Study Title

Introduced Protein Levels and Compositional Analyses of Roundup Ready®/Yieldgard® (GA21 x MON 810) Maize Lines Grown in 1998 Field Trials

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Study Completed On

August 3, 1999

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Statement of No Data Confidentiality Claims

No claim of confidentiality is made for any information contained in this study on the basis of its falling within the scope of FIFRA & 10(d)(1)(A), (B), or (C).

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Statement of Compliance

This study meets GLP requirements of 40 CFR Part 160 (EPA) except for the following:

The reference standards used for compositional analysis were not characterized according to GLP standards. This exception had no effect on the integrity or quality of the study because the reference standards were obtained from reputable suppliers.

Submitter: _____ Date: 8/5/99

Sponsor: _____ Date: 8/3/99

Study Director: Ravinder S Sidhu Date: 3 Aug 99

Quality Assurance Statement

Study Title: Introduced Protein Levels and Compositional Analyses of Roundup Ready®/Yieldgard® (GA21 x MON 810) Maize Lines Grown in 1998 Field Trials

Study Number: 99-01-50-01

Reviews conducted by the Quality Assurance Unit confirm that the final report reflects the raw data.

Additional reviews conducted by the Quality Assurance Unit of Covance Laboratories are presented in the contract facility report.

Dates Of Inspection / Audit	Phase	Date Reported To:	
		Study Director	Management
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C. Marie Braton

C. Marie Braton
Quality Assurance
AG Regulatory, Monsanto Company

August 3, 1999
Date

Signatures of Approval

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Certus International, Inc (St. Louis): Roy Sorbet (statistical analysis)

Study Initiation Date: February 15, 1999

Records Retention: All study specific raw data, protocols, final reports and facility records will be retained at Monsanto, St. Louis and/or Monsanto, LLN, except for raw data and facility records maintained at Covance Laboratories, Inc., Wisconsin Facility.

Sample Storage: Any unused study samples that are not destroyed will be stored at Monsanto, St. Louis and/or Monsanto, LLN.

Signatures of Approval:

Ravinder S Sidhu 3 Aug 99
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8/3/99
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Abbreviations

ADF	Acid detergent fiber
AA	Amino acid
AACC	American Association of Cereal Chemists
AOAC	Association of Official Analytical Chemists
AOCS	American Oil Chemists Society
AP	alkaline phosphatase
B.t.k.	*Bacillus thuringiensis* subsp, *kurstaki*
Cry1Ab	protein from *Bacillus thuringiensis* subsp. *Kurstaki* HD-1
DTT	Dithiothreitol
DW	Dry weight
ECB	European Corn Borer
mEPSPS	modified maize 5-enolpyruvylshikimate-3-phosphate synthase
E. coli	*Escherichia coli*
ELISA	Enzyme-linked immunosorbent assay
FA	Fatty acid
fwt	fresh weight of tissue
FW	Fresh weight
HEPES	N-[2-Hydroxyethyl]piperazine-N'-[ethanesulfonic acid]
HRP	horse radish peroxidase
hsp	heat-shock protein
LOD	Limit of Detection
LOQ	Limit of Quantitation
NDF or NDFE	Neutral detergent fiber
NOS	Nopaline synthase
OD	Optical denisty
OTP	Optimized transit peptide
PBST	Phosphate-buffered saline, Tween 20
PCR	Polymerase chain reaction
pNPP	p-nitrophenyl phosphate, AP substrate
RR	Roundup Ready®
SOP	Standard Operating Procedure
TBA	Tris-borate with L-ascorbic acid
T/C/R	Test/Control/Reference
TMB	(3,3',5,5' Tetramethylbenzidene) peroxidase substrate
Tris	Tris(hydroxymethyl)aminomethane
YG	YieldGard®

[Standard abbreviations, e.g., units of measure, according to format described in 'Instructions to Authors' in the Journal of Biological Chemistry]

I. Summary

Monsanto Company has developed Roundup Ready®/Yieldgard® (GA21 x MON 810) maize hybrids by conventional breeding of two genetically modified parental maize lines: 1) Roundup Ready (RR) line GA21 which contains the introduced modified maize 5-enolpyruvylyshikimate-3-phosphate synthase (mEPSPS) protein that confers tolerance to glyphosate, the active ingredient in Roundup™ herbicide, and 2) Yieldgard (YG) line MON 810 which contains the introduced Cry1Ab protein from *Bacillus thuringiensis* subsp, *kurstaki* (*B.t.k*) HD-1 that confers resistance to the European Corn Borer (ECB) and other lepidopteran insects. The mEPSPS protein has >99.3% amino acid sequence identity to the wild-type maize EPSPS enzyme, the only difference being a change in three of 445 amino acids. Maize plants that demonstrate commercial level tolerance to Roundup herbicide are called Roundup Ready (RR). Maize plants that provide commercial levels of protection against ECB and other lepidopteran insects are called YieldGard in the U.S. and Maisgard® in Europe (these will be called YieldGard in this report).

The purpose of this study was to estimate levels of the introduced proteins and to conduct compositional analyses of tissues collected from two hybrid groups of maize test lines (DK RR/YG and LH RR/YG) produced by conventional breeding of the corresponding genetically modified parental lines (DK RR and DK YG; LH RR and LH YG) and non-transgenic control lines (DK and LH). Forage and grain samples collected in U.S. and E.U. multi-site trials were analyzed by two enzyme-linked immunosorbent assays (ELISAs) to estimate the levels of mEPSPS and Cry1Ab protein present in these tissues. In addition, compositional analyses were conducted to measure proximate (protein, fat, ash, carbohydrate, moisture), acid detergent fiber (ADF), neutral detergent fiber (NDF), amino acid, fatty acid, vitamin E, mineral (calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc), phytic acid and trypsin inhibitor content of grain, and proximate, ADF and NDF content of forage.

Comparisons of mEPSPS protein levels in the multi-trait RR/YG lines vs. single trait parental RR lines, showed no notable differences in forage for the E.U. trials and in grain for the U.S. trials. However, mean mEPSPS protein levels were approximately 1.3 to 1.9-fold higher in forage for the RR/YG lines vs. parental RR lines in U.S. trials, and 1.3-fold higher in grain for the DK RR/YG line vs. the parental DK RR line in E.U. trials. Such reversal of differences according to geography (e.g., U.S. vs E.U.) are most likely due to biological variability and not considered significant. For both sets of hybrid groups produced in U.S. or E.U. multi-site field trials, there were no notable differences in Cry1Ab protein levels in either forage or grain in comparisons of the mult-trait RR/YG lines with single trait parental YG lines.

Statistical evaluation of the composition data showed that in 612 comparisons, there were only seven instances (14 values), involving five components, where the RR/YG line was

significantly different ($p < 0.05$) from both parental lines in the same direction, i.e., the mean value was either greater than or less than both parental lines. For four components, the absolute magnitude of each difference as a percent of the corresponding RR/YG line mean value was small (2.3-14.3%) and within the range of natural variability, and therefore not considered biologically relevant. For behenic acid, the absolute magnitude of the mean difference as a percent of the corresponding RR/YG line mean value ranged between 29-43%. Since the content of behenic acid in maize grain is typically very low (~0.2% of total fatty acids), differences between RR/YG and parental lines are likely exaggerated due to the increase in method variability at concentrations near the detection limit of the assay. This is supported by the fact that RR/YG line mean values for behenic acid and the other four components were within the range found for the non-transgenic control and commercial reference lines, and either within published literature ranges (Jugenheimer, 1976; Watson, 1982; Watson, 1987) or within previously reported ranges for non-transgenic maize varieties (Sanders and Patzer, 1995; Sanders *et al.*, 1996a,b; 1997a,b).

This data, together with the safe history of use of the host organism (maize) as a common source of animal feed and human food, lead to the conclusion that Roundup Ready®/ Yieldgard® (GA21 x MON 810) maize hybrids developed by conventional breeding of genetically modified parental maize are compositionally equivalent and as safe and nutritious as the maize varieties grown commercially today.

II. Introduction

A. Background

Monsanto Company has developed Roundup Ready®/Yieldgard® (GA21 x MON 810) maize hybrids by conventional breeding of two genetically modified parental maize lines: 1) Roundup Ready (RR) line GA21 which contains the introduced modified maize 5-enolpyruvylyshikimate-3-phosphate synthase (mEPSPS) protein that confers tolerance to glyphosate, the active ingredient in Roundup™ herbicide, and 2) Yieldgard® (YG) line MON 810 which contains the introduced Cry1Ab protein from *Bacillus thuringiensis* subsp, *kurstaki* (*B.t.k*) HD-1 that confers resistance to the European Corn Borer (ECB) and other lepidopteran insects. The mEPSPS protein has >99.3% amino acid sequence identity to the wild-type maize EPSPS enzyme, the only difference being a change in three of 445 amino acids. Maize plants that demonstrate commercial level tolerance to Roundup herbicide are called Roundup Ready (RR). Maize plants that provide commercial levels of protection against ECB and other lepidopteran insects are called YieldGard in the U.S. and Maisgard in Europe.

Maize line GA21 contains a single DNA insert consisting of the rice actin promoter and intron, an OTP (optimized transit peptide) sequence fused to the *mEPSPS* gene, and the *NOS 3'* (a 3' non-translated region of the nopaline synthase gene) termination sequence (Lirette *et*

al., 1998). Maize line MON 810 contains a single DNA insert consisting of an e35S promoter with a duplicated enhancer region obtained from cauliflower mosaic virus, a maize hsp70 (heat-shock protein) gene, and the *cry1Ab* gene (Kania *et al.*, 1995). The RR/YG maize hybrids developed by conventional breeding of maize lines GA21 and MON 810 produce both mEPSPS and Cry1Ab novel proteins.

B. Purpose

The purpose of this study was to estimate levels of the introduced proteins and to conduct compositional analyses of tissues collected from two Roundup Ready®/Yieldgard® (GA21 x MON 810) maize test lines produced by conventional breeding. The study also included the analyses of tissues collected from the corresponding genetically modified parental and non-transgenic control lines. The non-transgenic control lines have background genetics representative of the test lines but do not express either the mEPSPS or Cry1Ab protein. Forage and grain samples collected from multi-site U.S. and E.U. trials were analyzed by two enzyme-linked immunosorbent assays (ELISAs) to estimate the levels of mEPSPS and Cry1Ab proteins present in these tissues. In addition, compositional analyses were conducted to measure proximate (protein, fat, ash, moisture), acid detergent fiber (ADF), neutral detergent fiber (NDF), amino acid, fatty acid, vitamin E, mineral (calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc), phytic acid and trypsin inhibitor content of grain; and proximate, ADF and NDF content of forage. Additionally, carbohydrate values in forage and grain were determined by calculation.

III. Materials and Methods

A. Test , Control and Reference (T/C/R) Substances

In this study, there were two groups of T/C/R substances, corresponding to two hybrid groups:

Hybrid Group[a]	Line	Abbreviated Name[b]	Type[c]
DK	DK591 RR/BTY	DK RR/YG	T
	DK591 RR	DK RR	R
	DK591 BTY	DK YG	R
	DK591	DK	C
LH	HC35RR1 x LH172Bt810	LH RR/YG	T
	HC35RR1 x LH172	LH RR	R
	LH198 x LH172Bt810Sel2	LH YG	R
	LH198 x LH172	LH	C

[a]DK group from DEKALB Genetics Incorporated; LH group from Holden's Foundation Seed.
[b]RR = Roundup Ready; YG = YieldGard.
[c]T = test substance; R = Reference substance; and, C = control substance.

Both groups of T/C/R substances were grown in U.S. (Production Plan 98-01-50-01) and E.U. (Study Plan 98-BTRR-01-It/Sp) multi-site field trials. Additional reference substances included in the study were a) 14 non-genetically modified, commercial maize hybrids purchased from local growers in the U.S., and b) two locally-adapted, non-genetically modified commercial maize hybrids planted at each site in the E.U. multi-site trials.

B. Characterization of T/C/R Substances

The identity of U.S. forage and grain samples was based on sample handling records and mEPSPS and Cry1Ab ELISA data. A sample was considered correctly identified if the results of both ELISA assays matched the expected outcome [e.g., for a DK YG sample, the expected outcome would be a value lower than the limit of quantitation (LOQ) in the mEPSPS ELISA and a value greater than the limit of detection (LOD) in the Cry1Ab ELISA]. Additionally, polymerase chain reaction (PCR) analyses for the presence of GA21 and MON 810 and were conducted on grain samples from a single field site (IA1; U.S. multi-site trials) to confirm sample identity based on sample handling records and ELISA data.

The identity of E.U. forage samples was based on sample handling records and mEPSPS and Cry1Ab ELISA data. The identity of E.U. grain samples was based on sample handling records and Cry1Ab ELISA data only as the YG and control line samples had values greater than the LOD in the mEPSPS ELISA due to matrix effects and presence of the wild-type mEPSPS protein (see Section III.I for discussion).

C. Field Trials

The test, control and reference lines were produced in two field studies: U.S. multi-site trials (Production Plan 98-01-50-01) and E.U. multi-site trials (Study Plan 98-BTRR-01-It/Sp). A brief summary of these studies follows based on the U.S. multi-site (Sidhu *et al.*, 1999) and the EU multi-site (Vanbellinghen, 1999) field reports.

