Zero-Tannin Faba Bean Nutrient Assessment and Swine Performance Trials for Alberta

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PRAIRIE SWINE CENTRE INC.

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TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

In a collaborative project, between AAFRD Crop Diversification Centre North in Edmonton, Alberta and Prairie Swine Centre Inc. in Saskatoon, Saskatchewan, zero-tannin faba bean (variety Snowbird) was tested to establish a nutrient profile to be used by nutritionists and to evaluate subsequent swine performance and carcass traits.

General chemical characteristics of zero-tannin faba bean were measured, indicating that zero-tannin faba bean is a pulse crop containing high protein. Energy and amino acid digestibility were measured in cannulated grower-finisher pigs, indicating that the zero-tannin faba bean was higher than the listed National Research Council (NRC) book value in digestible energy and similar to the book value in apparent digestible lysine. The zero-tannin faba bean contained 1% tannins.

The determined energy and standardized amino acid values were used in a subsequent growth performance trial from 30 kg up to slaughter weight. The results of the trial indicated that pigs fed diets containing up to 30% faba bean had a similar voluntary feed intake than pigs fed diets based on soybean meal. Over the entire experimental period, growth performance was similar between barrows or gilts fed faba bean or soybean meal diets. In the grower period (30 to 60 kg body weight), barrows fed soybean meal had a higher average daily gain than pigs fed faba bean, but not the gilts. These results indicate that the diets were correctly formulated for gilts, but were perhaps under-formulated for barrows fed faba bean. Carcass traits were similar between barrows fed faba bean or soybean meal, but carcass lean depth was markedly higher for gilts fed soybean meal-based diets.

In summary, the results of the project indicate that the zero-tannin faba bean is a pulse crop with a desirable digestible nutrient profile that does not diminish voluntary feed intake of grower-finisher pigs at inclusion rates up to 30%. Some minor differences between pigs fed faba bean and soybean meal were observed in growth performance and carcass traits, but pigs fed faba bean achieved good performance and excellent carcass traits.

In conclusion, the zero-tannin faba bean is a worthwhile locally grown protein and energy source to consider as a replacement for imported soybean meal.

RESEARCH ABSTRACT

The nutritional value of zero-tannin faba bean for grower-finisher pigs. R. T. Zijlstra[1*], K. Lopetinsky[2], B. Dening[3], G. S. Bégin[4], and J. F. Patience[1]. [1]Prairie Swine Centre Inc., Saskatoon, SK, [2]Crop Diversification Centre North, Edmonton, AB, [3]Alberta Agriculture Food and Rural Development, Barrhead, AB, [4]Alberta Swine Diet Formulators Corp., Edmonton, AB.

Two experiments were conducted to evaluate the nutrient profile of zero-tannin faba bean and to investigate their effects on performance and carcass quality of grower-finisher pigs. In Exp. 1, chemical characteristics were analyzed, and content of ileal and total tract digestible energy (DE), and apparent ileal digestible amino acids (AA) of zero-tannin faba bean were measured using 12 barrows (60 kg; PIC) fitted with an ileal cannula. Standardized ileal digestible (SID) AA content was calculated and net energy (NE) estimated. Faba bean contained (as fed) 27.5% CP, 1.75% lysine, 0.88% threonine, 0.21% methionine, 9.6% ADF, 19.8% NDF, and 1.0% tannins. Pigs were fed either a 96-% faba bean diet to measure energy digestibility or a 62% faba bean with cornstarch to measure AA digestibility. Diets were fed twice daily at 3 x maintenance. After a 6-d acclimation, faeces were collected for 2 d and ileal digesta for 2 d. Ileal and total tract energy digestibility and DE content were 60.2 and 88.5% and 2,362 and 3,471 kcal kg^{-1} (as fed), respectively, and NE was 2,267 kcal kg^{-1}. Apparent ileal digestibility was 85.9, 76.1, and 74.1%, and standardized AA content was 1.54, 0.70, and 0.16% (as fed), for lysine, threonine, and methionine, respectively. In Exp. 2, 100 grower pigs in 20 pens were fed either a soybean or faba bean-based diet regime from 30 to 115 kg. Diets were formulated to equal NE and SID (Grower (30-60 kg), 2.40/3.95; Finisher I (60-90 kg), gilts 2.38/3.15, barrows 2.38/2.76; Finisher II (90-115 kg), gilts 2.38/2.92, barrows 2.35/2.55; Mcal kg^{-1} NE/g SID lysine $Mcal^{-1}$ NE, respectively) using determined NE and SID values for faba bean. Pigs were weighed, feed intake was measured, and commercial carcass measurements were obtained. From 30 to 115 kg, ADFI (2.58 and 2.56 kg d^{-1}, respectively) and ADG (0.96 and 0.98 kg d^{-1}) did not differ ($P > 0.10$) between faba bean and soybean meal, although minor performance differences occurred. At slaughter, back fat thickness did not differ ($P > 0.10$; 18.4 versus 18.2 mm); however, lean thickness tended to be higher for soybean meal than faba bean ($P < 0.10$; 60.3 versus 64.8 mm). In summary, zero-tannin faba bean have a desirable nutrient profile and do not alter ADFI of grower-finisher pigs at inclusion rates up to 30%. In conclusion, the zero-tannin faba bean is a worthwhile protein ingredient to consider as a replacement for soybean meal.

Key words: faba bean, pig, nutritional value

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INTRODUCTION

Faba bean (*Vicia faba* minor) production is not new to Alberta. Extensive research and development work was completed in the early 1970's on faba bean. At that time, tannin and other anti-nutritional factors, present in faba bean, limited the use of tannin containing faba bean in swine diets. However, today there are zero-tannin faba bean varieties that could be used in swine diets.

The purpose of this project was to remove barriers, which were preventing the increased use of zero-tannin faba bean in Alberta. Zero-tannin faba bean is new to Western Canada, therefore no swine performance trials had been conducted. Dr. Marv Anderson and Associates Ltd conducted an economic consultant's report, in fall 2003, on "Faba bean Opportunities and Constraints in Alberta". This report strongly supported the development of zero-tannin faba bean production in the Parkland, and parts of the Peace regions of Alberta. Faba bean is a cool season crop, which prefers cool moist growing conditions to maximize production. (See maps - Appendix D and E)

For any feed ingredient, it is important to understand its contents of nutrients, in particular the digestible nutrient content. Only then is precise diet formulation possible. The uniqueness of the zero-tannin faba bean appears to be its high protein, high energy, and extremely low anti-nutritional factors – a feed ingredient with great potential for the pork industry. For zero-tannin faba bean, a nutritional profile does not exist. Moreover, feeding trials have not been conducted with grower-finisher pigs to validate the nutritional profile and to ensure that feeding zero-tannin faba bean does not result in reduced feed intake or unacceptable carcass traits.

In the Barrhead, Alberta area, a number of producers have successfully grown and fed zero-tannin faba bean with excellent results. This project will objectively verify the results of these producers and determine actual values for the nutritional components of zero-tannin faba bean, which nutritionists require in the formation of hog rations.

As well, the high nitrogen fixation ability of faba bean (approximately 90% of total N requirements comes from biological N fixation) places great potential for faba bean in sustainable crop rotations, in the moister parts of Alberta (Parkland and Peace regions), based on increasing costs of nitrogen fertilizers.

The following three objectives summarize the scope of this project:

1. Develop a baseline seed compositional and nutritional profile
2. Conduct swine performance trials
3. Evaluate the results and determine the value of faba bean in swine diets.

The success of this project will have a significant impact on both the swine industry and the pulse industry in Alberta and beyond. The anticipated high feed value of zero-tannin faba bean in swine diets will result in a suitable and cost effective protein and energy feed source available to help grow the swine and faba bean industries in Alberta.

This project will develop a full swine nutritional performance data package based on nutritionally analyzed, zero-tannin faba bean. Research data will be interpreted in a cost-benefit analysis with swine grower and finisher diets utilizing zero-tannin faba bean compared to other protein feeds (e.g. field pea, soybean). Results will be made available to the swine industry, other faba bean end users, and to the pulse industry.

