, and the level of soybean meal is considerably increased.

Pigs weaned at approximately 17 days of age were offered the test diets for the 14 to 35 days post-weaning period. We weighed the pigs, recorded pen feed disappearance (intake plus waste) and calculated feed conversion for each week of the study. We also collected faecal samples towards the end of the trial to confirm of digestible energy (DE) content of diets.

What we Observed

Weaner pigs fed diets where ZT faba bean partially or completely replaced soybean meal had similar performance to pigs fed the 22% soybean meal control diet. Feed disappearance, weight gain and feed conversion were not significantly reduced by faba bean inclusion, either when compared week-to-week or for the overall trial period.

Overall, weaned pigs in this study seemed to tolerate faba bean quite well in the late nursery stage and did not appear to require a progressive adaptation to faba bean in the diet.

Implications

The practical level of ZT faba bean inclusion in swine diets will be ultimately determined by nutrient availability and cost in relation to other feed commodities.

Producers and nutritionists, however, should feel confident that Alberta-grown ZT faba bean (Snowbird, up to a 40% inclusion) can fully replace imported soybean meal as a source of supplemental protein in late nursery diets (10 – 23 kg or 14 – 35 days post-weaning) without detrimental effects to weaner pig performance.

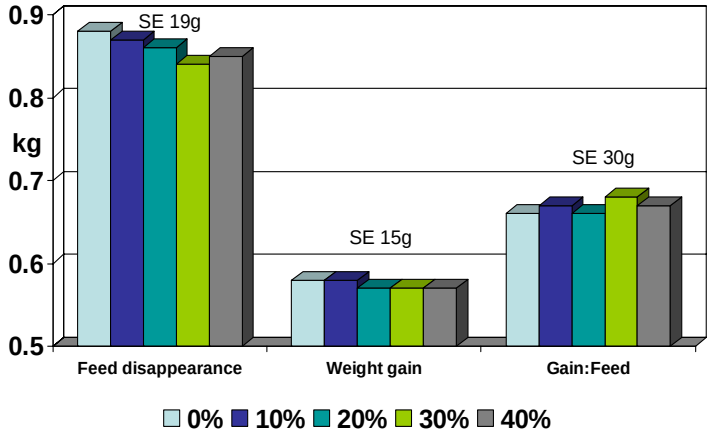


Figure 4. Zero tannin faba bean inclusion in late nursery pig diets

The effect of increasing levels of lupin kernel meal inclusion in nursery diets on growth performance in weaned pigs

Eduardo Beltranena[1,3], Miguel A. Barrera[2] and Ruurd T. Zijlstra[3]

[1]Alberta Agriculture and Rural Development, [2]Universidad Autónoma de Baja California, México,[3]University of Alberta

Background and Objective

Lupin and faba bean have been evaluated as cool weather legume alternatives to field pea in cereal crop rotations in Central Alberta. Lupin is the second highest N-fixing legume crop after faba bean. Once dehulled, lupin kernel meal offers the potential to replace imported soybean meal in swine diets (42 vs. 46% protein). But huge variations in dehulled protein content have been observed most likely due to inconsistent inoculation with rizobia spp. .

The objective of this experiment was to study the effect of increasing dietary inclusion levels of high and low protein lupin in nursery diets on the performance of weaner pigs.

Our Approach

High (42%) and a low (29%) crude protein lupin samples were identified and tested by feeding weaner pigs. Test diets were formulated to contain similar levels of dietary energy and amino acids, but we suspected weaner pigs would be challenged by the high levels non-starch polysaccharides (NSPs) in test diets with high inclusion levels of lupin.

Two groups of 80 castrates and 80 gilts, 40 and 40 per week were selected for this study starting at 27 – 30 d of age, 7 – 10d post-weaning. Animals were housed 2 gilts and 2 castrates per pen and had ad libitum access to water and to one of seven randomly assigned diets (soybean meal control, 10, 20, or 30% high or low protein lupin) for the duration of the 28-day trial. Pigs were individually weighed and pen feed disappearance was determined weekly.