U.S. multi-site trials. Trials were conducted at six sites in the US: Webster, IA; Bagley, IA; Carlyle, IL; Edwardsville, IL, York, NE; and, Noblesville, IN. At each site, there were two blocks (treated and untreated) separated by 20-30 feet, each containing four plots. The plots in the treated block were planted with RR/YG and RR lines; the plots in the untreated block were planted with YG and non-transgenic control lines. Each plot was approximately 15' x 30' in size with two rows/plot. The genetic purity of plants was maintained by bagging the tassels and ear shoots and self-pollinating each plant by hand. The following observations were recorded during the growing season: plant stand counts, growth stage, disease incidence, insect damage, start of pollen shed, start and end of pollination, and growth habit.

Prior to sampling, young leaf tissue from each plant in plots planted with the YG and RR/YG lines were screened with an ELISA kit to identify plants lacking the Cry1Ab protein. Cry1Ab-negative plants were tagged and not included in subsequent samplings. RR-negative

plants in plots containing the RR/YG and RR lines were identified by a single, early post-emergence application of Roundup Ultra™ herbicide at a target rate of 32 fl oz/A, to plants at the V4-V6 stage in the treated block. Plants showing signs of severe injury or death were excluded from sampling. At the IN site, there were an insufficient number of plants in three plots due to poor germination; consequently, forage was not collected and plants in these plots were preserved for grain sampling. Young leaf tissue was collected from plants at a growth stages between V6 - V13 across all sites. Forage was collected at the late dough/early dent stage by dividing 6 randomly selected plants (3/row) into three roughly equal segments and placing them on dry ice within 3 minutes of collection at all sites. Ears were harvested from 6 self-pollinated plants at normal kernel maturity (< 30% moisture), dried to a moisture of approximately 12-15%, shelled, and the kernels pooled to provide the grain sample. Forage (on dry ice) and grain (at ambient temperature) samples were then shipped to Monsanto's facility in Chesterfield, Missouri, USA for estimation of introduced protein levels and composition analyses.

EU multi-site field trials. Trials were conducted at seven locations in the E.U.: Fontellas, Spain; Castil de Vela, Spain; Sarinena, Spain; Sevilla, Spain; Cremona (Paderno Ponchielli), Italy; Piacenza (Caorso), Italy; and, Bologna (Bagnarola), Italy. At each site, there was one treated block and one untreated block, each containing four plots. The plots in the treated block were planted with RR/YG and RR lines; the plots in the untreated block were planted with YG, non-transgenic control and commercial reference lines. Approximately, 60 seeds of each line were sown into two rows/plot. There was a minimum isolation distance of 200 m between test plots and surrounding maize fields. The genetic purity of plants was maintained by bagging the tassels and ear shoots and self-pollinating each plant by hand.

A single, early post-emergence application of Roundup™ herbicide (MON 52276) was applied at a target rate of 3 l/ha to plants at the V8-V10 stage in the treated block; at the Piacenza (Caorso) site Roundup application occurred at the V4 - V6 stage. Young leaf tissue was collected from plants at a growth stages ranging between V6 - V10 across all sites. Forage (whole plant minus roots) was collected at the soft dough stage, reduced in size into 30-50 cm sections, and placed on dry ice. Ears were hand harvested at normal kernel maturity, dried to a moisture of approximately 10-20%, shelled, and the kernels pooled to provide the grain sample. Forage (on dry ice) and grain (at ambient temperature) were shipped to Monsanto's facility in Louvain-la-Neuve (LLN) for further processing. Forage samples were homogenized in the presence of dry ice in a grinder mixer and a 500 g subsample prepared for shipment. Forage (on dry ice) and grain subsamples (at ambient temperature) were then shipped to Monsanto's facility in Chesterfield, Missouri, USA for composition analyses.

D. Analytical Standards

Appropriate standards were used in each assay as reference standards for the analytical procedures. The analytical standards used for compositional analyses are described in Section III.G.

mEPSPS protein standard for ELISA. The mEPSPS protein standard (purity >85%; lot #6334221) was produced by a genetically modified *E. coli* strain (W3110), containing the plasmid vector pMON 32968. Single-use aliquots of mEPSPS protein standard (1.6 mg/mL) were stored at approximately -80°C in a buffer solution containing 50 mM HEPES-NaOH, pH 7.1 mM DTT and 15% (v/v) glycerol. The *E. coli*-produced mEPSPS protein was shown to be immunologically equivalent to the mEPSPS produced in maize leaf tissue by a dilution equivalence (parallelism) ELISA experiment (Rogan *et al.*, 1999).

Cry1Ab protein standard for ELISA. The Cry1Ab protein standard (purity 92%; lot #I92017) was prepared by trypsinization of the full length Cry1Ab protein produced in *E. coli* strain W3110 II-5 containing the plasmid vector pMAP40 (Heeren *et al.*, 1992). The purified protein was stored as a 1.8 mg/mL protein solution in 100 mM sodium carbonate, pH 10, at ≈ -80°C. Characterization of the standard has been described by Berberich and Lee (1994).

E. Test System

The test system for this study was a panel of analytical biochemical methods. Validated ELISA's were used to estimate mEPSPS (Rogan *et al.*, 1999) and Cry1Ab (Ledesma *et al.*, 1995) protein levels in forage and grain samples. Compositional analyses were performed by modifications of published methods that are currently used to evaluate the nutritional quality of maize (see Section III.G).

F. ELISA Analytical Methods

Extraction of protein from maize tissues. Maize tissues were processed and extracts prepared according to approved SOPs. Tissues were ground to a fine powder on dry ice in a blender or a vertical cutter mixer. All tissue powders were kept on dry ice during extract preparation. For the mEPSPS ELISA, forage was extracted with TBA (Tris-Borate with L-Ascorbic acid) buffer at a tissue to buffer ratio of 1:20 (w/v) and grain was extracted with PBST (Phosphate buffered saline with Tween 20) buffer at a tissue to buffer ratio of 1:100 (w/v). For the Cry1Ab ELISA, forage was extracted with TBA buffer at a tissue to buffer ratio of 1:50 (w/v) and grain was extracted with PBST buffer at a tissue to buffer ratio of 1:100 (w/v). Extracts were prepared using a Polytron tissue homogenizer (Brinkman, Inc., Westbury, NY) operating at ≈17,500 rpm for two 15 second bursts. Insoluble material was pelleted by centrifugation at 9264g (or ≈ 8,000 x rpm) for ≈10 minutes at ≈ 4°C. The supernatant was removed and stored frozen at approximately -80°C until needed.

mEPSPS ELISA. mEPSPS protein levels in forage and grain extracts were determined using a double antibody sandwich ELISA consisting of a polyclonal anti-mEPSPS antibody produced in rabbits as the capture antibody and a purified anti-mEPSPS IgG conjugated to horseradish peroxidase (HRP) as the detecting antibody (SOP BR-ME-0026-02). A horseradish peroxidase substrate, TMB (3,3',5,5' tetramethylbenzidene), was added for color development. The mEPSPS protein levels in plant tissue extracts were quantitated by comparison to a range of concentrations of the *E. coli*-produced mEPSPS reference standard. The positive control (lot #6178535) for the ELISA was a mEPSPS protein standard spiked into control maize grain tissue extract used as a quality control sample.

Cry1Ab ELISA. Cry1Ab protein levels in forage and grain extracts were determined using a double antibody sandwich ELISA consisting of a polyclonal anti-Cry1Ab antibody produced in rabbits as the capture antibody and purified anti-Cry1Ab IgG conjugated to alkaline phosphatase (AP) as the detecting antibody (SOP BR-ME-0093-01). An alkaline phosphate substrate tablet, pNPP (p-nitrophenyl phosphate), dissolved in ethanolamine-HCl buffer (pH $\approx$ 9.8) was added for color development. The Cry1Ab protein levels in plant tissue extracts were quantitated by comparison to a range of concentrations of the *E. coli*-produced Cry1Ab reference standard. The positive control (lot #2/8/91HBH) for the ELISA was a cotton seed extract used as a quality control sample.[1]

ELISA of U.S. muti-site field trial samples were conducted at Monsanto's facility in Chesterfield, MO, USA. ELISA of E.U. muti-site field trial samples were conducted at Monsanto's facility in LLN, Belgium, Europe (Hontis *et al.*, 1999).

G. Compositional Analytical Methods

Forage and grain samples were prepared as described in Section F above and shipped to Covance Laboratories, Inc., Madison, Wisconsin for compositional analyses. Grain samples were analyzed for proximate (protein, fat, ash, moisture), ADF, NDF, amino acid, fatty acid, vitamin E, mineral (calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc) phytic acid and trypsin inhibitor content. Forage samples were analyzed for proximate, ADF and NDF content. Carbohydrate values in forage and grain were determined by calculation. The same methods were used for the proximate analysis of forage and grain except for the analysis of fat as described below. The analytical data generated by Covance Laboratories, Inc. was summarized in an Analytical Subreport (CHW 6103-224) which was archived with the study files.

Acid detergent fiber (ADF). This is a modified version of the method described in USDA Agricultural Handbook No. 379.8 (1970). The sample was placed in a fritted vessel and washed with an acidic boiling detergent solution that dissolved the protein, carbohydrate, and

[1] This was a common quality control sample for evaluating cotton and corn plants producing the Cry1Ab protein.

ash. An acetone wash removed the fats and pigments. The lignocellulose fraction was collected on the frit and determined gravimetrically. The limit of detection of the method for this study was 0.1%. There was no analytical reference substance for this analysis.

Amino acid composition (TAAP). This is a modified version of AOAC method 982.30 (1995). The sample was assayed by three methods to obtain the full profile. Tryptophan required a base hydrolysis with sodium hydroxide. The sulfur containing amino acids required an oxidation with performic acid prior to hydrolysis with hydrochloric acid. Analysis of the samples for the remaining amino acids was accomplished through direct hydrolysis with hydrochloric acid. The individual amino acids were then quantitated using an automated amino acid analyzer. The limit of detection of the method for this study was 0.1 mg/g. The reference standards were: Beckman K18, 2.5 µmol/mL per constituent except cystine (1.25 µmol/mL), lot no. S806673; Aldrich L-tryptophan, 99%, lot no. 12729HS; Sigma L-cysteic acid hydrate, 99.4%, lot no. 65H2658; Sigma L-methionine sulfone, 100%, lot no. 12H3349.

Ash (ASHM). This is a modified version of AOAC method 923.03 (1995). The sample was placed in an electric furnace at 550 °C and ignited to drive off volatile organics. The nonvolatile matter remaining was quantitated gravimetrically and calculated to determine percent ash. The limit of detection of the method for this study was 0.1%. There was no analytical reference substance for this analysis.

Carbohydrates (CHO). This method is described in USDA Agricultural Handbook No. 74, p 2-11 (1973). Carbohydrate values were calculated by difference using the fresh weight-derived data and the following equation:

$$\% \text{ carbohydrates} = 100\% - (\% \text{ protein} + \% \text{ fat} + \% \text{ ash} + \% \text{ moisture})$$

Fat-acid hydrolysis (FAAH). This is a modified version of AOAC methods 922.06 and 954.02 (1995). The forage sample was hydrolyzed with hydrochloric acid at elevated temperature. The fat was extracted using ether and hexane. The extracts were washed with a dilute alkali solution and filtered through a sodium sulfate column. The extract was then evaporated, dried and weighed. The limit of detection of this method for this study was 0.1%. There was no analytical reference substance for this analysis.

Fat-soxhlet extraction (FSOX). This is a modified version of AOAC method 960.39 (1995). The grain sample was weighed into a cellulose thimble containing sand or sodium sulfate and dried to remove excess moisture. Pentane was dripped through the sample to remove the fat. The extract was evaporated, dried and weighed. This method was used for the grain sample analysis. The limit of detection of the method for this study was 0.1%.

Fatty acids (FAPM). This is a modified version of AOCS method Ce 1-62 (1981). The lipid in grain samples was extracted and saponified with 0.5 N sodium hydroxide in methanol. The saponification mixture was methylated with 14% (v/v) boron trifluoride:methanol. The resulting methyl esters were extracted with heptane containing an internal standard. The methyl esters of the fatty acids were analyzed by gas chromatography using external standards for quantitation. The limit of detection of this method for this study was 0.004%. The analytical reference standards (purity 99+%)were: Nu Chek Prep Hazelton special prep nos 1 (lot no. JA10-I), 2 (lot no.JA10-H), 3 (lot nos. JA12-I and F23-J), and 4 (lot no. JY30-I); and Nu Chek Prep methyl gamma linolenate (lot nos.U-63M-J20-H and U-63M-F25-J).

Minerals/ICP emission spectrometry (ICPS). This is a modified version of AOAC methods 984.27 and 985.01 (1995) and a literature method (Dahlquist *et al.*, 1978). The sample was dried, precharred, and ashed overnight at 500° ± 50°C. The ashed sample was treated with hydrochloric acid, taken to dryness, and put into a solution of 5% (v/v) hydrochloric acid. The amount of each element was determined at appropriate wavelengths by comparing the emission of the unknown sample, measured by the inductively coupled plasma, with the emission of the standard solutions described below.

Mineral	Lot Numbers	Concentration (ppm)	Limit of Detection (ppm)
Calcium	J5-111CA	10,000	20.0
Copper	6-137CU	1,000	0.500
Iron	6-172FE	1,000	2.00
Magnesium	K5-67MG	10,000	20.0
Manganese	6-55MN	1,000	0.300
Phosphorus	15-75P	10,000	20.0
Potassium	L5-149K	10,000	100.0
Sodium	L5-80NA	10,000	100.0
Zinc	6-171ZN	1,000	0.400

Moisture (M100). This is a modified version of AOAC methods 926.08 and 925.09 (1995). The sample was dried in a vacuum oven at 100°C to a constant weight. The moisture loss was determined and converted to percent moisture. The limit of detection of this method for this study was 0.1%. There was no analytical reference substance for this analysis.