One of Alberta Agriculture's key initiatives [1] is to grow the Alberta hog industry. Feed is the biggest input cost in raising hogs. If new feed sources can be found (i.e. zero-tannin faba bean) to decrease the feed cost and decrease our dependence on imported protein sources, it will put the Alberta hog industry in a more competitive position.

At present, a 25% substitution rate of faba bean for soybean meal (which is imported) would require over 40,000 acres of high yielding (4500 kg/ha or 4000 lbs/acre) faba bean production. Slightly lower yields, a developed faba bean pedigree seed industry, and some successful value-added processing projects could easily increase faba bean acres to over 100,000 acres within the next three to five years.

The resulting growth of Alberta's faba bean industry to over 100,000 acres would make faba bean the pulse crop with the second highest acreage in Alberta (field pea at 650,000 to 700,000 acres, chick pea at 50,000 to 60,000 acres, dry bean at 60,000 to 65,000 acres and lentil at 10,000 to 15,000 acres) [2]. An increase of 100,000 acres of faba bean can add $25M to $30M to the pulse industry in Alberta. However, if a 50% substitution of imported soybean meal, with faba bean was attained, this would require the production of 200,000 faba bean acres which would add $50M to $60M to the pulse industry in Alberta.

[1] AAFRD Crop Diversification Division Operational Plan (April 1, 2002 to March 31, 2003)
[2] Alberta 2004 Specialty Crops Report

I. BASELINE SEED COMPOSITIONAL AND NUTRITIONAL PROFILE OF ZERO-TANNIN FABA BEAN

a) Objective

To determine the digestible energy and amino acid content and estimate the net energy (NE) content of zero-tannin faba bean for grower-finisher pigs

b) Materials and Methods

Experimental Design

In one experimental period using cannulated grower pigs, two diets including zero-tannin faba bean were tested (Table 1). Twelve cannulated pigs (Pig Improvement Company (PIC), average body weight 50-60 kg) were fed one experimental diet each, for a total of 12 observations or six observations per diet after a transfer period for 4 days. The experimental period was 10 days: a 6-day acclimation to an experimental diet followed by a 2-day collection of faeces and urine and a 2-day collection of ileal digesta.

Table 1. Ingredient composition of experimental diets

	Energy digestibility [a] Diet A	Amino acid digestibility [b] Diet B
Ingredients (%)		
Faba bean	96.3	61.8
Corn starch	-	34.5
Limestone	1.1	1.1
Di-calcium phosphate	0.8	0.8
Mineral mix [c]	0.5	0.5
Vitamin mix [d]	0.5	0.5
Chromic oxide	0.4	0.4
Salt	0.4	0.4
Total	100.0	100.0
Estimated nutrient content (as is)		
DE (kcal/kg)	3400	3680
Crude protein (%)	26.4	17.0
Analyzed nutrient content (as is)		
DE (kcal/kg)	3329	3450
Crude protein (%)	-	17.3

[a] Faba bean is considered the sole energy source in Diet A.
[b] Faba bean is considered the sole protein and amino acid source in Diet B.
[c] Provided per kg of premix: zinc, 20 g; iron, 16 g; copper, 10 g; manganese, 5 g; iodine, 100 mg; selenium, 20 mg.
[d] Provided per kg of premix: vitamin A, 1 650 000 IU; vitamin D_3, 165 000 IU; vitamin E, 8 000 IU; niacin, 7 g; D-pantothenic acid, 3 g; riboflavin, 1 g; menadione, 800 mg; folic acid, 400 mg; thiamine, 200 mg; D-biotin, 40 mg; vitamin B_{12}, 5 mg.

Facilities and Equipment

Metabolism room 124 equipped with metabolism pens was used for the experiment for 14 days. The room housed 12 pigs in individual pens. The dimensions of the individual pens were 1.5 m (length) x 1.5 m (width) x 0.9 m (height), and allowed freedom of movement of pigs during the entire experiment. The flooring of the pen was plastic-coated expanded metal (Tenderfoot) and the siding was sturdy PVC-planking. A single-space feeder and a bowl-drinker were located at the front of the pen. Diets were stored in bags in Barn 3 Link.

Experimental Diets

One diet was formulated to contain faba bean as the sole energy source to measure energy digestibility and one diet was formulated to 17% CP to contain faba bean as the sole protein source to measure amino acid digestibility (Table 1). An indigestible marker, chromic oxide, was added to each diet. Diets were fortified with premixes to meet or exceed vitamin and mineral requirements.

The Sponsor sent approximately 300 kg of zero-tannin faba bean to PSCI. A composite sample (approximately 3 kg) was retained in PSCI's office building. The faba bean was transported to the University's Poultry Science facility. The beans were ground using a hammer mill passing through an 8/64" screen.

All hand-added ingredients included in the experimental diets were weighed out at the PSCI Feed Mill and transported to the University's Poultry Science facility. The faba bean and cornstarch were weighed accurately according to the mix-sheets and added to a horizontal 250-kg mixer. Diets were each mixed in one batch of 170 kg, and a proper sub-sample was collected. The mixed diets were transferred to Bonaflex® bags, sampled, and transported to PSCI. Upon arrival at the PSCI barn, diets were fumigated in the Biosecurity Room before entering the barn. Diet samples were stored together with the sample of faba bean in PSCI's office building.

Management

Twelve barrows (PIC, C15 x Canabrid) were surgically fitted with a simple T-cannula at the distal ileum. Cannulation surgeries and recovery were conducted according to existing standard operating procedure. Following recovery, the pigs were used for two experimental periods for another purpose prior to commencement of the study described in this report. The prior study is assumed to not have affected the data collected for the present study.

The room was maintained within the thermo-neutral zone of the pigs, with a 14 hr light (0700 to 2100)/10 hr dark cycle.

The diet was provided as a wet mash. Feed was added to the feeder followed immediately with 1:1 water, during the entire experiment. In addition, pigs had free access to water.

The pigs were first fed the regular production diet for four days during a transfer period upon completion of a previous experiment. Then, pigs were fed experimental diets for 10 days, the first six days as an acclimation and the last four days to collect feces and urine or digesta. Pigs were fed at 3 x the maintenance requirement using an estimated diet DE content of 3400 or 3680 kcal/kg for the diet to study energy and amino acid digestibility, respectively. Feeders were checked daily to ensure free flow of feed.

Animal Care

An animal care protocol written specifically for experiments with cannulated pigs was recently reviewed and approved (September 26, 2002) by the University Committee on Animal Care and Supply at the University of Saskatchewan. Pigs were cared for following PSCI's Standard Operating Procedures.

Data and Sample Collection Methods

A total of 2 diet, 12 fecal, 6 urine, and 12 digesta samples were collected.

- Feed. During the collection periods, feed samples were collected. Collected feed samples were stored in a freezer maintained at approximately –20 °C.
- Feces. Feces were collected for 2 days for a minimum of two times a day (0800 and 1600) using feces collection systems. Collected feces were pooled over the collection period into one bag per pig, which was stored in a freezer maintained at approximately –20 °C.
- Urine. For the pigs fed Diet A, urine was collected quantitatively for 2 days during feces collections for a minimum of two times per day using urine trays and collection bottles with 20 mL of concentrated HCl added. Of the collected urine, 10% was sub-sampled and pooled over the collection period into one Nalgene bottle per pig, which was stored in a freezer maintained at approximately –20 °C.
- Digesta. Digesta was collected for 2 days using bags containing diluted formic acid attached to the opened cannula barrel for 10 hr. Collected digesta was pooled over the collection period into one container per pig, which was stored in a freezer maintained at approximately –20 °C.
- Pigs. Pigs were weighed at the start and end of the experimental period.

Sample Processing and Laboratory Analyses

Norwest Labs tested the faba bean for standard nutrient composition to allow correct diet formulation prior to the digestibility experiment (Table 5).

Once the collection was completed, feces samples were thawed, homogenized, and transferred to designated bags. Digesta samples were thawed, homogenized, and transferred to designated trays. Then, samples were taken to the Department of Animal and Poultry Science laboratory for batch freeze-drying. Once freeze-dried, samples were equilibrated to room temperature and moisture for 2 to 4 h. Thereafter, diet and freeze-dried fecal, digesta, and urine samples were ground, mixed and stored in properly identified containers.