To evaluate nutrient digestibility, faecal grab samples were collected from the pen floor from randomly picked pigs in each pen on d 15 and 16.

What we Observed

Daily feed disappearance (i.e., feed intake) decreased in comparison to the soybean meal control diet as dietary inclusion of high protein lupin increased. The same trend was not observed with the low protein lupin. Likewise, average daily gain was reduced only in diets containing 20 and 30% high protein lupin. Gain:feed ratio improved as dietary inclusion of low and high protein lupin increased.

Implications

The results of this study demonstrate that locally-grown lupin kernel meal can fully replace imported soybean meal in nursery diets for weaner pigs.

The energy estimates used to formulate diets for this study most likely underestimated the net energy content of low protein lupin, but overestimated nutrient digestibility in high protein lupin.

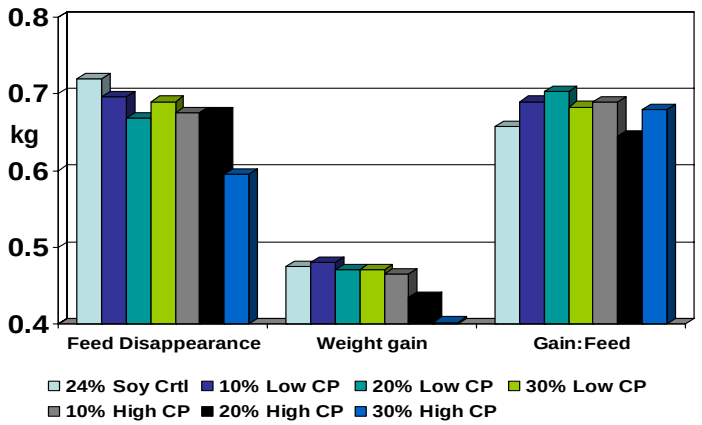


Figure 5. Lupin kernel meal in nursery pig diets

Nutrient digestibility of the air-classified protein and starch fractions of field pea and faba bean in grower pigs

Chathurika K. Gunawardena[1], Ruurd T. Zijlstra[1], Laki Goonewardene[1,2] and E Beltranena[1,2]

[1]University of Alberta, [2] Alberta Agriculture and Rural Development

Background and Objective

Most legume seed flours can be rapidly and economically fractionated by air-classification into protein and starch concentrates. The nutritional value of these air-classified legume concentrates requires characterization to assess the feeding opportunity for young animals.

This study sought to determine:

- Apparent total tract digestibility (ATTD) of dry matter (DM), organic matter (OM), gross energy (GE), starch, crude protein (CP), fat and ash;
- Apparent ileal digestibility (AID) of CP, amino acids (AA) and starch; and
- Standardized ileal digestibility (SID)

of AA of air-classified zero-tannin (ZT) faba bean and field pea protein and starch concentrates for growing pigs.

Our Approach

Legumes were compared to each other and to soy protein concentrate and unmodified corn starch as corresponding standards; corn starch also served as N-free diet to correct for endogenous AA losses.

In a Youden square design, eight ileal-cannulated barrows (24.9 ± 2.3 kg) were fed 6 diets over 7 periods at 3 times the maintenance digestible energy requirement. Periods encompassed a 5-d diet adaptation, 3-d faeces collection and 3-d ileal digesta collection.

What we Observed

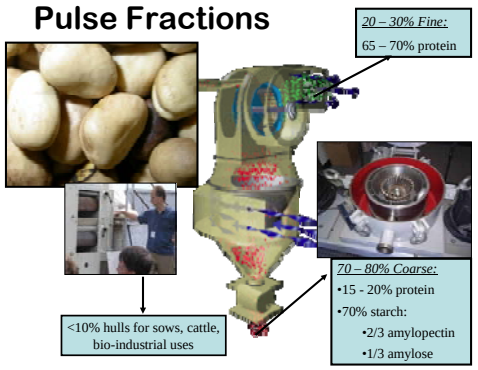
The ATTD of GE was 2% higher ($P < 0.05$) for faba bean than soy and intermediate for field pea protein (95.6, 93.7, 94.9%, respectively). The ATTD of GE was 3.6% higher ($P < 0.05$) for corn and field pea than faba bean starch (96.2, 95.1, 92.3%, respectively). The digestible energy (DE) value of faba bean was 7.8% higher ($P < 0.05$) than field pea or soy protein (4.58, 4.26, 4.24 Mcal/kg, respectively). The DE value of faba bean and field pea was 3.6% higher ($P < 0.05$) than corn starch (3.78, 3.74, 3.63 Mcal/kg, respectively).