Neutral detergent fiber, enzyme method (NDFE). This is a modified version of AACC method 32.20 (1983) and the method listed in USDA Agricultural Handbook No. 379 (1970). The sample was placed in a fritted vessel and washed with a boiling detergent solution that dissolved the protein, carbohydrate, enzyme and ash. An acetone wash removed the fats and pigments. The hemicellulose, cellulose and lignin fractions were collected on the frit and

determined gravimetrically. The limit of detection of this method for this study was 0.1%. There was no analytical reference substance for this analysis.

Phytic acid (VCXX). This a modification of two literature methods (Lehrfeld 1989; Lehrfeld 1994). The sample was extracted using ultrasonication. Purification and concentration was done on a silica based anion exchange (SAX) column. Sample analysis was done on a macroporous polymer HPLC column PRP-1, 5µm (150 x 4.1) and a refractive index detector. The limit of quantitation for this study was between 0.0536 and 0.0701%. The reference substance for this assay was Aldrich phytic acid, dodecasodium salt hydrate, 99%, lot no. 15124CR.

Protein (PGEN). This is a modified version of AOAC methods 955.04 and 979.09 (1995) and literature methods (Bradstreet, 1965; Kalthoff and Sandell, 1948). Protein and other nitrogenous compounds in the sample were reduced to ammonia by digesting the sample with sulfuric acid containing a mercury catalyst mixture. The acid digest was made alkaline, and the ammonia was distilled and titrated with a standard acid. The percent nitrogen was determined and converted to protein using the factor 6.25. The limit of detection of this method for this study was 0.1%. There was no analytical reference substance for this analysis.

Trypsin inhibitor (MIXX). This is a modified version of AOCS method Ba 12-75 (1997). Trypsin inhibitor activity in the sample was determined by suspending the ground, defatted sample in dilute sodium hydroxide solution. An appropriate dilution of the suspension was made, and an increasing series of aliquots of the diluted suspension was mixed with trypsin and benzoyl-DL-arginine-p-nitroanilide. After 10 minutes, the action of the trypsin was stopped by the addition of acetic acid. The diluted suspension mixture was filtered or centrifuged and the absorbance of each filtered solution was measured at 410 nm. Trypsin inhibitor activity was calculated from the change in absorbance values due to the aliquot volume. The limit of detection for this study was 1.0 TIU/mg.

Vitamin E (EFD2). This a modification of a literature method (Cort *et al.*, 1983). The sample was saponified to break down any fat and release any vitamin E. The saponified mixture was extracted with ethyl ether and then quantitated directly by high-performance liquid chromatography on a silica column. The limit of quantitation for this study was between 0.00112 and 0.00188 mg/g. The reference substance for this assay was USP alpha tocopherol, 100%, lot number L1.

H. Control of Bias

Maize tissues were ground thoroughly and mixed before extraction to minimize tissue bias. During the validation of the ELISA methods used in this study, the accuracy of the system was evaluated and the method optimized to minimize assay bias. Accuracy is defined by two components: extraction efficiency and recovery of purified protein standard spiked into the

control matrix. Cry1Ab protein levels were not corrected for bias since assay parameters were within an acceptable range; however mEPSPS protein levels were corrected for assay bias since the recovery values were lower than expected (see Table 1).

I. Data Reduction and Statistical Analysis

Data reduction for the mEPSPS protein was conducted using Microplate Manager software (version 2.0) available from Bio-Rad (Richmond, CA). Data reduction for the Cry1Ab protein was performed using ELISAREAD (V5.911F), a validated software developed by Monsanto. Microsoft Excel™ was used to transform mEPSPS and Cry1Ab ELISA data for the calculation of means and standard deviations of protein levels across sites. In E.U. multi-site trials, mEPSPS protein levels in YG and control grain samples were significantly above the LOD of the method at most sites, most likely due to matrix effects. Since the purpose of the study was to measure levels of the mEPSPS protein in the lines containing this protein, these background levels were subtracted from individual values according to site, and a mean value across sites calculated for each line.

Statistical analyses of the composition data was conducted by Certus International, Inc., Chesterfield, MO 63017, USA. Analytes with a high percentage of observations at or below the LOD of the assay were excluded from statistical analysis. Analytes with a low percentage of observations at or below the LOD of the assay were included in the analyses with an assigned value equal to half the LOD of the assay. The calcium value for one grain sample (#55; IA2; U.S. multi-site trials) was found to be 10-fold higher than any other sample from this site and therefore designated as an outlier and excluded from statistical analysis. A range of values was determined for the non-transgenic control and commercial reference lines but these were not included in the statistical analysis.

Statistical analyses of the U.S. and E.U. composition data was conducted separately and combined using a mixed model analysis of variance:

$$Y_{ijk} = U + L_i + B_{ij} + T_k + e_{ijk},$$

where U = overall mean, L_i = random location effect, B_{ij} = random spray block within location effect, T_k = treatment line effect, and e_{ijk} = residual error. The component values for the RR/YG lines were compared to those of the corresponding single trait parental lines (RR and YG) to determine significant differences. SAS® software was used to generate all summary statistics and perform all analyses (SAS Institute, 1989, 1990, 1996). Report tables present p-values from SAS® as either <0.001 or the actual value truncated to three decimal places.

J. Protocol Amendment

Protocol Amendment #1. Added vitamin E to the list of components to be analyzed in grain.

IV. Results and Discussion

A. T/C/R Substances Characterization

All E.U. and U.S. multi-site field samples except one were correctly identified. The identity of a forage sample from the Indiana site (#122) in the U.S. trials could not be verified since mEPSPS protein levels were consistently below the LOQ of the mEPSPS ELISA. Therefore this sample was excluded from statistical analysis of the composition data. PCR analyses for the presence of GA21 and MON 810 conducted on grain samples from a single field site (IA1; U.S. multi-site trials) confirmed sample identity based on sample handling records and ELISA data.

B. mEPSPS and Cry1Ab Protein Levels in Maize Tissues

Mean mEPSPS protein levels found in maize tissues are summarized in Table 1. In comparisons of mean mEPSPS protein levels in RR/YG vs. parental RR lines, no notable differences were observed in forage for the E.U. trials and in grain for the U.S. trials. However, mean mEPSPS protein levels were approximately 1.3 to 1.9-fold higher in forage for the RR/YG lines vs. parental RR lines in U.S. trials, and 1.3-fold higher in grain for the DK RR/YG line vs. the parental DK RR line in E.U. trials. Such reversal of differences according to geography, i.e., higher mEPSPS protein levels in forage for RR/YG vs. parental RR lines in the U.S. but not in the E.U. trials, and higher mEPSPS protein levels in grain for RR/YG vs. parental RR lines in the E.U. but not in the U.S. trials, are most likely due to biological variability and not considered significant. In U.S. multi-site trials, mean mEPSPS protein levels in forage and grain were below the LOQ of the assay in YG and control lines. In E.U. multi-site trials, mEPSPS protein levels were: a) below the LOD of the assay in YG and control lines in forage, b) below the LOD of the assay in control lines in grain, and c) slightly above the LOD of the assay at three sites in YG lines, most likely due to presence of the wild-type mEPSPS protein.

Mean Cry1Ab protein levels found in maize tissues are summarized in Table 2. Briefly, for both sets of hybrid groups produced in U.S. or E.U. multi-site field trials, there were no notable differences in mean Cry1Ab protein levels in either forage or grain for comparisons of the mult-trait RR/YG lines with corresponding single trait parental YG lines. Mean Cry1Ab protein levels in RR and control lines were below the LOD of the method in U.S. and E.U. field trial samples.

C. Compositional Analyses of Maize Tissues

The compositional analysis data and statistical evaluation are summarized in Tables 3-11. Statistical analysis of the data was conducted as described in Section III.I. Component values are expressed as follows: amino acids as % total amino acids; proximates (except moisture), ADF, NDF, minerals, phytic acid as % dry wt.; moisture as % fresh wt.; fatty acids as % total fatty acids; trypsin inhibitor as trypsin inhibitor units/mg dry wt; and vitamin E as mg/g dry

wt. The following components are not listed in Tables 3-11 since they had a high percentage of values below the LOD of the assay: sodium, 8:0 caprylic acid, 10:0 capric acid, 12:0 lauric acid, 14:0 myristic acid, 14:1 myristoleic acid, 15:0 pentadecanoic acid, 15:1 pentadecenoic acid, 16:1 palmitoleic acid, 17:0 heptadecanoic acid, 17:1 heptadecanoic acid, 18:3 gamma linolenic, 20:2 eicosadienoic acid, 20:3 eicosatrienoic acid, and 20:4 arachidonic acid.

In 612 comparisons between the multi-trait RR/YG and corresponding single trait parental RR and YG lines, there were 94 statistically significant differences ($p < 0.05$) in component levels (Table 9). Given the large number of comparisons, some false significant differences are expected, even if the RR/YG lines were identical to the parental RR and YG lines with respect to any component in either forage or grain. At the conventional 5% level of significance ($p < 0.05$), it is expected, on average, that there will be ~31 (0.05 x 612) significant results by chance alone. Therefore it is likely that some of the significant cases are false.

The 94 significant differences found for comparisons of RR/YG lines with parental RR and YG lines can be grouped as follows: i) 64 instances where the RR/YG line was significantly different from one parental line but not the other, ii) 8 instances (16 values) where the RR/YG line was significantly different from both parental lines but in opposite directions, i.e., the mean value was greater than one parental line but less than the other parental line, and iii) 7 instances (14 values; indicated by a * in Table 9) where the RR/YG line was significantly different from both parental lines in the same direction, i.e., the mean value was either greater than or less than both parental lines. Group i differences are not considered relevant as they lead to the contradictory conclusion that the RR/YG line is compositionally equivalent to one parental line but not to the other, given that both parents have the same genetic background. Group ii differences are not considered significant because the mean value for the RR/YG line lies within the range of both parental values.

There were five components with Group iii differences: proline, 22:0 behenic acid (twice), zinc, 20:0 arachidic acid, and 20:1 eicosenoic acid (twice). The absolute magnitude of each difference as a percent of the corresponding RR/YG line mean value ranged between 2.3-14.3% for four of the five components. Such small differences are considered within the range of natural variability and therefore not considered biologically relevant. For behenic acid, the absolute magnitude of the mean difference as a percent of the corresponding RR/YG line mean value ranged between 29-43%. Since the content of behenic acid in maize grain is typically very low (~0.2% of total fatty acids), differences between RR/YG and parental lines are likely exaggerated due to the increase in method variability at concentrations near the detection limit of the assay. This is supported by the fact that RR/YG line mean values for behenic acid and the other four components were within the range found for the non-transgenic control and commercial lines (Table 11), and either within published literature ranges (Jugenheimer, 1976; Watson, 1982; Watson, 1987) or within previously reported

ranges for nontransgenic maize varieties (Sanders and Patzer, 1995; Sanders *et al.*, 1996a,b; 1997a,b) (Table 12).

V. Conclusions

In comparisons of mean mEPSPS protein levels in the multi-trait RR/YG lines vs. single trait parental RR lines, no notable differences were observed in forage for the E.U. trials and in grain for the U.S. trials. However, mean mEPSPS protein levels were approximately 1.3 to 1.9-fold higher in forage for the RR/YG lines vs. parental RR lines in U.S. trials, and 1.3-fold higher in grain for the DK RR/YG line vs. the parental DK RR line in E.U. trials. Such reversal of differences according to geography are most likely due to biological variability and not considered significant.

ELISA results showed that for both sets of hybrid groups produced in U.S. or E.U. multi-site field trials, there were no notable differences in mean Cry1Ab protein levels in either forage or grain for comparisons of the mult-trait RR/YG lines with corresponding single trait parental YG lines.

Statistical evaluation of the composition data showed that in 612 comparisons, there were only seven instances (14 values), involving five components, where the RR/YG line was significantly different ($p < 0.05$) from both parental lines in the same direction, i.e., the mean value was either greater than or less than both parental lines. For four components, the absolute magnitude of each difference as a percent of the corresponding RR/YG line mean value was small (2.3-14.3%) and within the range of natural variability, and therefore not considered biologically relevant. For behenic acid, the absolute magnitude of the mean difference as a percent of the corresponding RR/YG line mean value ranged between 29-43%. Since the content of behenic acid in maize grain is typically very low (~0.2% of total fatty acids), differences between RR/YG and parental lines are likely exaggerated due to the increase in method variability at concentrations near the detection limit of the assay. This is supported by the fact that RR/YG line mean values for behenic acid and the other four components were within the range found for the non-transgenic commercial reference lines, and either within published literature ranges (Jugenheimer, 1976; Watson, 1982; Watson, 1987) or within previously reported ranges for nontransgenic maize varieties (Sanders and Patzer, 1995; Sanders *et al.*, 1996a,b; 1997a,b).

This data, together with the safe history of use of the host organism (maize) as a common source of animal feed and human food lead to the conclusion that Roundup Ready®/ Yieldgard® (GA21 x MON 810) maize hybrids developed by conventional breeding of genetically modified parental maize are compositionally equivalent and as safe and nutritious as the maize varieties grown commercially today.