Freeze-dried samples of diets, feces, digesta, and urine were analyzed at PSCI for moisture and gross energy content and at the Department of Animal and Poultry science for chromic oxide content. Feed and digesta samples were sent to the University of Missouri for analyses of amino acids content.

Calculations and Statistical Analyses

Using chromic oxide concentrations in diet, feces, and digesta, the apparent digestibility of energy and amino acids were calculated for each pig observation. Standardized amino acid digestibility was calculated according to Jansman et al. (2002).

c) Results and Conclusion

The results are listed in Tables 2, 3, 4, and 5. In Table 2, the total nutrient content of the batch of faba bean used in the digestibility and performance study is listed. Another 11 samples of faba bean were analyzed subsequently for general nutritional characteristics (Table 5). The results indicate that the sample of zero-tannin faba bean used in the digestibility study had a normal protein and fibre content and can be assumed to be representative of the total zero-tannin faba bean population.

Results of the chemical analyses indicate that faba bean are indeed high in protein relative to book values for field pea. The tannin level of the batch was 1.05% indicating that some tannins remain in zero-tannin faba bean (Table 2). Based on results of the present study and NE values from other databases, the NE content of the zero-tannin faba bean was listed at 9.49 MJ/kg or 2.27 Mcal/kg as fed.

A limitation of the present study might be that starch digestibility was not analyzed specifically. The French NE system generally assumes that starch is digested in the small intestine, whereas starch from faba bean might be partially digested in the large intestine. The assumption of starch digestibility and therefore NE values for zero-tannin faba bean should be verified further.

The measured DE content of the zero-tannin faba bean was 3,471 kcal/kg as fed (Table 3), and was 7% higher than the book value for faba bean of 3,245 kcal/kg (NRC 1998). Apparent amino acid digestibility for lysine (86%; Table 4) was slightly higher than the book value of 84% (NRC 1998), resulting in an apparent digestible lysine content of 1.54%. The particular sample of zero-tannin faba bean was thus 1.3% higher in DE and 22% higher in apparent digestible lysine contents than the book values for field pea (3,425 kcal DE/kg and 1.26 app. dig. lysine; NRC 1998), suggesting that the equal DE content and higher protein content should make zero-tannin faba bean worth more economically and nutritionally than field pea based on its digestible nutrient profile.

The developed NE and standardized amino acid contents for zero-tannin faba bean were used subsequently for diet formulation for the growth performance study (Section II).

TABLE 2. ANALYZED TOTAL NUTRIENT CONTENT OF ZERO-TANNIN FABA BEAN

Nutrient	As Fed	DM Basis
General characteristics [a]		
Moisture (%)	13.4	-
Ash (%)	3.1	3.6
Crude protein (%)	27.5	31.8
Acid detergent fibre (%)	9.6	11.1
Neutral detergent fibre (%)	19.8	22.9
Crude fibre (%)	7.8	9.1
Crude fat (%)	1.0	1.2
Gross energy (kcal/kg) [b]	3,923	4,486
Starch [c]	-	(43.7)
Tannin	1.05	-
Calcium	-	-
Phosphorus	-	-
Protein and amino acids [d]		
Moisture (%)	10.63	-
Crude protein (%)	27.3	30.60
Lysine	1.75	1.96
Threonine	0.88	0.99
Methionine	0.21	0.23
Cysteine	0.36	0.40
Total sulphur amino acids	0.56	0.63
Tryptophan	0.25	0.28
Isoleucine	1.13	1.31
Leucine	1.96	2.26
Valine	1.28	1.48
Arginine	2.38	2.75
Histidine	0.72	0.83
Phenylalanine	1.13	1.30
Tyrosine	0.76	0.88
Alanine	1.06	1.22
Aspartic acid	2.89	3.34
Glycine	1.11	1.28
Glutamic acid	4.61	5.32
Proline	1.09	1.26
Serine	0.99	1.14

[a] Norwest Labs (Lethbridge, AB)
[b] PSC
[c] Centraal Veevoeder Bureau (CVB), Lelystad, The Netherlands
[d] University of Missouri

Table 3. Ileal and total tract energy digestibility and DE content of zero-tannin faba bean

Nutrient	As fed	DM basis
Energy [a]		
Ileal		
Digestibility (%)	60.2	
DE content (kcal/kg)	2,362	2,702
Total tract		
Digestibility (%)	88.5	
DE content (kcal/kg)	3,471	3,970
Net energy [b]		
NE content (kcal/kg)	2,069	White flowering, CVB (1993)
NE content (kcal/kg)	2,000	NRC (1998)
NE content (kcal/kg) [c]	2,267	2,618

[a] Using Diet A

[b] Calculated using NE (kcal/kg DM) = 0.703 x DE (kcal/kg DM; 3970) + 1.58 x crude fat (g/kg DM; 12) + 0.47 x starch (g/kg DM; 437 ; CVB 1993) – 0.97 x CP (g/kg DM; 318) – 0.98 x crude fibre CP (g/kg DM; 91) = 2618 (Noblet 1994).

[c] NE 9.49 MJ/kg used for diet formulation

Table 4. Ileal amino acid digestibility and content of zero-tannin faba bean

Nutrient	Standardized As fed [a]	Apparent As fed	Apparent DM basis
Protein			
Digestibility (%)		75.6	-
Lysine			
Digestibility (%)		85.9	-
Content (%)	1.54	1.50	1.68
Threonine			
Digestibility (%)		76.1	-
Content (%)	0.70	0.67	0.75
Methionine			
Digestibility (%)		74.1	-
Content (%)	0.16	0.15	0.17
Cysteine			
Digestibility (%)		64.4	-
Content (%)	0.25	0.23	0.26
Total sulphur amino acids			
Content (%)	0.41	0.38	0.43
Tryptophan			
Digestibility (%)		76.4	-
Content (%)	0.20	0.19	0.21
Isoleucine			
Digestibility (%)		82.3	-
Content (%)		0.93	1.08
Leucine			
Digestibility (%)		84.3	-
Content (%)		1.65	1.91
Valine			
Digestibility (%)		80.0	-
Content (%)		1.02	1.18
Arginine			
Digestibility (%)		91.0	-
Content (%)		2.17	2.50

[a] Used for diet formulation

Table 5. Nutrient composition of faba bean samples

Nutrient, % DM	Snowbird Lab -2 1	Snowbird Lab -1 2	Saint Dennis 3	St Denis Seed 4	St Denis Seed 5	C. Wierenga 6	2003 Snowbird 7	Grande Prairie 8	Snowbird Previous years 9	Snowbird Namao 2003 10	Snowbird Westlock 2003 11
Moisture	10.2	9.4	12.5	15.5	15.7	8.9	8.6	11.7	9.6	16.8	7.5
Ash	3.3	3.3	3.5	3.3	3.3	3.53	3.48	3.09	3.3	4.1	3.2
Crude protein	29.3	30.4	30.4	28.4	27.9	28.0	23.8	30.8	30.1	32.7	28.8
Acid detergent fibre	12.2	10.9	11.8	11.3	12.1	13.5	13.7	11.3	9.3	11.6	11.0
Neutral detergent fibre	18.6	17.9	16.9	21.3	16.4	17.4	20.9	16.2	12.5	19.2	17.0
Crude fibre	9.4	8.5	8.4	9.1	9.0	9.7	9.9	9.2	8.4	9.3	5.4
Crude fat	1.6	1.2	1.3	1.2	1.2	1.3	1.2	1.4	1.2	1.1	1.2

II. VOLUNTARY FEED INTAKE, GROWTH PERFORMANCE, AND CARCASS QUALITY OF GROWER-FINISHER PIGS FED DIETS CONTAINING FABA BEAN OR SOYBEAN MEAL

a) Objective

To determine if voluntary feed intake, growth performance, and carcass quality is identical between grower-finisher pigs fed diets containing faba bean or soybean meal.

b) Materials and Methods

Experimental Design

Two dietary regimes (faba bean and soybean meal) were tested in grower-finisher pigs from approximately 30 kg to slaughter weight (Table 6). After 60 kg, barrows and gilts were fed separate diet formulations due to expected differences in nutrient requirements and voluntary feed intake. In one room, 100 grower pigs were housed in 20 pens, with five pigs per pen. Barrows and gilts were penned separately.