The calculated NE value was highest ($P < 0.05$) for faba bean, intermediate for field pea, and lowest for soy protein (3.16, 2.96, 2.91 Mcal/kg, respectively). The calculated NE values for faba bean and field pea were 2.5% higher ($P < 0.05$) than for corn starch (2.66, 2.65, 2.59 Mcal/kg, respectively).

Protein concentrates averaged 16% higher ($P < 0.05$) DE and NE values than starches. The SID of Lys was 6.0% higher ($P < 0.05$) for faba bean and field pea than soy protein (95.5, 92.6, 88.7%, respectively). The SID of Lys was 7.0% higher ($P < 0.05$) for faba bean than field pea starch.

Implications

The results of this study indicate that the air-classified fractions of ZT faba bean and field pea constitute concentrated sources of highly digestible protein and starch and would be appropriate for young animals with high nutritional demands.



Air-classified faba bean and field pea protein concentrates as replacements for specialty proteins in diets for weaned pigs

Chathurika K. Gunawardena[1], Ruurd T. Zijlstra[1], Laki Goonewardene[1,2] and E Beltranena[1,2]

[1]University of Alberta, [2]Alberta Agriculture and Rural Development

Objective

The objective of this study was to determine whether air-classified zero-tannin (ZT) faba bean or field pea protein concentrates yield comparable growth performance and nutrient digestibility differences compared to a combination of specialty proteins (soy protein concentrate, fishmeal and corn gluten meal), commonly used in North American nursery diets.

Our Approach

In a 28-day trial, 7.5 kg pigs (~27d of age) were weighed and pen feed disappearance calculated on a weekly basis. Faecal grabs samples were collected from each pen from d 18 to 21.

What we Observed

There was no effect of diet on daily feed disappearance, weight gain or gain:feed ratio for any weekly period or overall ($P > 0.05$). However, pigs fed the field pea protein diet were heavier (44 g) overall than pigs fed the other diets ($P < 0.05$).

Apparent total tract energy and protein digestibility improved nearly 2 % units when feeding the dehulled faba bean and field pea protein concentrate diets compared to the control diet, but was 3.5 % units lower by feeding the hulled faba bean concentrate diet ($P < 0.05$).

Phosphorus digestibility averaged 5 % units higher for the pulse protein diets compared to feeding the pigs the control diet ($P < 0.05$). Fat digestibility was different between the hulled and dehulled faba protein diets, 3.23 and 4.39 % units lower than the control diet, respectively; the field pea protein diet was 1.6 % units lower than the control diet ($P < 0.05$).

Fibre digestibility was improved by 9.37 and 1.81% units by feeding the dehulled faba bean and field pea protein diets, respectively, compared to the control diet, but was 6.8 % units lower by feeding the hulled faba protein diet ($P < 0.05$).

Implications

The growth of pigs fed the air-classified pulse fractions was similar between pulses or against those fed the combination of specialty proteins. Except for fat, nutrient digestibility for the dehulled pulse protein diets was equivalent or superior to the control diet suggesting that dehulled ZT faba bean and field pea protein fractions can provide highly concentrated nutrients to young pigs with high nutritional demands.