VI. Acknowledgments

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Table 1. mEPSPS Protein Levels in Tissues Collected in 1998 U.S. and E.U. Multi-Site Field Trials*

Line	Parameter	Forage[a,b,c] (µg/g fwt) U.S.	Forage[a,b,c] (µg/g fwt) E.U.	Grain[d,e,f,g,h] (µg/g fwt) U.S.	Grain[d,e,f,g,h] (µg/g fwt) E.U.
DK RR/YG	mean	14.6	32.4	4.3	5.5
	range	10.2-22.1	12.9-85.2	2.7-6.0	1.9-10.4
	SD	4.9	24.8	1.1	3.1
DK RR	mean	7.5	31.7	3.7	4.2
	range	5.5-10.6	10.0-70.0	3.0-4.3	n.d.-8.6
	SD	2.2	26.4	0.5	3.0
LH RR/YG	mean	11.2	24.2	5.3	7.6
	range	6.2 - 18.3	16.0 - 45.9	1.7-6.8	1.1-12.9
	SD	4.6	10.8	2.0	4.0
LH RR	mean	8.7	22.9	4.5	7.2
	range	5.7-11.3	5.9-60.7	3.1-6.6	n.d.-14.6
	SD	2.2	19.1	1.3	3.9

* SD = Standard Deviation; n.d. = not detected; OD = Optical Density.

[a]Values corrected for an assay bias of 0.37 [= extraction efficiency (86.2/100) x spike recovery (42.49/100)].

[b]LOQ = 4.3 µg/g fwt for U.S. samples; LOD = 0.210 OD for E.U. samples.

[c]Mean values for DK YG, DK, LH YG and LH were < LOQ for U.S. samples and < LOD for the E.U. samples.

[d]Values corrected for an assay bias of 0.56 [= extraction efficiency (100/100) x spike recovery (55.7/100)].

[e]LOQ = 1.0 µg/g fwt for U.S. samples; LOD = 0.209 OD for E.U. samples.

[f]For each hybrid group, background-correction for matrix effects at each site conducted by subtracting the YG + control mean value from all individual values at that site. A mean value across sites was then calculated. The 'not detected' in the range of values for some LH RR and DK RR grain samples results from the background-correction and not from the ELISA. These samples were harvested from plants treated with Roundup herbicide, thereby confirming that the plants contained the RR gene.

[g]Mean values for DK YG, DK, LH YG and LH were < LOQ for U.S. samples. After background-correction, mean values for E.U. samples were as follows: DK YG = 1.7 µg/g fwt; LH YG = 1.4 µg/g fwt; DK = n.d.; LH = n.d.

Table 2. Cry1Ab Protein Levels in Tissues Collected in 1998 U.S. and E.U. Multi-Site Field Trials*

Line	Parameter	Forage[a,c] (µg/g fwt) U.S.	Forage[a,c] (µg/g fwt) E.U.	Grain[b,c] (µg/g fwt) U.S.	Grain[b,c] (µg/g fwt) E.U.
DK RR/YG	mean	6.1	6.7	0.6	1.0
	range	5.1 - 8.7	3.9 - 8.7	0.4 - 0.8	0.5 -1.7
	SD	1.5	1.5	0.2	0.5
DK YG	mean	6.4	6.6	0.6	1.0
	range	5.2 -8.4	4.9-8.8	0.4 - 1.0	0.3-1.6
	SD	1.3	1.4	0.2	0.5
LH RR/YG	mean	6.1	5.8	0.5	0.9
	range	4.8 - 8.3	2.8 - 8.4	0.4 - 0.8	0.6- 1.4
	SD	1.3	1.9	0.2	0.2
LH YG	mean	6.5	6.1	0.5	1.5
	range	4.7 - 7.5	4.0-9.2	0.4 - 0.7	0.4 - 3.2
	SD	1.1	1.8	0.1	1.0

*SD = Standard Deviation; OD = Optical Density.
[a]LOD = 0.3 µg/g fwt for U.S. samples; LOD = 0.142 OD for E.U. samples.
[b]LOD = 0.1 µg/g fwt for U.S. samples; LOD = 0.160 OD for E.U. samples.
[c]Values for DK RR, DK, LH RR and LH were < LOD for U.S. samples and E.U. samples.

TABLE 3. US FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	27.57(1.21) [23.11 - 30.07]	2.26(0.97) [-0.026 - 4.87]	0.27,4.24	0.027
		DK RR/YG	29.83(1.25) [27.59 - 34.95]			
		DK RR	29.36(1.25) [28.49 - 32.95]	0.47(1.01) [-1.08 - 2.00]	-1.58,2.53	0.641
		LH YG	28.30(1.21) [24.85 - 35.67]	-0.81(0.97) [-3.70 - 2.14]	-2.79,1.18	0.411
		LH RR/YG	27.49(1.25) [24.61 - 31.97]			
		LH RR	27.22(1.25) [25.94 - 28.92]	0.26(1.01) [-3.29 - 3.81]	-1.79,2.31	0.796
	Neutral Detergent Fiber (% DW)	DK YG	43.45(1.41) [40.06 - 48.15]	3.72(1.37) [-0.83 - 6.48]	0.91,6.54	0.011
		DK RR/YG	47.17(1.48) [41.58 - 51.00]			
		DK RR	45.47(1.48) [44.09 - 47.86]	1.70(1.41) [-2.51 - 4.72]	-1.18,4.59	0.236
		LH YG	44.63(1.41) [41.39 - 49.32]	0.56(1.37) [-3.12 - 5.24]	-2.25,3.37	0.684
		LH RR/YG	45.19(1.48) [41.02 - 50.53]			
		LH RR	44.29(1.48) [40.42 - 50.00]	0.90(1.41) [-1.45 - 3.39]	-1.99,3.79	0.528

TABLE 3. US FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Ash (% DW)	DK YG	4.59(0.33) [4.12 - 5.52]	-0.16(0.42) [-0.51 - 0.15]	-1.03,0.72	0.713
		DK RR/YG	4.44(0.35) [4.10 - 5.01]			
		DK RR	4.34(0.35) [3.33 - 5.50]	0.095(0.38) [-1.23 - 0.81]	-0.68,0.87	0.803
		LH YG	5.53(0.33) [4.01 - 7.48]	-1.10(0.42) [-3.50 - 0.28]	-1.97,-0.23	0.015
		LH RR/YG	4.43(0.35) [3.65 - 6.10]			
		LH RR	4.98(0.35) [3.95 - 6.02]	-0.55(0.38) [-1.81 - 0.73]	-1.32,0.23	0.159
	Carbohydrates (% DW)	DK YG	85.04(0.69) [83.37 - 86.62]	0.46(0.67) [-0.24 - 1.07]	-0.97,1.89	0.502
		DK RR/YG	85.50(0.73) [83.76 - 87.39]			
		DK RR	84.91(0.73) [80.93 - 88.34]	0.60(0.59) [-0.95 - 2.83]	-0.62,1.82	0.323
		LH YG	83.39(0.69) [82.33 - 85.26]	0.89(0.67) [-1.49 - 3.04]	-0.53,2.32	0.202
		LH RR/YG	84.28(0.73) [82.16 - 86.73]			
		LH RR	84.07(0.73) [81.81 - 85.26]	0.21(0.59) [-1.56 - 2.29]	-1.01,1.43	0.724

TABLE 3. US FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Moisture (% FW)	DK YG	68.62(1.43) [63.80 - 73.00]	-0.88(0.85) [-3.70 - 1.10]	-2.66,0.89	0.312
		DK RR/YG	67.73(1.46) [64.60 - 71.50]			
		DK RR	67.39(1.46) [62.60 - 72.10]	0.34(0.83) [-1.20 - 2.30]	-1.37,2.05	0.686
		LH YG	70.15(1.43) [66.20 - 74.60]	-1.44(0.85) [-3.00 - 1.10]	-3.21,0.34	0.107
		LH RR/YG	68.71(1.46) [64.90 - 72.10]			
		LH RR	67.63(1.46) [62.30 - 71.40]	1.08(0.83) [-1.90 - 5.10]	-0.63,2.79	0.205
	Protein (% DW)	DK YG	8.21(0.63) [6.94 - 10.30]	-0.25(0.36) [-0.78 - 0.50]	-0.00,0.50	0.497
		DK RR/YG	7.96(0.64) [6.16 - 10.80]			
		DK RR	8.34(0.64) [5.95 - 10.87]	-0.38(0.37) [-0.92 - 0.20]	-1.14,0.37	0.310
		LH YG	8.76(0.63) [6.97 - 10.72]	-0.00098(0.36) [-0.89 - 0.88]	-0.75,0.75	0.997
		LH RR/YG	8.76(0.64) [7.18 - 11.17]			
		LH RR	8.34(0.64) [7.35 - 10.63]	0.42(0.37) [-0.68 - 1.00]	-0.33,1.18	0.261

TABLE 3. US FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Total Fat (% DM)	DK YG	2.16(0.19) [1.81 - 2.83]	-0.084(0.19) [-0.63 - 0.22]	-0.47,0.30	0.658
		DK RR/YG	2.07(0.20) [1.18 - 3.05]			
		DK RR	2.38(0.20) [1.91 - 2.72]	-0.31(0.19) [-1.52 - 0.32]	-0.70,0.079	0.113
		LH YG	2.32(0.19) [1.50 - 3.22]	0.18(0.19) [-0.42 - 1.13]	-0.20,0.57	0.338
		LH RR/YG	2.50(0.20) [2.29 - 2.80]			
		LH RR	2.59(0.20) [2.25 - 3.04]	-0.087(0.19) [-0.28 - 0.20]	-0.48,0.30	0.651

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	alanine (% Total AA)	DK YG	7.62(0.084) [7.33 - 7.92]	0.024(0.067) [-0.099 - 0.21]	-0.11,0.16	0.727
		DK RR/YG	7.64(0.084) [7.36 - 7.84]			
		DK RR	7.65(0.084) [7.51 - 7.80]	-0.0076(0.062) [-0.18 - 0.14]	-0.13,0.12	0.903
		LH YG	7.78(0.084) [7.41 - 8.00]	-0.21(0.067) [-0.43 - 0.025]	-0.35,-0.076	0.003
		LH RR/YG	7.57(0.084) [7.10 - 8.01]			
		LH RR	7.54(0.084) [7.31 - 7.82]	0.034(0.062) [-0.29 - 0.32]	-0.092,0.16	0.585
	arginine (% Total AA)	DK YG	4.57(0.15) [4.11 - 5.05]	0.010(0.15) [-0.49 - 0.49]	-0.31,0.33	0.944
		DK RR/YG	4.58(0.15) [4.05 - 4.97]			
		DK RR	4.47(0.15) [3.92 - 4.81]	0.11(0.11) [-0.35 - 0.37]	-0.11,0.33	0.310
		LH YG	4.34(0.15) [3.93 - 4.88]	0.21(0.15) [-0.40 - 0.48]	-0.11,0.53	0.175
		LH RR/YG	4.55(0.15) [3.81 - 5.29]			
		LH RR	4.53(0.15) [4.08 - 5.06]	0.025(0.11) [-0.28 - 0.43]	-0.20,0.25	0.822

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	aspartic acid (% Total AA)	DK YG	6.52(0.078) [6.38 - 6.73]	-0.032(0.086) [-0.23 - 0.086]	-0.21,0.15	0.716
		DK RR/YG	6.48(0.078) [6.32 - 6.78]			
		DK RR	6.50(0.078) [6.34 - 6.81]	-0.015(0.077) [-0.13 - 0.11]	-0.17,0.14	0.846
		LH YG	6.59(0.078) [6.40 - 6.70]	-0.023(0.086) [-0.23 - 0.18]	-0.20,0.15	0.791
		LH RR/YG	6.56(0.078) [6.30 - 6.82]			
		LH RR	6.71(0.078) [6.37 - 7.14]	-0.15(0.077) [-0.33 - 0.062]	-0.31,0.0078	0.061
	cystine (% Total AA)	DK YG	2.16(0.081) [1.85 - 2.26]	0.050(0.11) [-0.19 - 0.31]	-0.18,0.28	0.655
		DK RR/YG	2.21(0.081) [2.02 - 2.54]			
		DK RR	2.13(0.081) [1.98 - 2.25]	0.075(0.099) [-0.071 - 0.29]	-0.13,0.28	0.455
		LH YG	2.09(0.081) [1.72 - 2.42]	0.062(0.11) [-0.42 - 0.24]	-0.16,0.29	0.576
		LH RR/YG	2.15(0.081) [1.74 - 2.55]			
		LH RR	2.35(0.081) [2.14 - 2.72]	-0.20(0.099) [-0.80 - 0.13]	-0.40,0.0054	0.056

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	glutamic acid (% Total AA)	DK YG	19.27(0.23) [18.59 - 20.04]	0.19(0.19) [-0.11 - 0.67]	-0.20,0.58	0.326
		DK RR/YG	19.46(0.23) [18.95 - 20.03]			
		DK RR	19.37(0.23) [18.99 - 19.77]	0.092(0.17) [-0.39 - 0.44]	-0.25,0.43	0.588
		LH YG	19.51(0.23) [18.58 - 20.23]	-0.32(0.19) [-1.18 - 0.37]	-0.71,0.066	0.099
		LH RR/YG	19.19(0.23) [18.04 - 20.28]			
		LH RR	18.98(0.23) [18.25 - 19.78]	0.21(0.17) [-0.53 - 1.06]	-0.13,0.55	0.220
	glycine (% Total AA)	DK YG	3.93(0.11) [3.62 - 4.21]	0.015(0.097) [-0.11 - 0.21]	-0.19,0.22	0.880
		DK RR/YG	3.94(0.11) [3.64 - 4.24]			
		DK RR	3.87(0.11) [3.59 - 4.05]	0.073(0.077) [-0.17 - 0.21]	-0.085,0.23	0.351
		LH YG	3.69(0.11) [3.43 - 4.05]	0.24(0.097) [0.029 - 0.37]	0.038,0.45	0.023
		LH RR/YG	3.93(0.11) [3.57 - 4.31]			
		LH RR	4.01(0.11) [3.66 - 4.50]	-0.082(0.077) [-0.34 - 0.14]	-0.24,0.076	0.296