- The two dietary regimes were fed to five pens with barrows and five pens with gilts, for a total of 10 observations per dietary regime and 20 pens in total.
- The dietary regime was divided into three phases (Table 6): 30 to 60 kg (Grower), 60 to 90 kg (Finisher I), and 90 kg to market (Finisher II). During the Grower phase, barrows and gilts received the same diet within each regime. During the Finisher I and II phases, barrows and gilts received separate diets within each regime.

Voluntary feed intake and growth performance were measured at every diet change and 21 days after starting to feed a new diet. Carcass traits were measured by obtaining carcass information during commercial slaughter by giving unique tattoo numbers to each pen of pigs. Any suspicious data (commercial data will have misreads) were removed from the data set, for example, in case the dressing percentage was lower than 76% or higher than 82%.

Facilities and Equipment

One room with 20 pens was used for the experiment for up to four months; 20 pens out of the available 20 pens were used to reach 10 observations per dietary regime. All pens within the room (Room 148) housed experimental pigs and extra pens out of the same weaning group were housed elsewhere. The room housed five pigs per pen. The flooring of the pen was fully-slatted concrete and the siding was sturdy PVC-planking. A single-space feeder was located at the front of the pen and a nipple-drinker was located at the back of the pen. Diets were stored in bulk in bins, one bin per diet.

Experimental Diets

The diets were formulated to meet or exceed the requirements for amino acids and other nutrients (Table 6) according to the regular feeding program at Prairie Swine Centre. Diets were formulated for NE and standardized amino acid content. Diets were formulated without antibiotic growth promoters, animal by-products or animal fats.

For the animal experiment, 20,000 kg of each dietary regime were mixed in 1,000-kg batches, and delivered in bulk to Prairie Swine Centre as mash diets. Diets were processed at the PSC Elstow Research Farm's feedmill from the start of the experiment. Diets were based on wheat,

barley and included soybean meal or faba bean as the main protein source. The faba bean was delivered from Alberta in mini-bulk bags.

The diets were provided as dry mash. Pigs had free access to water. Feeders and drinkers were checked daily to ensure free flow of feed and water.

▪ 25-30 kg	All pigs	PSC 3 diet	Acclimation
▪ 30-60 kg	All pigs	Grower diet	
▪ 60-90 kg	Gilts	Finisher I - gilt diet	
	Barrows	Finisher I - barrow diet	
▪ 90 kg-market	Gilts	Finisher II - gilt diet	
	Barrows	Finisher II - barrow diet	

Animal and Diet Randomization

First, pigs were selected within gender out of a larger, single weaning group based on body weight and ADG (weight per day of age since birth), ensuring that fifty healthy pigs per gender were available. Second, the fifty pigs within gender were sorted by body weight and divided into five weight categories (heavy, medium-heavy, medium, medium light, and light) with ten pigs in each category. Third, one pig from each of five weight categories was randomly assigned to each of ten pens, resulting in ten pens with five barrows and ten pens with five gilts. Fourth, barrow pens were on one side of the room (pen 1 through 10), whereas gilt pens were on the other side (pen 11 through 20). Finally, pens with an odd number (1, 3, etc.) were assigned to dietary regime AA and pens with an even number (2, 4, etc.) were assigned to dietary regime BB.

Animal Management and Care

After selection, pigs were moved into the room and were fed a regular diet (PSC-3), for a minimum of three and a maximum of seven days, to acclimate the pigs to the room and their pen mates. The switch from regular diet to experimental diets was direct, i.e., without having a period of mixing the diets together.

The rooms were maintained, as much as possible, within the thermo-neutral zone of the pigs, with a 14 hr light (0700 to 2100)/10 hr dark cycle.

The animal care protocol for regular care of grower-finisher pigs, as approved by the University Committee of Animal Care and Supply of the University of Saskatchewan, was valid for the project. Pigs were cared for following PSCI's Standard Operating Procedures.

Pigs with a health status or body condition that deteriorated beyond acceptance at any time were weighed and removed from the experiment. The reason for removal was noted (Table 9). The data collected for such animals were excluded for the specific period that the removal occurred from statistical analyses.

Table 6. Ingredient composition and calculated nutrient content of experimental diets

	Grower (30-60 kg)		Finisher I (60-90 kg)				Finisher II (90 kg-mrkt)			
	Faba	SBM	Gilts		Barrows		Gilts		Barrows	
			Faba	SBM	Faba	SBM	Faba	SBM	Faba	SBM
Ingredients (%)										
Barley	-	-	37.21	27.68	37.43	27.16	48.08	40.30	72.86	66.75
Wheat	59.66	75.56	29.00	53.74	29.70	54.38	23.30	43.73	3.60	19.80
Faba bean	30.00	-	30.00	-	29.30	-	25.00	-	20.00	-
Soybean meal	5.90	20.00	-	15.00	-	15.00	-	12.50	-	10.00
Limestone	1.43	1.42	0.89	0.89	0.89	0.89	0.90	0.90	0.89	0.89
Dicalcium phosphate	0.80	0.74	0.94	0.86	0.94	0.86	0.78	0.72	0.82	0.77
Canola oil	0.60	0.80	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Salt	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Vitamin mix	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Mineral mix	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
L-Lysine-HCl	0.18	0.22	0.11	0.12	-	-	0.12	0.13	0.08	0.09
L-Threonine	0.14	0.06	0.10	0.01	0.04	-	0.09	0.02	0.05	-
DL-Methionine	0.09	-	0.05	-	-	-	0.03	-	-	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Calculated nutrient content [a]										
NE (Mcal/kg)	2.40		2.38		2.38		2.38		2.35	
(MJ/kg)	10.04		9.96		9.96		9.96		9.83	
St. Dig. Lysine (g/Mcal NE) [b]	3.95		3.15		2.76		2.92		2.55	
(g/MJ NE)	0.95		0.75		0.66		0.70		0.61	
(%)	0.95		0.75		0.66		0.69		0.60	
Calcium (%)	0.74		0.65		0.65		0.63		0.63	
Avail. Phosphorus (%)	0.30		0.32		0.32		0.28		0.28	

[a] Diets were formulated on the basis of NE and standardized amino acids.

[b] Standardized digestible lysine. Other essential amino acids as a (minimum) ratio to lysine

Data and Sample Collection Methods

During diet processing, samples of the main ingredients and diets were taken. During the animal study, one diet sample per week was collected per diet. Collected feed samples were pooled over the experimental period into one bag per diet, which was stored in a freezer maintained at approximately –20 °C. Pigs were weighed at the start of each experimental period, every 21 days, at every diet change, and at the end of the experimental period. Feed was weighed at each time point that pigs were weighed. Performance and days on test were measured for the total experiment and separately for the Grower, Finisher I, and Finisher II periods.

When the average weight of barrows or gilts within one room reached either 60 or 90 kg (± 7 days), the pigs were weighed individually and the feed for all pens for the specific gender was switched to the next phase. Prior to shipping for slaughtering the first pig, all pigs on test were weighed; the first pig was brought to slaughter as soon as it reached market weight. Afterwards, pigs were marketed as close as possible to their optimum shipping weight (115 kg) with a final close within three weeks of marketing the first pig within a room.

Statistical Analyses

To compare differences in voluntary feed intake and growth performance between diets, data were analyzed by ANOVA using the GLM procedure within SAS (SAS Institute Inc. 1996). Pen was considered the experimental unit. The statistical model included the following factors: diet, gender and diet x gender, and initial body weight as a covariate. Results were reported as least-square means for each of the three phases separately and for the total experimental period.

c) Results and Conclusion

Average daily feed intake did not differ between pigs fed faba bean or soybean meal for each of the phases and the overall experimental period ($P > 0.10$; Table 7). These results indicate that pigs, including grower pigs, can consume up to 30% faba bean in their diets without negative effects on voluntary feed intake. These results are an important finding and mean that zero-tannin faba bean can be incorporated into swine diets without reduced growth performance, provided that nutrient digestibility and availability can be assessed accurately.