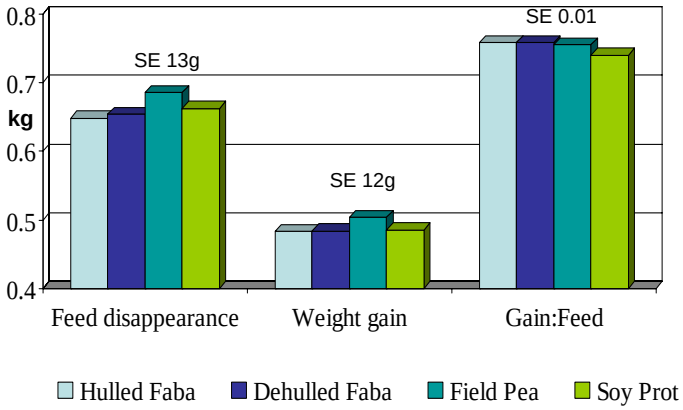


Figure 6. Feeding hulled or dehulled ZT faba bean, field pea or soy protein concentrate to weaner pigs

Starch and energy digestibility in weaned pigs fed extruded zero-tannin faba bean starch and wheat as an energy source

Kris T. Wierenga[1], Eduardo Beltranena[1,2], Jorge L. Yánez[3] and Ruurd T. Zijlstra[1]

[1]University of Alberta, [2]Alberta Agriculture and Rural Development,[3]Universidad Autónoma de Baja California, México

Objective

Digestion of extruded starch is poorly characterized. The purpose of this study was to compare digestibility parameters of wheat and extruded zero tannin (ZT) faba bean starch.

Our Approach

Two diets containing ground wheat grain or faba bean starch were extruded individually or combined 50:50 (wt/wt) and fed to weaned pigs.

What we Observed

Ileal starch digestion tended to be higher ($P < 0.10$) for the extruded wheat diet than the extruded faba bean diets, while total tract digestibility of starch and energy was higher ($P < 0.05$) for the two extruded faba bean starch diets than the extruded wheat grain diet. Feed intake tended to be higher ($P < 0.10$) for the extruded faba bean starch diet, but final body weight was not affected by extruded starch source. Feed intake tended to be higher ($P < 0.10$) for extruded faba bean starch diet, but final body weight was not affected by extruded starch source.

Implications

The *in vivo* kinetics of starch and energy digestion differed between extruded wheat grain and faba bean starch diets.

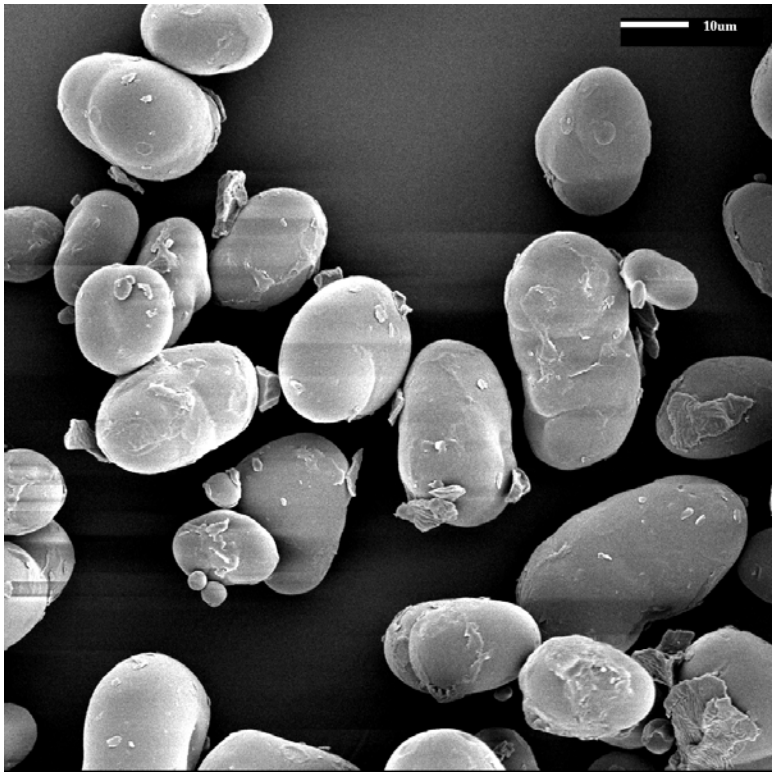


Figure 7. Scanning electron micrograph of faba bean starch granules

The effect of starch source on growth performance, nutrient digestibility, nitrogen balance and plasma metabolites of weaned pigs fed pulse starches