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	histidine (% Total AA)	DK YG	2.86(0.059) [2.74 - 2.96]	-0.053(0.056) [-0.12 - 0.14]	-0.17,0.062	0.351
		DK RR/YG	2.81(0.059) [2.62 - 2.99]			
		DK RR	2.81(0.059) [2.65 - 2.93]	0.0027(0.052) [-0.20 - 0.13]	-0.10,0.11	0.959
		LH YG	2.80(0.059) [2.71 - 3.00]	0.15(0.056) [0.037 - 0.27]	0.036,0.27	0.011
		LH RR/YG	2.95(0.059) [2.78 - 3.15]			
		LH RR	2.98(0.059) [2.79 - 3.26]	-0.034(0.052) [-0.12 - 0.14]	-0.14,0.072	0.515
	isoleucine (% Total AA)	DK YG	3.66(0.076) [3.44 - 3.85]	-0.042(0.099) [-0.48 - 0.37]	-0.24,0.16	0.673
		DK RR/YG	3.62(0.076) [3.38 - 3.89]			
		DK RR	3.67(0.076) [3.57 - 3.84]	-0.049(0.098) [-0.39 - 0.28]	-0.25,0.15	0.617
		LH YG	3.66(0.076) [3.50 - 4.12]	0.12(0.099) [-0.51 - 0.41]	-0.085,0.32	0.244
		LH RR/YG	3.77(0.076) [3.61 - 3.97]			
		LH RR	3.82(0.076) [3.44 - 4.11]	-0.049(0.098) [-0.28 - 0.21]	-0.25,0.15	0.619

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	leucine (% Total AA)	DK YG	12.90(0.26) [12.24 - 13.99]	0.043(0.22) [-0.43 - 0.64]	-0.41,0.50	0.845
		DK RR/YG	12.95(0.26) [12.45 - 13.66]			
		DK RR	13.00(0.26) [12.43 - 13.62]	-0.052(0.18) [-0.75 - 0.24]	-0.42,0.32	0.776
		LH YG	13.39(0.26) [12.35 - 14.27]	-0.39(0.22) [-1.07 - 0.18]	-0.84,0.064	0.087
		LH RR/YG	13.00(0.26) [11.69 - 13.93]			
		LH RR	12.87(0.26) [12.13 - 13.81]	0.14(0.18) [-0.57 - 1.27]	-0.23,0.51	0.452
	lysine (% Total AA)	DK YG	3.19(0.13) [2.83 - 3.37]	-0.10(0.12) [-0.29 - 0.23]	-0.36,0.16	0.414
		DK RR/YG	3.09(0.13) [2.70 - 3.45]			
		DK RR	3.05(0.13) [2.71 - 3.34]	0.032(0.10) [-0.25 - 0.20]	-0.18,0.25	0.759
		LH YG	2.97(0.13) [2.77 - 3.34]	0.21(0.12) [-0.052 - 0.49]	-0.048,0.47	0.104
		LH RR/YG	3.18(0.13) [2.72 - 3.83]			
		LH RR	3.33(0.13) [2.92 - 4.08]	-0.14(0.10) [-0.40 - 0.21]	-0.36,0.069	0.175

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	methionine (% Total AA)	DK YG	2.22(0.069) [2.00 - 2.35]	0.043(0.098) [-0.13 - 0.18]	-0.15,0.24	0.662
		DK RR/YG	2.26(0.069) [2.11 - 2.36]			
		DK RR	2.16(0.069) [2.04 - 2.25]	0.099(0.095) [-0.14 - 0.24]	-0.095,0.29	0.306
		LH YG	2.09(0.069) [1.64 - 2.25]	0.0093(0.098) [-0.53 - 0.45]	-0.19,0.21	0.924
		LH RR/YG	2.10(0.069) [1.71 - 2.29]			
		LH RR	2.27(0.069) [2.07 - 2.72]	-0.17(0.095) [-0.63 - 0.081]	-0.37,0.022	0.079
	phenylalanine (% Total AA)	DK YG	5.08(0.065) [4.84 - 5.45]	0.018(0.059) [-0.23 - 0.12]	-0.10,0.14	0.768
		DK RR/YG	5.10(0.065) [4.96 - 5.22]			
		DK RR	5.10(0.065) [4.95 - 5.23]	0.0060(0.052) [-0.092 - 0.11]	-0.000,0.11	0.907
		LH YG	5.10(0.065) [4.88 - 5.40]	0.0092(0.059) [-0.25 - 0.20]	-0.11,0.13	0.877
		LH RR/YG	5.11(0.065) [4.78 - 5.37]			
		LH RR	5.10(0.065) [4.97 - 5.34]	0.0076(0.052) [-0.22 - 0.27]	-0.098,0.11	0.884

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	proline (% Total AA)	DK YG	8.68(0.089) [8.32 - 8.89]	0.042(0.10) [-0.14 - 0.42]	-0.16,0.25	0.676
		DK RR/YG	8.73(0.089) [8.44 - 8.99]			
		DK RR	8.84(0.089) [8.64 - 9.24]	-0.12(0.097) [-0.38 - 0.23]	-0.32,0.079	0.230
		LH YG	8.84(0.089) [8.39 - 9.19]	0.24(0.10) [0.011 - 0.56]	0.040,0.45	0.020
		LH RR/YG	9.09(0.089) [8.84 - 9.31]			
		LH RR	8.88(0.089) [8.75 - 9.13]	0.21(0.097) [-0.0078 - 0.38]	0.0069,0.40	0.042
	serine (% Total AA)	DK YG	4.92(0.28) [4.57 - 5.34]	-0.35(0.37) [-2.72 - 0.36]	-1.14,0.45	0.366
		DK RR/YG	4.58(0.28) [2.62 - 5.36]			
		DK RR	4.88(0.28) [4.26 - 5.17]	-0.31(0.28) [-1.64 - 0.56]	-0.89,0.27	0.286
		LH YG	4.98(0.28) [4.56 - 5.29]	-0.76(0.37) [-3.20 - 0.49]	-1.55,0.036	0.059
		LH RR/YG	4.22(0.28) [2.09 - 5.04]			
		LH RR	4.20(0.28) [3.21 - 5.11]	0.024(0.28) [-1.12 - 1.03]	-0.55,0.60	0.932

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	threonine (% Total AA)	DK YG	3.59(0.098) [3.45 - 3.73]	-0.12(0.12) [-0.97 - 0.17]	-0.38,0.15	0.367
		DK RR/YG	3.47(0.098) [2.76 - 3.76]			
		DK RR	3.54(0.098) [3.34 - 3.64]	-0.067(0.094) [-0.58 - 0.16]	-0.26,0.12	0.477
		LH YG	3.54(0.098) [3.42 - 3.64]	-0.18(0.12) [-1.07 - 0.25]	-0.45,0.086	0.169
		LH RR/YG	3.36(0.098) [2.52 - 3.67]			
		LH RR	3.40(0.098) [3.06 - 3.65]	-0.042(0.094) [-0.54 - 0.27]	-0.23,0.15	0.659
	tryptophan (% Total AA)	DK YG	0.63(0.025) [0.51 - 0.68]	0.034(0.028) [-0.064 - 0.13]	-0.023,0.091	0.229
		DK RR/YG	0.66(0.025) [0.61 - 0.74]			
		DK RR	0.62(0.025) [0.58 - 0.67]	0.041(0.027) [-0.016 - 0.079]	-0.013,0.096	0.128
		LH YG	0.62(0.025) [0.57 - 0.76]	0.041(0.028) [-0.034 - 0.15]	-0.016,0.098	0.147
		LH RR/YG	0.66(0.025) [0.58 - 0.75]			
		LH RR	0.64(0.025) [0.57 - 0.70]	0.016(0.027) [-0.068 - 0.12]	-0.038,0.070	0.545

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	tyrosine (% Total AA)	DK YG	3.39(0.19) [2.68 - 3.93]	0.20(0.27) [-0.95 - 1.13]	-0.35,0.75	0.468
		DK RR/YG	3.59(0.19) [2.60 - 3.86]			
		DK RR	3.53(0.19) [3.24 - 3.73]	0.055(0.26) [-1.10 - 0.57]	-0.48,0.59	0.834
		LH YG	3.26(0.19) [2.32 - 3.73]	0.32(0.27) [-0.46 - 1.32]	-0.23,0.87	0.248
		LH RR/YG	3.58(0.19) [3.20 - 3.70]			
		LH RR	3.31(0.19) [2.45 - 3.73]	0.27(0.26) [-0.063 - 1.18]	-0.27,0.80	0.317
	valine (% Total AA)	DK YG	4.81(0.11) [4.55 - 4.94]	0.026(0.14) [-0.39 - 0.82]	-0.25,0.31	0.847
		DK RR/YG	4.83(0.11) [4.34 - 5.37]			
		DK RR	4.80(0.11) [4.59 - 5.17]	0.029(0.13) [-0.53 - 0.29]	-0.23,0.28	0.816
		LH YG	4.75(0.11) [4.45 - 4.96]	0.27(0.14) [-0.31 - 0.71]	-0.014,0.55	0.061
		LH RR/YG	5.01(0.11) [4.64 - 5.25]			
		LH RR	5.07(0.11) [4.56 - 5.45]	-0.052(0.13) [-0.30 - 0.36]	-0.31,0.20	0.681

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	16:0 palmitic (% Total FA)	DK YG	9.67(0.072) [9.42 - 9.86]	-0.024(0.093) [-0.24 - 0.18]	-0.22,0.17	0.803
		DK RR/YG	9.65(0.072) [9.34 - 10.03]			
		DK RR	9.49(0.072) [9.35 - 9.62]	0.16(0.074) [-0.045 - 0.51]	0.012,0.31	0.035
		LH YG	9.40(0.072) [9.25 - 9.53]	-0.21(0.093) [-0.45 - 0.091]	-0.41,-0.012	0.038
		LH RR/YG	9.19(0.072) [9.02 - 9.34]			
		LH RR	9.17(0.072) [8.94 - 9.45]	0.024(0.074) [-0.17 - 0.16]	-0.13,0.18	0.743
	18:0 stearic (% Total FA)	DK YG	1.97(0.059) [1.79 - 2.29]	0.22(0.056) [-0.025 - 0.55]	0.11,0.33	<0.001
		DK RR/YG	2.20(0.059) [1.97 - 2.48]			
		DK RR	2.31(0.059) [2.18 - 2.51]	-0.11(0.056) [-0.33 - 0.074]	-0.22,0.00094	0.051
		LH YG	1.83(0.059) [1.72 - 2.00]	0.041(0.056) [-0.066 - 0.13]	-0.072,0.15	0.463
		LH RR/YG	1.87(0.059) [1.77 - 2.02]			
		LH RR	1.91(0.059) [1.84 - 2.00]	-0.035(0.056) [-0.16 - 0.024]	-0.15,0.078	0.534

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:1 oleic (% Total FA)	DK YG	32.76(0.86) [28.60 - 37.38]	1.41(1.02) [-2.89 - 7.70]	-0.66,3.49	0.175
		DK RR/YG	34.17(0.86) [30.27 - 38.66]			
		DK RR	35.14(0.86) [34.01 - 36.01]	-0.97(1.02) [-5.54 - 2.65]	-3.04,1.11	0.349
		LH YG	25.42(0.86) [23.67 - 27.47]	-0.96(1.02) [-2.17 - -0.30]	-3.04,1.11	0.352
		LH RR/YG	24.46(0.86) [23.21 - 25.72]			
		LH RR	24.02(0.86) [22.87 - 26.05]	0.44(1.02) [-0.38 - 2.09]	-1.64,2.51	0.671
	18:2 linoleic (% Total FA)	DK YG	53.69(0.92) [48.72 - 57.75]	-1.59(1.10) [-8.48 - 3.02]	-3.83,0.64	0.156
		DK RR/YG	52.09(0.92) [47.36 - 56.53]			
		DK RR	51.14(0.92) [49.91 - 52.26]	0.96(1.10) [-2.55 - 5.87]	-1.28,3.19	0.389
		LH YG	61.32(0.92) [59.41 - 63.00]	1.20(1.10) [0.19 - 2.36]	-1.03,3.44	0.281
		LH RR/YG	62.53(0.92) [61.42 - 64.05]			
		LH RR	62.87(0.92) [61.23 - 63.94]	-0.34(1.10) [-2.17 - 0.23]	-2.57,1.89	0.758

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:3 linolenic (% Total FA)	DK YG	0.98(0.023) [0.90 - 1.06]	-0.087(0.025) [-0.21 - 0.036]	-0.14,-0.037	0.001
		DK RR/YG	0.89(0.023) [0.76 - 0.94]			
		DK RR	0.93(0.023) [0.88 - 1.03]	-0.040(0.025) [-0.12 - 0.034]	-0.090,0.011	0.116
		LH YG	1.10(0.023) [1.04 - 1.19]	0.027(0.025) [-0.017 - 0.083]	-0.024,0.077	0.292
		LH RR/YG	1.13(0.023) [1.05 - 1.20]			
		LH RR	1.16(0.023) [1.07 - 1.26]	-0.028(0.025) [-0.11 - 0.019]	-0.079,0.022	0.264
	20:0 arachidic (% Total FA)	DK YG	0.43(0.014) [0.40 - 0.46]	0.031(0.019) [-0.028 - 0.13]	-0.0073,0.069	0.109
		DK RR/YG	0.46(0.014) [0.40 - 0.54]			
		DK RR	0.46(0.014) [0.44 - 0.48]	-0.0047(0.019) [-0.043 - 0.054]	-0.043,0.033	0.801
		LH YG	0.41(0.014) [0.39 - 0.44]	-0.041(0.019) [-0.064 - -0.0056]	-0.079,-0.0034	0.033
		LH RR/YG	0.37(0.014) [0.35 - 0.38]			
		LH RR	0.37(0.014) [0.22 - 0.43]	0.0036(0.019) [-0.051 - 0.16]	-0.034,0.042	0.846