Average daily gain across the entire experimental period did not differ between pigs fed faba bean or soybean meal ($P > 0.10$; Table 7). In the grower period, barrows fed soybean meal had a 7% higher average daily gain than pigs fed faba bean diets ($P < 0.05$); however, the average daily gain was similar for gilts fed faba bean and soybean meal. The difference in average daily gain for the grower period was entirely due to a difference in feed efficiency ($P < 0.05$).

An explanation for these results might be that the digestible or available nutrients from faba bean might have been overestimated using the digestibility data provided by finisher pigs in the present project, which needs further evaluation. Two possibilities exist: (1) the digestible amino content or (2) the net energy content was overestimated for grower pigs using finisher pigs in the digestibility study. The actual achieved digestible amino acid content might have been reduced due to the direct switch toward a diet high in faba bean or a reduced capability of grower pigs to digest faba bean. The actual achieved net energy content might have been reduced, for example due to an overestimated starch digestibility.

Index and value was similar between treatments. Average carcass quality of the pigs was excellent measuring 66.6 mm lean depth for gilts and 59.8 mm lean depth for barrows and 16.4 mm back fat for gilts and 19.9 mm back fat for barrows. Carcass quality was similar between pigs fed faba bean and soybean meal; however, lean depth of pigs fed soybean meal was superior by 4.0 mm ($P < 0.05$; Table 8). Dressing percentage was higher for pigs fed soybean meal, suggesting that mass of the visceral organs was higher in pigs fed faba bean ($P < 0.05$; Table 8). Faba bean contain a substantial amount of fibre, which, together with perhaps fermented starch, may cause a larger gut mass. Finally, considering that the commercial carcass data can be trusted, soybean meal diets may have provided additional digestible amino acids or energy during part of the experiment, or protein mass of pigs fed faba bean was distributed differently.

In summary, pigs fed diets based on faba bean achieved overall an excellent performance and carcass quality. However, further research is needed to ensure that growth performance and carcass traits for pigs fed faba bean is identical to pigs fed soybean meal in commercial swine production.

Table 7. Performance data of grower-finisher pigs fed faba bean- or soybean meal-based

Variable	Gilts		Barrows		Pooled	*P* - value		
	Faba bean	Soybean meal	Faba bean	Soybean meal	SEM	Diet	Gender	D x G
Average daily gain (kg/d) [z]								
Grower	0.868	0.887	0.914 [a]	0.984 [b]	0.021	0.08	0.04	0.25
Finisher 1	0.911	0.917	1.039	1.073	0.028	0.52	0.01	0.61
Finisher 2	1.174	1.152	0.995	0.963	0.048	0.61	0.02	0.91
Total	0.936	0.943	0.974	1.013	0.016	0.20	0.03	0.32
Average daily feed intake (kg/d)								
Grower	1.968	1.997	2.132	2.154	0.070	0.75	0.14	0.96
Finisher 1	2.726	2.617	3.202	3.197	0.088	0.57	0.01	0.57
Finisher 2	2.984	2.935	3.366	3.253	0.079	0.37	0.01	0.69
Total	2.421	2.386	2.738	2.726	0.070	0.77	0.01	0.87
Feed efficiency								
Grower	0.442	0.446	0.429 [a]	0.457 [b]	0.007	0.07	0.98	0.12
Finisher 1	0.334	0.351	0.327	0.337	0.010	0.23	0.48	0.73
Finisher 2	0.393	0.393	0.293	0.296	0.012	0.92	0.01	0.91
Total	0.387	0.396	0.356	0.372	0.006	0.10	0.01	0.62
Feed conversion								
Grower	2.27	2.25	2.33	2.19	0.038	0.07	0.99	0.12
Finisher 1	3.02	2.87	3.07	2.97	0.096	0.24	0.62	0.78
Finisher 2	2.55	2.54	3.38	3.38	0.114	0.96	0.01	0.98
Total	2.59	2.53	2.81	2.69	0.046	0.10	0.01	0.53

[z] Means are least-square means based on 5 observations per treatment per gender.
[a, b] Means without the same superscript with the same row and gender differ ($P < 0.05$).

Table 8. Carcass data of grower-finisher pigs fed faba bean- or soybean meal-based

	Gilts		Barrows		Pooled	*P* - value		
	Faba bean	Soybean meal	Faba bean	Soybean meal	SEM	Diet	Gender	D x G
Shipping BW	117.1	115.2	116.2	115.1	0.82	0.08	0.55	0.63
BW at slaughter	116.9	115.1	116.2	115.2	0.81	0.10	0.70	0.61
Dress weight	91.8	92.4	92.0	92.1	0.90	0.71	0.99	0.80
Dressing (%)[y]	78.4	80.3	79.2	80.0	0.51	0.03	0.68	0.33
Backfat (mm) [x]	16.7	16.0	20.8	19.0	0.94	0.16	0.01	0.50
Lean (mm) [x]	64.1 [a]	69.1 [b]	58.3	61.2	1.60	0.03	0.01	0.51
Yield (%) [x]	61.3	62.2	59.5	60.4	0.48	0.09	0.01	0.94
Index [x]	114.4	114.9	109.3	112.3	1.12	0.14	0.01	0.30
Value [x]	159.5	158.7	150.2	152.4	2.22	0.74	0.01	0.50

[y] Calculated as % of dress weight versus body weight at slaughter for pigs with complete data set. Analyzed using body weight at slaughter as covariate.
[x] Analyzed using carcass weight as covariate.
[a, b] Means without the same superscript with the same row and gender differ ($P < 0.05$).

Table 9. Record of pigs removed from the experiment

Gender	Diet	Period	Reason	Date
Gilt	Faba bean	Grower	Prolapse	Dec 28/03
Barrow	Soybean meal	Grower	Ulcer	Jan 6/04
Gilt	Faba bean	Finisher 1	Tail-bite	Jan 28/04
Barrow	Faba bean	Finisher 1	Tail-bite	Feb 3/04
Barrow	Faba bean	Finisher 1	Tail-bite	Feb 3/04
Barrow	Soybean meal	Finisher 1	Tail-biter	Feb 3/04
Gilt	Soybean meal	Finisher 1	Lame	Feb 10/04
Barrow	Faba bean	Finisher 1	Prolapse	Feb 10/04

Dietary regime appears not directly related reason for removing pigs from an experiment (diarrhea or other gastro-intestinal disorders)

III. ECONOMIC ANALYSIS

a) Feeding Zero-tannin Faba Bean to Growing and Finishing Swine

The use of faba bean (*Vicia faba*) in swine feeds is not new. However, because of the anti-nutritional factors found in traditional varieties, mainly tannins, their routine use has been limited. These tannins negatively affect the palatability of the feed and interfere with normal digestive processes.

Some newer varieties of faba bean have been bred to contain significantly lower levels of tannins. Recent feeding trials with diets containing zero-tannin faba bean at the Prairie Swine Centre in Saskatoon have shown no differences in feed acceptance or average daily gain when compared to soybean meal based diets. These findings would imply that, if priced right, zero-tannin faba bean could be used as an alternative ingredient to soybean meal.

The purpose of this paper is to present and discuss a new ingredient alternative that is becoming increasingly available to pork producers. A copy of the actual feeding trial referred to in this paper is available from Bert Dening, AAFRD Business & Innovation Division, Barrhead AB (780/674-8247).

Nutrient Content of Zero-tannin Faba Bean

The chemical and nutrient compositions of soybean meal and zero-tannin faba bean are given in Table 10. Field pea was included to give another comparative reference point. The nutrients were corrected to 90% air dry basis.

The protein content of the zero-tannin faba bean used in the feeding trial was 27.5% (28.6% on a 90% air dry basis) but several samples referred to in the PSCI report indicate that the protein content could reach well over 30% and even as high as 35% (90% air dry basis). As more samples of zero-tannin faba bean are analyzed, a more reliable range for expected protein content will be established.

The amino acid levels in zero-tannin faba bean are not only slightly higher than those typically found in pea, they are more digestible as well (see digestibility coefficients). Predictably, this would mean that, like pea, a greater amount of bean would have to be added to a typical hog feed than soybean meal in order to achieve a balanced diet. Conversely, a lower amount of bean would be used as compared to pea.