Chathurika K. Gunawardena[1], Ruurd T. Zijlstra[1], Laki Goonewardene[1,2] and E Beltranena[1,2]

[1]University of Alberta, [2]Alberta Agriculture and Rural Development

Background and Objective

Starches have structural properties that affect their rate of digestion and the animal or human response to their absorption. Legumes have higher content of slow digestible starch (amylase) compared to cereal grains. Slow digestible starch results in a more prolonged but continuous rather than a sharp but short increment in glucose after absorption from the gut into the blood stream (glycaemic index). The resulting prolonged release of insulin in blood may be more important for lean tissue deposition, which may then be more synchronous with muscle amino acid uptake resulting in animal growth. Thus, dietary starch source and type may modulate muscle growth and reduce nitrogen excretion.

The present study evaluated the effect of feeding air-classified zero tannin (ZT) faba bean and field pea starch in comparison to unmodified potato, tapioca, wheat or corn starch as the primary source of dietary energy for young pigs.

Our Approach

One week post-weaning, 36 crossbred barrows were relocated to individual pens for a 21 d trial. Feed disappearance and weigh gain were measured for the first 14d on trial. Faeces and urine were collected during the last five days on trial. Pre- (-15 min) and post-feeding (120 min) blood samples were also collected to asses metabolic state on Day 21.

What we Observed

Feed disappearance was highest ($P < 0.05$) for barrows fed field pea and tapioca, followed by corn, wheat and potato and lowest for those fed the faba bean starch diet for the 0 – 14d period. Barrows fed tapioca, field pea, corn and wheat grew faster ($P < 0.05$) than those fed potato or the faba bean starch diet for the 0 – 14d period. Gain:feed was highest ($P < 0.05$) for barrows fed corn, wheat and tapioca, followed by field pea and lowest for those fed the faba bean or potato starch diets.

The ATTD of dry matter (DM), gross energy (GE), digestible energy (DE) and crude protein (CP) was highest ($P < 0.05$) for corn and tapioca, followed by faba bean and field pea, then by wheat and were lowest for the potato starch diet. The ATTD of starch was not different among starch sources except for potato starch that was lower ($P < 0.05$) than the rest.

Nitrogen retention (g/d) was highest ($P < 0.05$) for wheat, followed by field pea and tapioca and was lowest for pigs fed the faba bean or potato starch diets; starch source had no effect on N retention when expressed as a percentage of N intake.

Implications

The results of this study confirmed differences in starch digestibility that were reflected in animal performance. Faba bean starch proved to be more slowly digested than pea starch, and both rated slower than grain starch (corn, wheat).

Inclusion of both cereal and pulse grains in swine diets provides both fast and intermediate digestible starches likely to support more adequate lean deposition rates than cereal grains alone.

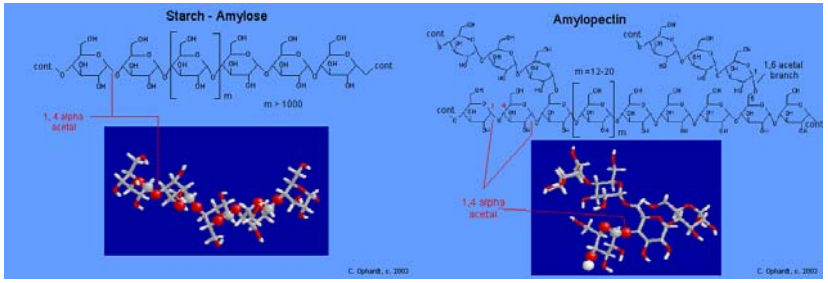


Figure 8. Structures of amylase and amylopectin

Summary of Extension Activities

Below is a chronological listing of presentations and publication where results from the studies contained in this report have previously been extended.

2008

Beltranena, E. and R. T. Zijsltra. 2008. Getting value from your feed dollar with novel, western-Canadian feed ingredients. Proceedings of the Saskatchewan Pork Symposium.