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	20:1 eicosenoic (% Total FA)	DK YG	0.35(0.0097) [0.34 - 0.36]	0.0024(0.014) [-0.035 - 0.072]	-0.026,0.030	0.863
		DK RR/YG	0.35(0.0097) [0.32 - 0.41]			
		DK RR	0.35(0.0097) [0.34 - 0.37]	0.00041(0.013) [-0.027 - 0.038]	-0.027,0.028	0.975
		LH YG	0.32(0.0097) [0.30 - 0.34]	-0.014(0.014) [-0.048 - 0.015]	-0.042,0.013	0.299
		LH RR/YG	0.31(0.0097) [0.28 - 0.33]			
		LH RR	0.31(0.0097) [0.22 - 0.34]	-0.0016(0.013) [-0.056 - 0.11]	-0.029,0.026	0.904
	22:0 behenic (% Total FA)	DK YG	0.15(0.012) [0.10 - 0.18]	0.036(0.017) [-0.0023 - 0.087]	0.0012,0.072	0.043
		DK RR/YG	0.18(0.012) [0.17 - 0.22]			
		DK RR	0.18(0.012) [0.17 - 0.19]	0.0036(0.017) [-0.017 - 0.040]	-0.032,0.039	0.836
		LH YG	0.18(0.012) [0.17 - 0.20]	-0.043(0.017) [-0.093 - 0.030]	-0.078,-0.0076	0.018
		LH RR/YG	0.14(0.012) [0.084 - 0.20]			
		LH RR	0.20(0.012) [0.17 - 0.22]	-0.060(0.017) [-0.13 - -0.00061]	-0.095,-0.024	0.001

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	4.14(0.24) [3.43 - 5.45]	0.10(0.29) [-0.51 - 0.79]	-0.49,0.70	0.726
		DK RR/YG	4.24(0.24) [3.43 - 4.94]			
		DK RR	4.66(0.24) [3.64 - 5.71]	-0.42(0.29) [-1.42 - 0.10]	-1.01,0.18	0.164
		LH YG	4.23(0.24) [3.89 - 4.68]	-0.11(0.29) [-1.13 - 0.38]	-0.70,0.49	0.715
		LH RR/YG	4.13(0.24) [3.54 - 4.64]			
		LH RR	4.29(0.24) [3.25 - 5.78]	-0.16(0.29) [-1.59 - 1.39]	-0.75,0.43	0.585
	Neutral Detergent Fiber (% DW)	DK YG	11.82(0.62) [10.04 - 15.03]	0.35(0.50) [-1.44 - 1.65]	-0.66,1.36	0.489
		DK RR/YG	12.17(0.62) [10.68 - 13.59]			
		DK RR	12.02(0.62) [11.00 - 13.21]	0.15(0.50) [-0.63 - 1.67]	-0.86,1.16	0.771
		LH YG	11.22(0.62) [9.66 - 14.32]	0.66(0.50) [-2.24 - 1.69]	-0.35,1.67	0.194
		LH RR/YG	11.88(0.62) [10.40 - 13.85]			
		LH RR	11.44(0.62) [10.40 - 13.91]	0.43(0.50) [-0.27 - 1.25]	-0.58,1.44	0.387

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Calcium (% DW)	DK YG	0.0048(0.00039) [0.0037 - 0.0073]	0.00014(0.00031) [-0.0010 - 0.0016]	-0.00050,0.00078	0.664
		DK RR/YG	0.0049(0.00039) [0.0034 - 0.0065]			
		DK RR	0.0041(0.00039) [0.0033 - 0.0053]	0.00086(0.00030) [0.00009 - 0.0021]	0.00025,0.0015	0.007
		LH YG	0.0062(0.00041) [0.0054 - 0.0077]	-0.0010(0.00033) [-0.0018 - 0.00002]	-0.0017,-0.00036	0.003
		LH RR/YG	0.0051(0.00039) [0.0044 - 0.0060]			
		LH RR	0.0053(0.00039) [0.0044 - 0.0063]	-0.00020(0.00030) [-0.00000 - 0.00023]	-0.00082,0.00041	0.505
	Copper (% DW)	DK YG	0.00021(0.00002) [0.00016 - 0.00030]	0(0.00003) [-0.00000 - 0.00005]	-0.00007,0.00005	0.745
		DK RR/YG	0.00020(0.00002) [0.00016 - 0.00026]			
		DK RR	0.00015(0.00002) [0.00014 - 0.00017]	0.00005(0.00003) [0.00003 - 0.00009]	0,0.00000	0.079
		LH YG	0.00025(0.00002) [0.00017 - 0.00043]	0(0.00003) [-0.00020 - 0.00008]	-0.00007,0.00005	0.726
		LH RR/YG	0.00024(0.00002) [0.00019 - 0.00029]			
		LH RR	0.00018(0.00002) [0.00015 - 0.00022]	0.00007(0.00003) [0 - 0.00011]	0.00001,0.00012	0.015

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Iron (% DW)	DK YG	0.0021(0.00008) [0.0019 - 0.0024]	0.00013(0.00010) [0 - 0.00034]	-0.00007,0.00034	0.200
		DK RR/YG	0.0022(0.00008) [0.0020 - 0.0024]			
		DK RR	0.0021(0.00008) [0.0020 - 0.0023]	0.00010(0.00010) [-0.00008 - 0.00042]	-0.00010,0.00031	0.316
		LH YG	0.0020(0.00008) [0.0017 - 0.0027]	-0.00002(0.00010) [-0.00085 - 0.00024]	-0.00022,0.00019	0.850
		LH RR/YG	0.0020(0.00008) [0.0018 - 0.0022]			
		LH RR	0.0020(0.00008) [0.0018 - 0.0022]	0.00004(0.00010) [-0.00022 - 0.00024]	-0.00017,0.00025	0.691
	Magnesium (% DW)	DK YG	0.11(0.0045) [0.099 - 0.12]	0.0076(0.0049) [-0.0035 - 0.024]	-0.0025,0.018	0.133
		DK RR/YG	0.12(0.0045) [0.11 - 0.14]			
		DK RR	0.12(0.0045) [0.11 - 0.13]	0.0026(0.0043) [-0.0061 - 0.0072]	-0.0062,0.012	0.548
		LH YG	0.12(0.0045) [0.11 - 0.14]	-0.011(0.0049) [-0.028 - 0.011]	-0.021,-0.00065	0.037
		LH RR/YG	0.11(0.0045) [0.090 - 0.13]			
		LH RR	0.11(0.0045) [0.091 - 0.12]	0.0072(0.0043) [-0.0013 - 0.018]	-0.0016,0.016	0.105

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Manganese (% DW)	DK YG	0.00050(0.00006) [0.00028 - 0.00083]	0.00002(0.00003) [-0.00007 - 0.00013]	-0.00005,0.00009	0.513
		DK RR/YG	0.00052(0.00006) [0.00031 - 0.00076]			
		DK RR	0.00054(0.00006) [0.00033 - 0.00068]	-0.00001(0.00003) [-0.00007 - 0.00008]	-0.00008,0.00005	0.657
		LH YG	0.00067(0.00006) [0.00045 - 0.00089]	-0.00015(0.00003) [-0.00026 - -0.00004]	-0.00022,-0.00009	<0.001
		LH RR/YG	0.00052(0.00006) [0.00028 - 0.00063]			
		LH RR	0.00045(0.00006) [0.00026 - 0.00058]	0.00007(0.00003) [-0.00004 - 0.00013]	0,0.00013	0.049
	Phosphorus (% DW)	DK YG	0.31(0.010) [0.29 - 0.34]	0.022(0.011) [0.0012 - 0.046]	-0.00004,0.045	0.050
		DK RR/YG	0.34(0.010) [0.30 - 0.37]			
		DK RR	0.31(0.010) [0.29 - 0.35]	0.022(0.011) [-0.0046 - 0.034]	0.00038,0.044	0.046
		LH YG	0.34(0.010) [0.32 - 0.37]	-0.016(0.011) [-0.059 - 0.047]	-0.039,0.0065	0.156
		LH RR/YG	0.33(0.010) [0.28 - 0.36]			
		LH RR	0.32(0.010) [0.27 - 0.35]	0.0095(0.011) [-0.031 - 0.055]	-0.012,0.031	0.380

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Potassium (% DW)	DK YG	0.39(0.0095) [0.36 - 0.43]	0.016(0.011) [-0.0012 - 0.040]	-0.0070,0.038	0.170
		DK RR/YG	0.41(0.0095) [0.38 - 0.44]			
		DK RR	0.39(0.0095) [0.35 - 0.40]	0.023(0.011) [-0.012 - 0.043]	0.00035,0.045	0.046
		LH YG	0.36(0.0095) [0.31 - 0.40]	-0.011(0.011) [-0.034 - 0.044]	-0.033,0.012	0.349
		LH RR/YG	0.35(0.0095) [0.34 - 0.37]			
		LH RR	0.38(0.0095) [0.35 - 0.40]	-0.023(0.011) [-0.047 - -0.0088]	-0.045,-0.00019	0.048
	Zinc (% DW)	DK YG	0.0021(0.00015) [0.0016 - 0.0025]	0.00016(0.00006) [0.00005 - 0.00038]	0.00003,0.00029	0.015
		DK RR/YG	0.0023(0.00015) [0.0016 - 0.0026]			
		DK RR	0.0022(0.00015) [0.0016 - 0.0025]	0.00016(0.00006) [0.00003 - 0.00024]	0.00003,0.00028	0.016
		LH YG	0.0024(0.00015) [0.0017 - 0.0027]	-0.00002(0.00006) [-0.00017 - 0.00018]	-0.00015,0.00011	0.748
		LH RR/YG	0.0023(0.00015) [0.0016 - 0.0027]			
		LH RR	0.0022(0.00015) [0.0014 - 0.0028]	0.00012(0.00006) [-0.00000 - 0.00024]	0,0.00024	0.068

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscallaneous	Phytic Acid (% DW)	DK YG	0.86(0.062) [0.73 - 1.03]	0.15(0.066) [-0.081 - 0.32]	0.012,0.28	0.033
		DK RR/YG	1.01(0.062) [0.90 - 1.15]			
		DK RR	0.95(0.062) [0.80 - 1.39]	0.053(0.066) [-0.31 - 0.29]	-0.081,0.19	0.428
		LH YG	0.95(0.062) [0.84 - 1.19]	-0.051(0.066) [-0.26 - 0.15]	-0.19,0.083	0.443
		LH RR/YG	0.90(0.062) [0.72 - 1.11]			
		LH RR	0.90(0.062) [0.72 - 1.12]	-0.0039(0.066) [-0.11 - 0.12]	-0.14,0.13	0.953
	Trypsin Inhibitor (TIU/mg DW)	DK YG	4.47(0.33) [3.36 - 6.16]	0.18(0.41) [-1.42 - 1.78]	-0.66,1.03	0.658
		DK RR/YG	4.66(0.33) [3.61 - 5.33]			
		DK RR	4.70(0.33) [4.23 - 6.54]	-0.048(0.41) [-1.80 - 0.99]	-0.89,0.79	0.908
		LH YG	4.84(0.33) [3.84 - 6.30]	0.22(0.41) [-1.36 - 2.14]	-0.62,1.06	0.603
		LH RR/YG	5.06(0.33) [4.46 - 6.25]			
		LH RR	4.92(0.33) [3.69 - 6.28]	0.14(0.41) [-1.37 - 1.05]	-0.70,0.98	0.742

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscellaneous	Vitamin E (mg/g DW)	DK YG	0.015(0.00064) [0.013 - 0.018]	0.00008(0.00067) [-0.0032 - 0.0045]	-0.0013,0.0015	0.905
		DK RR/YG	0.015(0.00064) [0.013 - 0.018]			
		DK RR	0.013(0.00064) [0.012 - 0.016]	0.0023(0.00061) [-0.00040 - 0.0063]	0.0010,0.0035	<0.001
		LH YG	0.0077(0.00064) [0.0060 - 0.0092]	-0.00006(0.00067) [-0.0019 - 0.0014]	-0.0014,0.0013	0.934
		LH RR/YG	0.0076(0.00064) [0.0051 - 0.0088]			
		LH RR	0.0073(0.00064) [0.0048 - 0.0095]	0.00029(0.00061) [-0.00070 - 0.0015]	-0.00095,0.0015	0.638
Proximate	Ash (% DW)	DK YG	1.41(0.065) [1.34 - 1.50]	-0.17(0.085) [-0.49 - 0.091]	-0.35,0.0045	0.055
		DK RR/YG	1.24(0.065) [0.91 - 1.45]			
		DK RR	1.42(0.065) [1.26 - 1.57]	-0.18(0.077) [-0.58 - 0.0049]	-0.33,-0.020	0.028
		LH YG	1.36(0.065) [1.18 - 1.51]	-0.036(0.085) [-0.35 - 0.14]	-0.21,0.14	0.677
		LH RR/YG	1.32(0.065) [1.06 - 1.52]			
		LH RR	1.31(0.065) [1.11 - 1.54]	0.011(0.077) [-0.45 - 0.38]	-0.15,0.17	0.889