More amino acid analysis research will be required to create reliable regression equations (amino acid prediction formulas) as well as to substantiate digestibility coefficients for zero-tannin faba bean. The amino acid levels and associated digestibilities listed in Table 10 are those that were actually analysed in the laboratory and tested in live, cannulated pigs.

Different energy contents are also listed in Table 10. It is important to note that although some legumes typically have lower DE values than soybean meal, the NE values are actually higher. This is precisely the case for both field pea and zero-tannin faba bean. This issue needs to be considered if a nutritionist is to successfully incorporate these legumes into hog feed when using

the DE system. The scientific community is increasingly adopting the NE system as the standard of comparison and formulation. The formulations used in the feeding trials at the PSCI were based on the NE system.

Table 10. Comparative Nutrient Profiles

General Characteristics [a]	Soybean Meal	Field Pea [b]	ZTFB [f] [c]
Crude Protein (%)	46.50	22.60	28.62
Acid Detergent Fibre (%)	5.4	8.19	10.0
Neutral Detergent Fibre (%)	8.9	16.65	20.61
Crude Fibre (%)	3.90	5.50	8.19
Crude Fat (%)	1.30	1.10	1.08
Starch (%)	4.60	46.80	39.33
DE (kcal/kg)	3,754 [d]	3,485	3,573
ME (kcal/kg)	3,398 [d]	3,240	-
NE (kcal/kg)	2,091 [d]	2,450	2,267
Calcium (%)	0.30	0.12	0.11
Phosphorus (%)	0.7	0.40	0.48
Total Amino Acid Content [e] [b] [c]			
Lysine (%)	2.86	1.67	1.76
Threonine (%)	1.84	0.94	0.89
Methionine (%)	0.65	0.27	0.21
Cysteine (%)	0.72	0.21	0.36
Methionine + Cysteine (%)	1.36	0.48	0.57
Tryptophan (%)	0.63	.024	0.25
Standardized Ileal Digestibility Coefficient [e] [e] [c]			
Lysine (%)	89	81	88
Threonine (%)	86	76	80
Methionine (%)	90	74	76
Cysteine (%)	83	68	69
Methionine + Cysteine (%)	86	70	73
Tryptophan (%)	87	70	80
Apparent Ileal Digestibility Coefficient [e] [e] [c]			
Lysine (%)	88	79	85
Threonine (%)	83	69	75
Methionine (%)	89	69	71
Cysteine (%)	79	60	64
Methionine + Cysteine (%)	84	65	67
Tryptophan (%)	85	64	76

[a] All ingredients presented on a 90% air dry basis.
[b] Source: The Feed Pea Focus, Alberta – Saskatchewan – Manitoba Pulse Growers
[c] Source: Prairie Swine Centre Inc., Saskatoon
[d] Source: Noblet
[e] Source: Degussa
[f] zero-tannin faba bean

Comparing Diet Costs

The pigs in the PSCI trials were grouped by gender and fed three diets from 30 kg to market. Although cost comparisons could easily have been performed on any of the trial formulations, the following discussion is based on the Gilt Finisher I Diets (Table 11).

These formulas are identical on a nutrient basis. However, the zero-tannin faba bean formula costs $33.55 less than the conventional soybean meal based formula. This represents a savings of about $10.00 per pig marketed. Even if zero-tannin faba bean were used in some kind of combination with soybean meal, a significant reduction in feed cost would be realized.

Table 11. Gilt Finisher I Diets

	(kg)	**(kg)**
Soybean Meal	150	0
ZTFB	0	300
Wheat	540	290
Barley	275	375
Premix [a]	30	30
Canola Oil	5	5
Total kg	1000	1000
Cost of formula [b]	$221.13/tonne	$187.58/tonne
Cost difference	$33.55/tonne	

[a] The composition of the premix is different for each formula. Refer to the trial report for a complete breakdown of the formulas and nutrient content.

[b] Ingredient costs (June 2004) are: Soybean Meal $480.00, ZTFB $200.00, Wheat $160.00, Barley $135.00, Canola Oil $890.00, ZTFB Premix $870.00, Soybean Meal Premix $705.00. The costs quoted for both premixes are estimated retail prices.

Calculating a Breakeven Price

Calculating the breakeven price of any ingredient is useful because not only does it give an indication as to whether or not using that ingredient is cost effective, but it also serves as a guide as to just how much could actually be paid for that ingredient.

One fairly simple way of calculating a breakeven price for zero-tannin faba bean would be to divide the dollar difference between the two formulas by the amount of zero-tannin faba bean (ZTFB) in the formula and adding (or subtracting) that value to the tonne price of zero-tannin faba bean.

EXAMPLE 1:

Cost difference between the two formulas in Table 11 = $33.55
Price of ZTFB per tonne = $200.00
Amount of ZTFB used in the formula = 300 kg

Calculation:

$33.55/300 kg ZTFB * 1000 kg ZTFB = $111.83

Breakeven = $111.83 + $200.00 = $311.83

In other words, if zero-tannin faba bean were to cost $311.83, there would be neither an advantage nor disadvantage to using them in your feed, as compared to soybean meal.

EXAMPLE 2

If the zero-tannin faba bean were to actually cost $400.00 per tonne, the bean formula in table 2 would cost $26.45 more than the soybean meal formula. In this case, the cost difference calculation would have to be subtracted from the zero-tannin faba bean price. The calculation would be as follows:

$26.45/300 kg ZTFB * 1000 kg ZTFB = $88.16

Breakeven = $400.00 – $88.16 = $311.83

Notice that the breakeven price is the same as that calculated above in EXAMPLE 1.

A simpler method to obtaining a current breakeven value for any ingredient including zero-tannin faba bean, would be to contact your feed supplier and have the nutritionist run your formulas in the least cost formulation program for you. Using your ingredient prices, the nutritionist would be able to calculate precisely what a breakeven value would be on your farm.

Conclusion

Tannin levels have been shown to be significantly reduced in zero-tannin faba bean. Indeed, the PSCI research and feeding trials have confirmed that diets containing high levels of zero-tannin faba bean are as palatable to growing swine as soybean meal based diets.

Further, this research has also been very useful in establishing a more accurate nutrient profile than previously existed for zero-tannin faba bean. This will be of great benefit to nutritionists by providing a guide that can assist them to more correctly formulate these beans into swine feeds.

As reported in the trial summary, growth performance was similar between the test groups. However, there were some discrepancies that arose during some individual feeding periods that will need to be monitored in future feeding trials. Additional carcass evaluation comparisons will also need to be carried out in efforts to establish more precise formulation and feeding recommendations for zero-tannin faba bean.

There are some pork producers in Alberta that are currently using zero-tannin faba bean in their hog feeds. Some have been using them for more than two years now. On these farms the bean is being used either as a complete substitute for or in combination with soybean meal, depending on the diet. With zero-tannin faba bean currently available at about the same price as field pea,

these producers are realizing even greater savings in feed costs than they normally would from using pea.

As with any new or unknown ingredient, nutrient and feeding standards need to be established, results need to be duplicated and consistency of animal performance confirmed. With the PSCI research and feeding trials as a solid reference starting point, zero-tannin faba bean have taken a major first step in accomplishing those goals.

In summary, zero-tannin faba bean look very promising as an alternative ingredient for use in swine feeds. As availability increases, we should expect to see more routine use in hog feeds.

b) Economic Impact Of Zero-tannin Faba Bean on Alberta Hog and Crop Industry

Canada imports about a million tonnes of soybean meal a year from the USA; a large part of this goes to the hog industry in Canada. If we can replace a significant part of this with zero-tannin faba bean there is a net benefit to our economy. It gives hog producers a local excellent product to feed; and grain producers an alternative crop that also fixes a lot of nitrogen.

Hog Protein Use in Alberta

If soybean meal was the sole protein source for hogs from farrow to finish, about 50 kilograms of soybean meal would be used per market hog shipped. This includes all the feed used for sows and boars. In Canada, we produce about 23,000,000 market hogs per year. If soy was the sole protein source then we would need to import 1,152,000 tonnes. Just for Canada's hog industry, Alberta represents about 15% of Canada's market hog production. This works out to about 173,000 tonnes of soybean meal that would be needed to supply protein to Alberta's hog industry, if only soy was fed.