R. T. Zijlstra and E. Beltranena. 2008. Regaining Competitiveness –Alternative Feedstuffs for Swine. Alberta Pork meetings in Grand Prairie, Fort Saskatchewan, Red Deer and Lethbridge

Zijlstra, R. T., K. Lopetinsky, and E. Beltranena. 2008. The nutritional value of zero-tannin faba bean for grower-finisher pigs. Can. J. Anim. Sci. 88:293–302.

Gunawardena, C. K., R. T. Zijlstra and E. Beltranena. 2008. Nutrient digestibility of lupin and the air-classified protein and starch fractions of field pea and faba bean in grower pigs. 41th meeting of the Midwestern Section, American Society of Animal Science, Des Moines, IA. Abstr. 136, J. Anim. Sci. Suppl. 2.

Gunawardena, C. K., R. T. Zijlstra, L. Goonewardene and E. Beltranena. 2008. Faba bean and field pea protein concentrates as replacements for specialty proteins in nursery diets for weaned pigs. 41th meeting of the Midwestern Section, American Society of Animal Science, Des Moines, IA. Abstr. 138, J. Anim. Sci. Suppl. 2.

Gunawardena, C., W. Robertson, M. Young, L. Goonewardene, R. Zijlstra, and E. Beltranena. 2008. Feeding zero-tannin faba bean to hogs: Effects on pork yield in primal cuts and loin quality. Western Hog Journal Vol. 30, No. pp. 57 – 62.

Gunawardena, C., W. Robertson, M. Young, R. Zijlstra and E. Beltranena. 2007. Feeding zero-tannin faba bean to hogs: Effects on Animal Performance and Carcass Traits. Western Hog Journal Vol. 29, No. 2, pp 47 – 51.

Gunawardena, C. K., R. T. Zijlstra and E. Beltranena. 2008. Nutrient digestibility of lupin and the air-classified protein and starch fractions of field pea and faba bean in grower pigs. Advances in Pork Production, Vol. 19. Abstr. A-08.

Gunawardena, C. K., R. T. Zijlstra, L. Goonewardene and E. Beltranena. 2008. Faba bean and field pea protein concentrates as replacements for specialty proteins in nursery diets for weaned pigs. Advances in Pork Production, Vol. 19. Abstr. A-07.

2007

Wierenga, K. T., E. Beltranena, J. L. Yáñez and R. T. Zijlstra. 2007. Starch and energy digestibility in weaned pigs fed extruded zero-tannin faba bean starch and wheat as an energy source. Can. J. Anim. Sci. 88:65 – 69.

Gunawardena, C. K., Robertson, W., Young, M., Zijlstra, R. T., and Beltranena, E. 2007. Zero-tannin faba bean, field pea and soybean meal as dietary protein sources for growing-finishing pigs. 40th meeting of the Midwestern Section, American Society of Animal Science, Des Moines, IA. Abstr. 130. J. Anim. Sci. Suppl. 2.

Gunawardena, C. K., Robertson, W., Young, M., Zijlstra, R. T., and Beltranena, E. 2007. Growth Performance and Carcass Characteristics of Growing – Finishing Hogs Fed Zero-Tannin Faba bean, Field Pea or Soybean Meal as Protein Sources. Advances in Pork Production, Vol. 18, Abstr. A-23.

Gunawardena, C. K., Robertson, W., Young, M., Zijlstra, R. T., and Beltranena, E. 2007. Cut-out Yield and Pork Quality of Hogs Fed Zero-Tannin Faba bean, Field Pea or Soybean Meal as Protein Sources. Advances in Pork Production, Vol. 18, Abstr. A-24.

Summary of Extension Activities *(cont'd)*

2007 (*cont'd*)

Zijlstra, R. T. and E. Beltranena. 2007. New frontier in processing: ingredient fractionation. In Manipulating Pig Production XI. J. E. Patterson and J. A. Barker, Eds. Australasian Pig Science Association, Werribee, Vic, Australia, pp. 216 - 222.

Gunawardena, C., Robertson, W., Young, M., Zijlstra, R., and Beltranena, E. 2007. Feeding Zero-Tannin Faba bean to Hogs. FarmTech, Edmonton, AB.