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Carbohydrates (% DW)	DK YG	84.81(0.55) [83.08 - 85.71]	-0.49(0.48) [-2.10 - 0.45]	-1.48,0.50	0.317
		DK RR/YG	84.32(0.55) [82.50 - 85.55]			
		DK RR	84.33(0.55) [83.10 - 85.32]	-0.011(0.46) [-1.77 - 1.27]	-0.95,0.93	0.980
		LH YG	83.60(0.55) [80.89 - 85.78]	1.89(0.48) [0.023 - 3.15]	0.90,2.88	<0.001
		LH RR/YG	85.49(0.55) [83.75 - 87.86]			
		LH RR	86.36(0.55) [84.31 - 88.91]	-0.87(0.46) [-1.86 - -0.24]	-1.80,0.070	0.068
	Moisture (% FW)	DK YG	12.33(0.82) [9.80 - 14.50]	0.035(0.70) [-2.04 - 4.60]	-1.44,1.51	0.960
		DK RR/YG	12.37(0.82) [9.46 - 18.40]			
		DK RR	11.67(0.82) [9.04 - 13.60]	0.70(0.58) [-1.35 - 6.20]	-0.49,1.88	0.241
		LH YG	12.38(0.82) [10.60 - 14.20]	-0.33(0.70) [-2.28 - 0.90]	-1.80,1.14	0.643
		LH RR/YG	12.05(0.82) [9.72 - 14.70]			
		LH RR	11.64(0.82) [9.10 - 14.50]	0.42(0.58) [-0.000 - 1.60]	-0.77,1.61	0.477

TABLE 4. US GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Protein (% DW)	DK YG	10.72(0.55) [9.59 - 13.02]	0.13(0.42) [-0.36 - 0.90]	-0.75,1.01	0.758
		DK RR/YG	10.86(0.55) [9.93 - 12.79]			
		DK RR	10.81(0.55) [9.73 - 11.98]	0.044(0.35) [-0.94 - 1.55]	-0.67,0.76	0.900
		LH YG	11.84(0.55) [9.44 - 14.85]	-1.55(0.42) [-3.97 - 0.040]	-2.43,-0.67	0.001
		LH RR/YG	10.29(0.55) [8.02 - 11.63]			
		LH RR	9.72(0.55) [7.61 - 11.38]	0.57(0.35) [-0.30 - 1.56]	-0.15,1.28	0.114
	Total Fat (% DW)	DK YG	3.05(0.21) [2.41 - 3.78]	0.53(0.28) [-0.18 - 1.69]	-0.048,1.11	0.069
		DK RR/YG	3.58(0.21) [3.15 - 4.18]			
		DK RR	3.44(0.21) [3.04 - 3.99]	0.14(0.24) [-0.19 - 0.56]	-0.34,0.63	0.549
		LH YG	3.20(0.21) [2.75 - 3.80]	-0.30(0.28) [-0.99 - 0.90]	-0.88,0.28	0.288
		LH RR/YG	2.90(0.21) [2.26 - 3.65]			
		LH RR	2.61(0.21) [1.11 - 3.11]	0.29(0.24) [-0.36 - 1.15]	-0.20,0.77	0.237

TABLE 5. EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	23.05(1.43) [19.34 - 27.01]	-0.13(1.11) [-4.23 - 2.83]	-2.37,2.11	0.907
		DK RR/YG	22.92(1.43) [19.31 - 27.41]			
		DK RR	23.86(1.43) [18.61 - 28.24]	-0.94(1.11) [-5.24 - 2.05]	-3.18,1.30	0.402
		LH YG	21.95(1.43) [17.44 - 27.07]	1.06(1.11) [0.25 - 2.95]	-1.18,3.30	0.344
		LH RR/YG	23.01(1.43) [17.80 - 27.37]			
		LH RR	24.75(1.43) [18.14 - 32.01]	-1.73(1.11) [-7.12 - 1.45]	-3.97,0.51	0.126
	Neutral Detergent Fiber (% DW)	DK YG	37.65(1.80) [31.57 - 42.90]	1.73(1.53) [-3.20 - 4.33]	-1.35,4.82	0.263
		DK RR/YG	39.38(1.80) [34.04 - 44.77]			
		DK RR	39.45(1.80) [32.51 - 43.95]	-0.071(1.53) [-6.96 - 4.80]	-3.16,3.01	0.962
		LH YG	37.31(1.80) [32.14 - 43.38]	0.99(1.53) [-3.42 - 5.34]	-2.09,4.08	0.520
		LH RR/YG	38.31(1.80) [32.20 - 42.89]			
		LH RR	41.98(1.80) [32.04 - 51.87]	-3.67(1.53) [-14.10 - 4.48]	-6.75,-0.58	0.020

TABLE 5. EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Ash (% DW)	DK YG	4.18(0.49) [3.01 - 5.96]	-0.45(0.36) [-1.39 - 1.49]	-1.17,0.26	0.208
		DK RR/YG	3.72(0.49) [2.27 - 4.61]			
		DK RR	3.56(0.49) [2.14 - 5.23]	0.16(0.36) [-0.62 - 1.00]	-0.56,0.88	0.652
		LH YG	4.51(0.49) [2.46 - 6.88]	-0.12(0.36) [-1.93 - 1.33]	-0.84,0.60	0.736
		LH RR/YG	4.39(0.49) [2.93 - 5.95]			
		LH RR	4.47(0.49) [2.35 - 8.28]	-0.083(0.36) [-2.34 - 1.99]	-0.80,0.63	0.816
	Carbohydrates (% DW)	DK YG	85.07(0.70) [83.95 - 86.93]	0.34(0.56) [-0.87 - 1.48]	-0.78,1.46	0.543
		DK RR/YG	85.41(0.70) [83.53 - 87.94]			
		DK RR	85.98(0.70) [84.00 - 88.24]	-0.57(0.56) [-1.79 - 0.81]	-1.69,0.55	0.307
		LH YG	84.61(0.70) [81.90 - 86.60]	0.27(0.56) [-1.54 - 2.07]	-0.85,1.39	0.630
		LH RR/YG	84.88(0.70) [82.73 - 87.68]			
		LH RR	84.81(0.70) [79.72 - 88.27]	0.068(0.56) [-2.41 - 3.93]	-1.05,1.19	0.903

TABLE 5. EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Moisture (% FW)	DK YG	67.87(3.94) [55.00 - 77.60]	-0.93(1.64) [-6.00 - 6.70]	-4.24,2.38	0.574
		DK RR/YG	66.94(3.94) [50.00 - 78.00]			
		DK RR	63.20(3.94) [43.80 - 76.80]	3.74(1.64) [-0.30 - 14.10]	0.44,7.05	0.027
		LH YG	69.50(3.94) [59.40 - 78.50]	-0.76(1.64) [-6.60 - 5.00]	-4.06,2.55	0.646
		LH RR/YG	68.74(3.94) [52.80 - 77.30]			
		LH RR	66.71(3.94) [48.50 - 77.30]	2.03(1.64) [-1.80 - 7.80]	-1.28,5.34	0.222
	Protein (% DW)	DK YG	8.61(0.46) [6.82 - 10.35]	-0.13(0.32) [-1.17 - 1.21]	-0.79,0.54	0.703
		DK RR/YG	8.49(0.46) [6.22 - 9.36]			
		DK RR	8.19(0.46) [6.38 - 9.73]	0.30(0.29) [-0.55 - 1.11]	-0.30,0.90	0.315
		LH YG	8.76(0.46) [7.40 - 10.39]	0.12(0.32) [-1.12 - 0.84]	-0.54,0.79	0.712
		LH RR/YG	8.89(0.46) [7.03 - 10.21]			
		LH RR	8.58(0.46) [5.98 - 9.82]	0.31(0.29) [-0.79 - 1.91]	-0.29,0.90	0.305

TABLE 5. EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Total Fat (% DW)	DK YG	2.14(0.24) [1.18 - 2.82]	0.24(0.26) [-1.06 - 0.72]	-0.28,0.76	0.356
		DK RR/YG	2.38(0.24) [1.43 - 3.18]			
		DK RR	2.27(0.24) [1.73 - 3.27]	0.11(0.25) [-0.45 - 1.23]	-0.40,0.63	0.663
		LH YG	2.12(0.24) [1.47 - 2.90]	-0.27(0.26) [-1.10 - 1.11]	-0.79,0.25	0.300
		LH RR/YG	1.85(0.24) [0.73 - 2.72]			
		LH RR	2.14(0.24) [1.54 - 2.80]	-0.29(0.25) [-1.95 - 1.04]	-0.81,0.22	0.260

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	alanine (% Total AA)	DK YG	7.68(0.070) [7.44 - 7.89]	0.10(0.065) [-0.085 - 0.31]	-0.027,0.24	0.117
		DK RR/YG	7.78(0.070) [7.53 - 8.00]			
		DK RR	7.80(0.070) [7.57 - 8.12]	-0.017(0.065) [-0.27 - 0.12]	-0.15,0.11	0.794
		LH YG	7.75(0.070) [7.55 - 7.88]	-0.066(0.065) [-0.22 - 0.12]	-0.20,0.066	0.321
		LH RR/YG	7.68(0.070) [7.45 - 7.90]			
		LH RR	7.60(0.070) [7.29 - 7.87]	0.076(0.065) [-0.21 - 0.37]	-0.056,0.21	0.250
	arginine (% Total AA)	DK YG	4.62(0.15) [4.02 - 5.21]	-0.11(0.16) [-0.88 - 0.58]	-0.43,0.22	0.504
		DK RR/YG	4.51(0.15) [3.73 - 5.22]			
		DK RR	4.52(0.15) [4.02 - 4.95]	-0.0096(0.16) [-0.41 - 0.88]	-0.33,0.32	0.952
		LH YG	4.59(0.15) [4.25 - 4.84]	-0.075(0.16) [-0.35 - 0.18]	-0.40,0.25	0.643
		LH RR/YG	4.51(0.15) [4.07 - 4.77]			
		LH RR	4.74(0.15) [4.04 - 5.36]	-0.22(0.16) [-0.78 - 0.45]	-0.55,0.10	0.173

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	aspartic acid (% Total AA)	DK YG	6.84(0.077) [6.57 - 7.61]	-0.13(0.094) [-0.72 - 0.25]	-0.32,0.058	0.167
		DK RR/YG	6.71(0.077) [6.53 - 6.89]			
		DK RR	6.69(0.077) [6.50 - 6.94]	0.014(0.094) [-0.30 - 0.33]	-0.18,0.20	0.881
		LH YG	6.76(0.077) [6.54 - 6.91]	-0.13(0.094) [-0.24 - -0.022]	-0.32,0.058	0.168
		LH RR/YG	6.63(0.077) [6.44 - 6.77]			
		LH RR	6.83(0.077) [6.55 - 7.21]	-0.21(0.094) [-0.77 - 0.15]	-0.39,-0.016	0.034
	cystine (% Total AA)	DK YG	2.10(0.079) [1.77 - 2.27]	-0.022(0.081) [-0.19 - 0.10]	-0.19,0.14	0.792
		DK RR/YG	2.08(0.079) [1.80 - 2.29]			
		DK RR	2.01(0.079) [1.81 - 2.19]	0.064(0.081) [-0.24 - 0.44]	-0.10,0.23	0.438
		LH YG	2.09(0.079) [1.88 - 2.42]	0.087(0.081) [-0.14 - 0.27]	-0.077,0.25	0.291
		LH RR/YG	2.18(0.079) [1.95 - 2.67]			
		LH RR	2.18(0.079) [1.96 - 2.39]	0.0034(0.081) [-0.36 - 0.65]	-0.16,0.17	0.966

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	glutamic acid (% Total AA)	DK YG	19.16(0.19) [18.40 - 19.77]	0.30(0.18) [-0.27 - 0.77]	-0.063,0.67	0.102
		DK RR/YG	19.46(0.19) [18.50 - 20.06]			
		DK RR	19.41(0.19) [18.90 - 20.00]	0.052(0.18) [-0.50 - 0.60]	-0.31,0.42	0.775
		LH YG	19.14(0.19) [18.74 - 19.51]	-0.063(0.18) [-0.49 - 0.34]	-0.43,0.30	0.729
		LH RR/YG	19.08(0.19) [18.46 - 19.66]			
		LH RR	18.90(0.19) [17.91 - 19.75]	0.18(0.18) [-0.45 - 0.83]	-0.18,0.55	0.316
	glycine (% Total AA)	DK YG	3.86(0.10) [3.40 - 4.07]	0.018(0.088) [-0.20 - 0.41]	-0.16,0.19	0.841
		DK RR/YG	3.88(0.10) [3.44 - 4.49]			
		DK RR	3.79(0.10) [3.58 - 4.12]	0.095(0.088) [-0.14 - 0.52]	-0.082,0.27	0.284
		LH YG	3.70(0.10) [3.48 - 3.91]	-0.0019(0.088) [-0.23 - 0.13]	-0.18,0.18	0.983
		LH RR/YG	3.70(0.10) [3.52 - 3.97]			
		LH RR	3.88(0.10) [3.56 - 4.41]	-0.19(0.088) [-0.63 - 0.10]	-0.37,-0.012	0.036