If soy is replaced by faba bean in a diet, you would need to add roughly twice as much because protein (lycine) is about 50% of soy. This would mean 173,000 tonnes times two or 346,000 tonnes of zero-tannin faba bean would need to be fed. Faba bean cannot replace 100% of soy but only about 80% when you look at all diets together. This means 346,000 tonnes times 80% or about 277,000 tonnes of faba bean could be fed to replace about 140,000 tonnes of imported soy bean meal. (It is not the full 173,000 because some diets still need soy.) These, of course, are maximum values.

Other products such as meat meal and pea are also fed to hogs in large amounts. Faba bean is superior to pea for hogs so could replace much of the pea use, as farmers see their potential. Meat meal is a different story and is a matter of least cost ration and what is most economical.

The Bottom Line

Even though 277,000 tonnes of faba bean might be the high extreme, to say that Alberta's hog industry could absorb 100,00 tonnes is very realistic. Then we add in all of western Canada, and 200,000 to 300,000 tonnes is not out of the question. Then you add in other feeding industries such as cattle, poultry and fish and the potential is very great.

Conclusion

This trial has shown that zero-tannin faba bean is a good hog feed and can replace a significant amount of imported soy bean meal. This represents a win-win situation for our agriculture

industry. Grain producers have an excellent crop to add to their rotation and livestock producers have another choice of protein.

IV. REFERENCES

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V. COMMUNICATION PLAN

a) Project Outcome

This project will develop a full swine nutritional performance data package[1] based on nutritionally analyzed, zero-tannin faba bean. Research data will be interpreted in a cost-benefit analysis with swine grower and finisher diets utilizing zero-tannin faba bean compared to other protein feeds (e.g. field pea, soybean). Results will be made available to the swine industry, other faba bean end users, and to the pulse growing industry.

b) Project Impact

The overall goal is to remove the two barriers, identified in the consultants study, (*Faba bean Opportunities & Constraints in Alberta* by Marv Anderson and Associates Ltd.) in order to further expand the usage of zero-tannin faba bean in an expanding hog industry and to promote growth of the faba bean seed production industry.

This project will develop a swine protein and energy feed source to assist in growth of the hog industry. Increasing faba bean crop production will provide a crop diversification opportunity for the Parkland and Peace regions of Alberta.

c) Project Communication Strategy

Based on discussions with invested parties and a SWOT analysis, recommendations are as follows:

The first priority is a direct reporting of the project outcome to a targeted audience. In this case, it is the feed nutritionists of the major feed companies throughout the province.

The second, and more inclusive phase of the communication plan may involve the department and public at large but will be aimed at the Alberta hog and pulse producer. This will be to (1) inform of the general nature of the project, (2) gauge interest in introducing a new feed component and crop, (3) incite support for the continuing phases, and (4) generally inform the positive impact it can have on Alberta's agriculture industry.

The first phase of the communication plan will take place in the next few months. These are the more directed reporting responsibilities. The second and more general phase will occur over the fall 2004 and into 2005. This will include the promotion of further steps, once they have been established, and God willing, funded.

Analysis and time lines in the following appendices:

SWOT Analysis	Appendix A
Audience	Appendix B
Proposed Schedule of Communication	Appendix C

[1] Data package will be a compact disk accompanying the report. It will contain: a .pdf copy of the final report, a PowerPoint presentation on the recommendations, and a copy of the poster to be displayed at industry meetings.

VI. APPENDIX

Appendix A. SWOT Analysis

1. Project Strengths:
   - Results have the capacity to benefit a number of different industries in Alberta
   - World-renowned expertise (Ruurd Zijlstra, John Patience, Germain Bégin) with international reputation
   - Strong team from Alberta Agriculture, Food and Rural Development and effective collaboration with industry
   - Alternative crop for grain producers; producers can be better assured of market options.
   - Agronomic research efforts will be more cost effective and focused
   - Forged ties and networks across disciplines

2. Project Weaknesses:
   - Due to lack of definite funding, next steps cannot be firmly established
   - Value and importance of Alberta-specific data on field pea not fully recognized by pulse industry
   - No precise data on field pea in Alberta to compare to zero-tannin faba bean

3. Project Opportunities:
   - Research data comparing field pea and zero-tannin faba bean can be more focused, thereby saving time and resources
   - More feed and crop options for Alberta swine and pulse industry
   - Opportunity to firmly establish Alberta's stake in the feed market and displace imported soybean
   - Alternative crop to include in rotations, benefiting overall environmental health
   - Economic effect that new crops could have on existing acreage (substituting) that are currently in rotation.
   - AAFRD staff could better understand the various disciplines that influence new crop development and commercialization
   - Aligning project team with highly credible individuals in the hog, feed and pulse industry
   - Baseline data is needed for field pea for effective comparisons. This increases the growth potential and success of the project.
   - Good chance of cascading effect in ties with local feed companies showing interest. Hog producers will be willing to feed, feed companies will be willing to try, in turn pulse producers will have an immediate market. – *talk about a value chain*!

4. Project Threats:
    - Funding for important next steps is not guaranteed
    - Resources, people, time, etc. to get the word out. Need to keep the momentum up even months down the road.
    - The validity of the research study could be challenged. This is one study, and there were some differences in the early stages in the feeding of gilts versus barrows. Additionally, this study compares faba bean to soybean and field pea, which is generally accepted in rations, was not compared due to the additional costs of doing the research with the pea included.
    - Difficult to protect the intellectual property in this report. Other organizations could capitalize or "scoop" Albertan's on these opportunities.

Appendix B. Audience

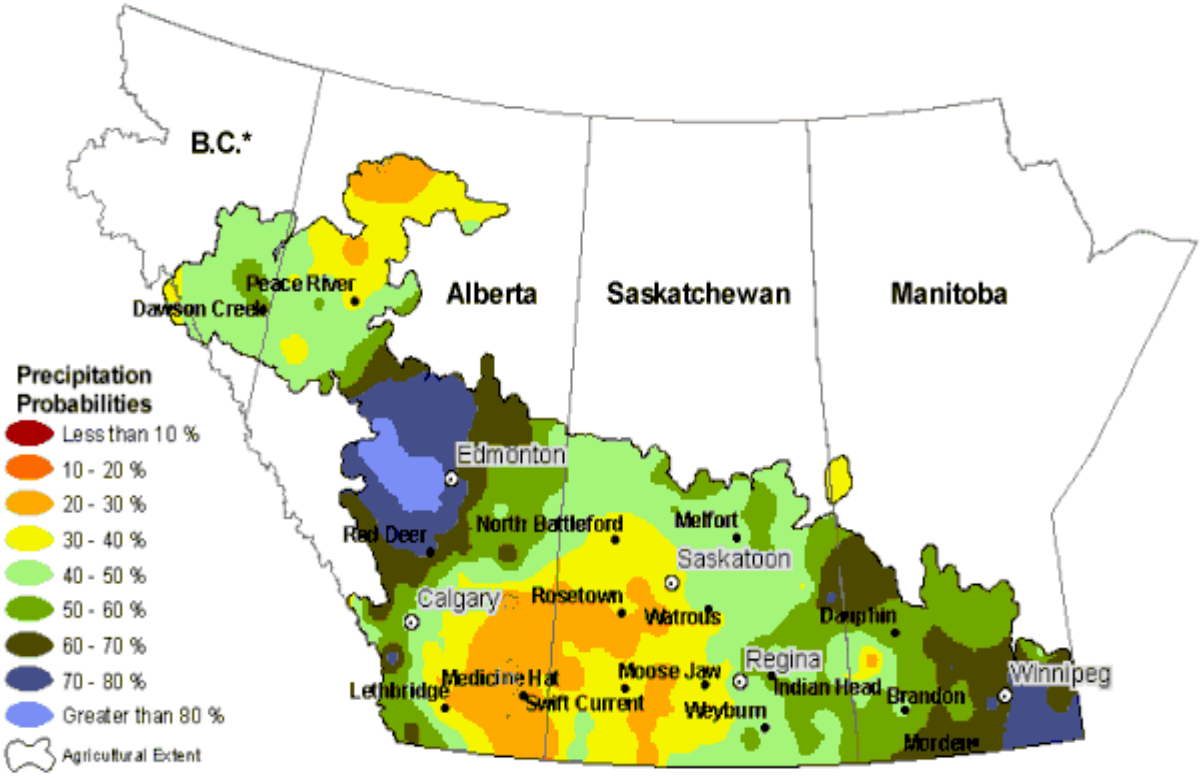
1. Project Audience:
    - Nutritionists of major feed companies
    - Hog producers
    - Pulse growers
    - Pulse Grower front office staff, executive director, director of extension
    - AAFRD Livestock Development Division
    - AAFRD Crop Diversification Division staff
    - AAFRD Business and Innovation Division staff
    - Agriculture and Agri-Food Canada – esp. Alberta researchers
2. Targeted Communication (outcomes):
    - Presentation of results
    - Report in government AAFRD library for reference
    - Targeted delivery of report to specific individuals-directors/branch heads
3. General Communication (promotion):
    - Data package
    - Newsletter articles
        - Alberta Pork Producers (fall)
        - Alberta Pulse Growers (fall &/or winter)
        - AgKnowledge
        - Western Hog Journal
    - Quarterly report write-up
    - Presentations at targeted meetings – *Ruurd Zijlstra, Bert Dening, Germain Bégin*
        - Nutritionists
        - Hog grower meetings
        - Alberta Pulse Growers Commission regional zone meetings
        - Posters for regional zone meetings, FarmTech 2005