Zijlstra, R. and Beltranena, E. 2007. Latest developments in alternative feedstuffs for pigs. Proc. Manitoba Swine Seminar. pp. 167 - 172. Winnipeg, MB, Jan 31-Feb 1.

Beltranena, E. and Zijlstra, R. 2007. Novel feed grains and pulses in western Canada. Advances in Pork Production, Vol. 18, pp. 229 – 236.

2006

Omogbenigun, F., R. T. Zijlstra and E. Beltranena. 2006. Inclusion of zero-tannin faba bean and substitution for soybean meal in nursery diets on weaned pig performance. 39th meeting of the Midwestern Section, American Society of Animal Science, Des Moines, IA. Abstr. 297. JAS Suppl.

Omogbenigun, F., R.T. Zijlstra and E. Beltranena. 2006. Inclusion of zero-tannin faba bean and substitution for soybean meal in nursery diets on weaned pig performance. Advances in Pork Production Vol 17, Abstr. 12

Omogbenigun, O., Zijlstra and Beltranena, E. 2006. Zero-Tannin Faba bean Can Fully Replace Soybean Meal in Late Nursery Diets. Proceeding of the 8th Red Deer Swine Technology Workshop, Red Deer, AB.

Young, M., Robertson, W., Zijlstra, R. and Beltranena, E. 2006. Locally-Grown Zero-Tannin Faba bean or Pea as Replacement for Imported Soybean Meal in Hog Diets. Proceeding of the 8th Red Deer Swine Technology Workshop, Red Deer, AB.

Young, M., W. Robertson, R. Zijlstra and E. Beltranena. 2006. Locally-grown zero-tannin faba bean or pea as a replacement for imported soybean meal in hog diets. Proceedings of the 2006 On-farm Feedmill Management Workshop, Edmonton and Brooks, AB

2005

Omogbenigun, O., R. Zijlstra and E. Beltranena. 2005. Zero-tannin faba bean can fully replace soybean meal in late nursery diets. Western Hog Journal Vol. 27, No. 2, pp 47.

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We would like to commend **Ken Lopetinsky, Mark Olson** and **Sheri Strydhorst** for their leadership in pulse research agronomy and extension.

Funders

We are thankful for the funding support and look forward to further contributing together to the Pulse industry in the Prairie Provinces

Ongoing fully-funded efforts

Feed Quality Evaluation/NIRS

Objective: Development of NIRS calibration for feedstuffs including field pea.

Components: swine and poultry, lab analyses, NIRS

Funder: ACIDF

Partially-funded efforts

Characterization of feed value of alternative feedstuffs for swine

Objective: Digestible nutrient values of feedstuffs missing from data bases, including some pulses.

Funder: Nutreco Canada

Request: Alberta Funding Consortium

Increasing intestinal health and metabolic health using functional characteristics of barley and field pea fibre and starch in the pig model

Objective: Characterize functional properties of unique carbohydrate sources in the pig model

Funder: Alberta Ingenuity/NSERC, Provimi, Danisco Animal Nutrition

Request: Alberta Funding Consortium

Feedback Form

Please detach and return completed form

We have plans to continue our work on the value of pulse crops for livestock and poultry feeding but we need your help. In order to prioritize our future research we are asking you to review the proposed projects below and rank them in terms of priority (low to high).

Proposed project	Priority level				
	Low		Medium		High
Comparison of lentil varieties for feeding nursery pigs and broilers	☐	☐	☐	☐	☐
Feeding different faba bean cultivars to pigs and broilers (low vicine and covicine, ZT)	☐	☐	☐	☐	☐
Feeding different lupin cultivars to pigs and broilers (Arabella vs. new ones)	☐	☐	☐	☐	☐
Evaluation of the dietary level of inclusion of chick pea in weaner pig nursery diets	☐	☐	☐	☐	☐
Optimize air-classification parameters to preserve starch structure and functional properties	☐	☐	☐	☐	☐
Air-classification of lentils: How lentil fractions stack up to field pea and faba bean fractions	☐	☐	☐	☐	☐

Are there any other high priority feed-related projects you would like to see us undertake involving pulses? If so, please describe your idea below.

Thank you for your feedback!