Appendix C. Proposed Schedule of Communications

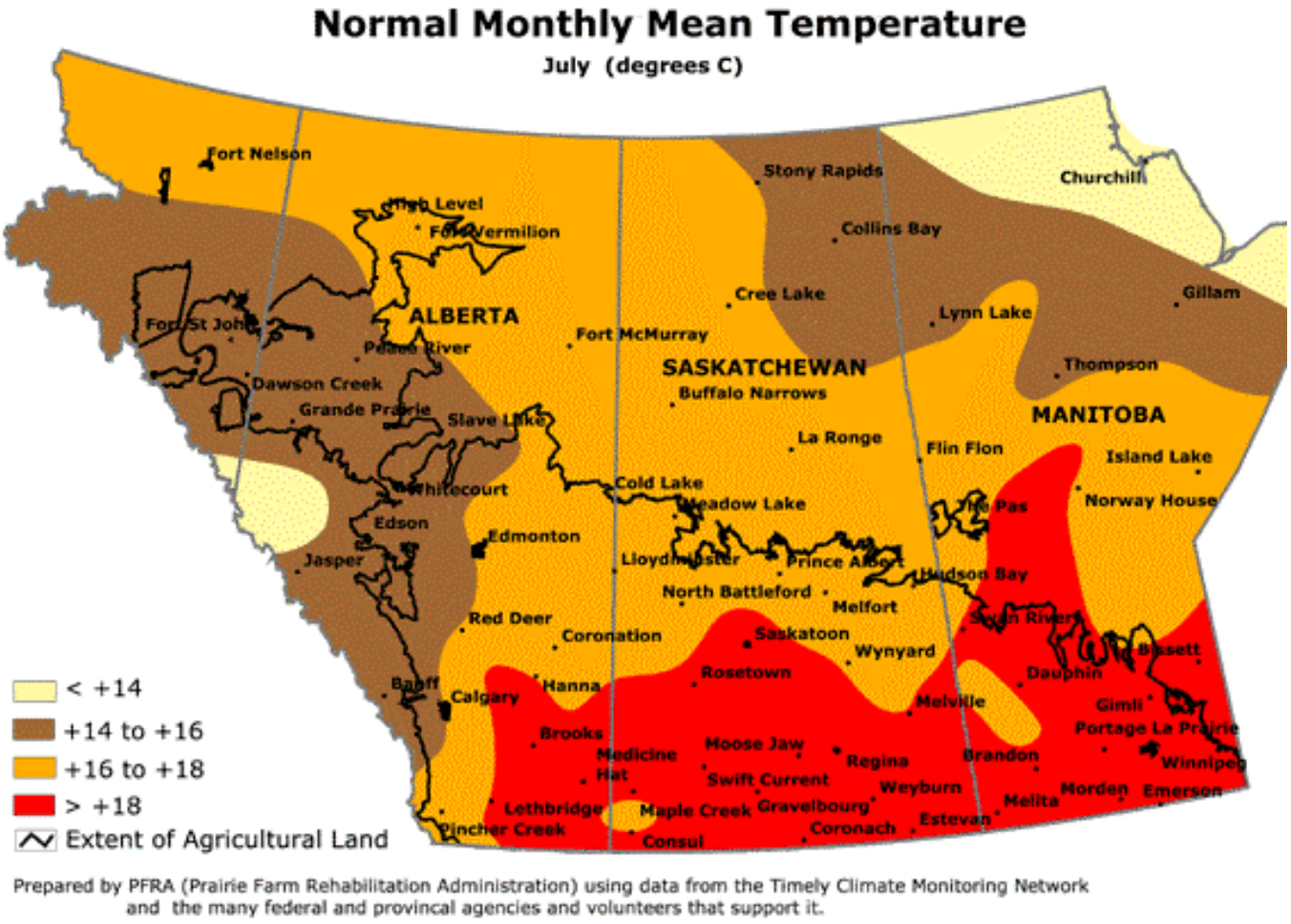
June 25	Complete report in June *(Ken, Bert, Germain, Carol)*
June 30	Write-up for CDD quarterly report *(Valerie)*
July	Western Hog Exchange Newsletter *(Bert)*
July 7	Article for August Agknowledge *(Valerie)*
July	Alberta Pork website *(Bert)*
July	Canadian Society of Animal Science – Edmonton *(Ruurd, John)*
July/Aug	AgriNews article – benefits of faba bean in hog rations *(Bert)*
July/Aug	Call of the Land – benefits of faba bean in hog rations *(Bert)*
Aug 15	Copies of report to AAFRD division directors/branch heads (Livestock Division, Crop Diversification Division, and Business & Innovation Division, as well as other interested individuals, i.e. University of Alberta) *(Ken, Carol, Valerie)*
Aug	CC article and invitations to the JGO presentation *(Ken, Carol)*
Aug	Request time on agendas to present at major meetings *(Bert, Ken, Mark et al.)*
Aug/Sept	Western Hog Journal article - fall issue *(Bert)*
Sept 15	Presentation at JGO (Brown bag) *(Ken chair –Bert, Germain, Ruurd)*
Sept/Oct	Create presentation - CD *(Bert, Germain, Ruurd, Carol)*
Sept/Oct	Three posters for meetings *(Ken, Mark, Sheryl, Carol, Ruurd, Germain)*
Oct 1	Copies of report to Neil Crawford library *(Ken, Valerie, Carol)*
Oct	Presentation to the nutritionists from companies - travelling road show *(Bert, Germain, Ruurd)* three locations - north, central and south Alberta
Oct 31	Swine Technical update - Red Deer *(Bert)*
Oct/Nov	AgriNews article – faba bean as a new crop in the rotation *(Ken, Mark)*
Oct/Nov	Call of the Land– faba bean as a new crop in the rotation *(Ken, Mark)*
Nov/Dec	Poster presentations at APG Zone annual meetings *(Ken, Mark, Sheryl)*
Jan 2005	Poster displayed at FarmTech 2005 *(Ken, Mark, Sheryl)*
Jan 2005	Banff Pork Seminar - presentation *(Bert, Germain, Ruurd, Carol)*
June 2005	Journal of Animal Science *(Ruurd, Bert, Germain)*

Appendix D. Precipitation Data – April 1 and July 30 (1971-2000)

Probability of Receiving ~ 216 mm (~ 8.5") of Precipitation Between April 1st and July 30th Based Upon Historical Data (1971 - 2000)



Appendix E. Normal Monthly Mean Temperature



Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincal agencies and volunteers that support it.