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	histidine (% Total AA)	DK YG	2.81(0.054) [2.59 - 2.96]	-0.033(0.045) [-0.12 - 0.066]	-0.12,0.058	0.464
		DK RR/YG	2.77(0.054) [2.52 - 3.00]			
		DK RR	2.79(0.054) [2.66 - 2.98]	-0.014(0.041) [-0.21 - 0.12]	-0.097,0.069	0.733
		LH YG	2.90(0.054) [2.71 - 3.07]	-0.069(0.045) [-0.15 - 0.025]	-0.16,0.023	0.135
		LH RR/YG	2.83(0.054) [2.73 - 2.93]			
		LH RR	2.88(0.054) [2.59 - 3.15]	-0.048(0.041) [-0.23 - 0.18]	-0.13,0.035	0.252
	isoleucine (% Total AA)	DK YG	3.61(0.10) [3.32 - 3.78]	-0.19(0.14) [-0.53 - 0.054]	-0.48,0.10	0.183
		DK RR/YG	3.42(0.10) [3.11 - 3.83]			
		DK RR	3.63(0.10) [3.34 - 4.04]	-0.21(0.093) [-0.38 - 0.046]	-0.40,-0.018	0.032
		LH YG	3.63(0.10) [3.14 - 3.89]	0.0012(0.14) [-0.49 - 0.76]	-0.29,0.29	0.992
		LH RR/YG	3.63(0.10) [3.20 - 3.90]			
		LH RR	3.53(0.10) [2.97 - 3.83]	0.10(0.093) [-0.25 - 0.67]	-0.087,0.29	0.281

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	leucine (% Total AA)	DK YG	13.06(0.22) [12.18 - 14.07]	0.17(0.22) [-0.70 - 1.10]	-0.27,0.61	0.444
		DK RR/YG	13.23(0.22) [12.07 - 14.09]			
		DK RR	13.40(0.22) [12.84 - 14.04]	-0.17(0.22) [-0.94 - 0.44]	-0.61,0.27	0.441
		LH YG	13.35(0.22) [12.87 - 13.80]	0.089(0.22) [-0.25 - 0.65]	-0.35,0.53	0.687
		LH RR/YG	13.44(0.22) [12.86 - 14.03]			
		LH RR	12.99(0.22) [11.74 - 13.64]	0.45(0.22) [-0.29 - 1.48]	0.0059,0.89	0.047
	lysine (% Total AA)	DK YG	3.11(0.11) [2.70 - 3.34]	-0.038(0.10) [-0.22 - 0.41]	-0.24,0.17	0.713
		DK RR/YG	3.07(0.11) [2.61 - 3.75]			
		DK RR	3.00(0.11) [2.64 - 3.42]	0.070(0.10) [-0.17 - 0.62]	-0.14,0.27	0.496
		LH YG	3.03(0.11) [2.81 - 3.37]	0.059(0.10) [-0.011 - 0.30]	-0.15,0.26	0.563
		LH RR/YG	3.08(0.11) [2.80 - 3.36]			
		LH RR	3.26(0.11) [2.85 - 3.77]	-0.17(0.10) [-0.74 - 0.22]	-0.38,0.033	0.098

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	methionine (% Total AA)	DK YG	1.97(0.097) [1.73 - 2.22]	0.083(0.098) [-0.10 - 0.20]	-0.11,0.28	0.399
		DK RR/YG	2.05(0.097) [1.82 - 2.22]			
		DK RR	1.92(0.097) [1.66 - 2.13]	0.13(0.097) [-0.040 - 0.46]	-0.067,0.33	0.190
		LH YG	1.95(0.097) [1.69 - 2.27]	0.0016(0.098) [-0.23 - 0.37]	-0.20,0.20	0.987
		LH RR/YG	1.96(0.097) [1.67 - 2.63]			
		LH RR	1.99(0.097) [1.68 - 2.42]	-0.031(0.097) [-0.45 - 0.69]	-0.23,0.16	0.746
	phenylalanine (% Total AA)	DK YG	5.15(0.057) [4.84 - 5.35]	0.013(0.071) [-0.17 - 0.33]	-0.13,0.16	0.854
		DK RR/YG	5.16(0.057) [4.93 - 5.39]			
		DK RR	5.18(0.057) [5.06 - 5.37]	-0.013(0.061) [-0.13 - 0.12]	-0.14,0.11	0.836
		LH YG	5.12(0.057) [4.99 - 5.23]	0.076(0.071) [-0.085 - 0.27]	-0.070,0.22	0.292
		LH RR/YG	5.20(0.057) [5.02 - 5.35]			
		LH RR	5.06(0.057) [4.71 - 5.23]	0.14(0.061) [-0.080 - 0.45]	0.016,0.26	0.028

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	proline (% Total AA)	DK YG	8.44(0.13) [8.27 - 8.64]	0.21(0.15) [-0.030 - 0.49]	-0.10,0.52	0.177
		DK RR/YG	8.65(0.13) [8.40 - 8.86]			
		DK RR	8.52(0.13) [8.11 - 9.00]	0.13(0.14) [-0.35 - 0.61]	-0.16,0.42	0.376
		LH YG	8.69(0.13) [8.19 - 9.22]	0.099(0.15) [-0.55 - 0.58]	-0.21,0.41	0.521
		LH RR/YG	8.79(0.13) [8.19 - 9.30]			
		LH RR	8.63(0.13) [7.63 - 9.30]	0.16(0.14) [-0.43 - 0.76]	-0.13,0.45	0.273
	serine (% Total AA)	DK YG	5.08(0.15) [4.79 - 5.38]	0.15(0.17) [-0.56 - 0.46]	-0.21,0.50	0.410
		DK RR/YG	5.23(0.15) [4.34 - 5.63]			
		DK RR	5.00(0.15) [4.48 - 5.40]	0.23(0.16) [-0.31 - 0.54]	-0.088,0.55	0.151
		LH YG	4.79(0.15) [3.70 - 5.41]	0.21(0.17) [-1.06 - 1.29]	-0.14,0.57	0.229
		LH RR/YG	5.00(0.15) [4.35 - 5.44]			
		LH RR	5.01(0.15) [4.60 - 5.56]	-0.0049(0.16) [-0.57 - 0.65]	-0.32,0.31	0.975

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	threonine (% Total AA)	DK YG	3.70(0.050) [3.57 - 3.80]	-0.0036(0.068) [-0.18 - 0.15]	-0.14,0.13	0.958
		DK RR/YG	3.69(0.050) [3.44 - 3.91]			
		DK RR	3.62(0.050) [3.42 - 3.76]	0.071(0.068) [-0.12 - 0.20]	-0.067,0.21	0.303
		LH YG	3.54(0.050) [3.22 - 3.71]	0.068(0.068) [-0.30 - 0.41]	-0.070,0.21	0.323
		LH RR/YG	3.60(0.050) [3.36 - 3.80]			
		LH RR	3.65(0.050) [3.47 - 3.81]	-0.046(0.068) [-0.26 - 0.23]	-0.18,0.092	0.507
	tryptophan (% Total AA)	DK YG	0.57(0.023) [0.48 - 0.65]	-0.023(0.025) [-0.16 - 0.065]	-0.074,0.028	0.360
		DK RR/YG	0.55(0.023) [0.47 - 0.66]			
		DK RR	0.54(0.023) [0.47 - 0.60]	0.0037(0.023) [-0.084 - 0.079]	-0.043,0.050	0.872
		LH YG	0.55(0.023) [0.50 - 0.64]	-0.017(0.025) [-0.094 - 0.049]	-0.068,0.034	0.501
		LH RR/YG	0.53(0.023) [0.47 - 0.58]			
		LH RR	0.57(0.023) [0.49 - 0.61]	-0.036(0.023) [-0.10 - 0.036]	-0.082,0.011	0.127

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	tyrosine (% Total AA)	DK YG	3.52(0.18) [2.75 - 3.95]	-0.27(0.26) [-1.29 - 1.23]	-0.79,0.25	0.298
		DK RR/YG	3.25(0.18) [2.67 - 3.98]			
		DK RR	3.45(0.18) [2.86 - 4.02]	-0.20(0.24) [-0.84 - 1.06]	-0.69,0.28	0.407
		LH YG	3.66(0.18) [3.04 - 3.97]	-0.17(0.26) [-1.08 - 0.56]	-0.69,0.35	0.515
		LH RR/YG	3.49(0.18) [2.89 - 3.85]			
		LH RR	3.65(0.18) [2.39 - 3.98]	-0.16(0.24) [-1.04 - 0.83]	-0.64,0.33	0.508
	valine (% Total AA)	DK YG	4.73(0.13) [4.44 - 4.99]	-0.23(0.15) [-0.52 - 0.086]	-0.55,0.099	0.160
		DK RR/YG	4.50(0.13) [4.09 - 5.07]			
		DK RR	4.73(0.13) [4.30 - 5.09]	-0.23(0.12) [-0.50 - 0.061]	-0.47,0.016	0.065
		LH YG	4.78(0.13) [4.22 - 5.15]	-0.10(0.15) [-0.62 - 0.66]	-0.43,0.22	0.516
		LH RR/YG	4.68(0.13) [4.23 - 4.94]			
		LH RR	4.68(0.13) [3.96 - 5.17]	-0.00018(0.12) [-0.45 - 0.75]	-0.24,0.24	0.998

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	16:0 palmitic (% Total FA)	DK YG	9.64(0.093) [9.37 - 9.89]	-0.067(0.11) [-0.24 - 0.33]	-0.29,0.16	0.549
		DK RR/YG	9.57(0.093) [9.27 - 10.22]			
		DK RR	9.34(0.093) [9.13 - 9.54]	0.24(0.11) [-0.025 - 0.72]	0.012,0.46	0.039
		LH YG	9.22(0.093) [9.04 - 9.50]	-0.17(0.11) [-0.38 - 0.077]	-0.40,0.051	0.125
		LH RR/YG	9.04(0.093) [8.79 - 9.36]			
		LH RR	8.91(0.093) [8.71 - 9.40]	0.13(0.11) [-0.037 - 0.33]	-0.093,0.35	0.244
	18:0 stearic (% Total FA)	DK YG	1.82(0.061) [1.57 - 2.13]	0.19(0.042) [0.036 - 0.34]	0.10,0.27	<0.001
		DK RR/YG	2.01(0.061) [1.78 - 2.42]			
		DK RR	2.10(0.061) [1.93 - 2.38]	-0.097(0.042) [-0.24 - 0.040]	-0.18,-0.012	0.027
		LH YG	1.73(0.061) [1.64 - 1.96]	0.024(0.042) [-0.048 - 0.20]	-0.061,0.11	0.566
		LH RR/YG	1.76(0.061) [1.62 - 1.95]			
		LH RR	1.82(0.061) [1.72 - 1.97]	-0.063(0.042) [-0.16 - 0.0022]	-0.15,0.023	0.146

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:1 oleic (% Total FA)	DK YG	29.62(1.03) [24.17 - 34.08]	1.41(1.03) [-0.37 - 3.42]	-0.67,3.50	0.179
		DK RR/YG	31.03(1.03) [25.01 - 35.30]			
		DK RR	31.76(1.03) [28.88 - 36.02]	-0.73(1.03) [-3.87 - 2.89]	-2.81,1.36	0.485
		LH YG	24.12(1.03) [22.56 - 26.82]	-1.47(1.03) [-2.80 - -0.16]	-3.56,0.61	0.161
		LH RR/YG	22.65(1.03) [21.05 - 24.39]			
		LH RR	22.12(1.03) [20.69 - 23.58]	0.53(1.03) [-0.83 - 1.93]	-1.56,2.62	0.610
	18:2 linoleic (% Total FA)	DK YG	57.10(1.08) [52.29 - 62.50]	-1.51(1.07) [-3.85 - 0.60]	-3.67,0.65	0.165
		DK RR/YG	55.59(1.08) [50.94 - 61.14]			
		DK RR	54.96(1.08) [50.22 - 57.79]	0.63(1.07) [-3.15 - 3.35]	-1.54,2.79	0.561
		LH YG	62.97(1.08) [59.76 - 64.85]	1.74(1.07) [0.34 - 3.07]	-0.42,3.90	0.111
		LH RR/YG	64.71(1.08) [62.83 - 66.70]			
		LH RR	65.21(1.08) [63.69 - 66.89]	-0.49(1.07) [-1.78 - 0.67]	-2.65,1.67	0.647

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:3 linolenic (% Total FA)	DK YG	0.95(0.029) [0.89 - 1.06]	-0.025(0.032) [-0.081 - 0.058]	-0.088,0.039	0.441
		DK RR/YG	0.93(0.029) [0.87 - 0.99]			
		DK RR	0.91(0.029) [0.88 - 1.00]	0.022(0.032) [-0.019 - 0.084]	-0.041,0.086	0.483
		LH YG	1.12(0.029) [1.02 - 1.33]	-0.021(0.032) [-0.15 - 0.081]	-0.085,0.043	0.507
		LH RR/YG	1.10(0.029) [1.04 - 1.18]			
		LH RR	1.13(0.029) [0.99 - 1.31]	-0.028(0.032) [-0.13 - 0.089]	-0.091,0.036	0.382
	20:0 arachidic (% Total FA)	DK YG	0.39(0.012) [0.34 - 0.44]	0.017(0.0098) [-0.0054 - 0.048]	-0.0027,0.037	0.088
		DK RR/YG	0.41(0.012) [0.38 - 0.44]			
		DK RR	0.43(0.012) [0.38 - 0.47]	-0.021(0.0098) [-0.072 - 0.020]	-0.041,-0.0015	0.035
		LH YG	0.38(0.012) [0.35 - 0.42]	-0.028(0.0098) [-0.050 - -0.015]	-0.048,-0.0085	0.006
		LH RR/YG	0.35(0.012) [0.32 - 0.38]			
		LH RR	0.37(0.012) [0.34 - 0.45]	-0.026(0.0098) [-0.072 - -0.00076]	-0.045,-0.0057	0.012

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	20:1 eicosenoic (% Total FA)	DK YG	0.32(0.0090) [0.30 - 0.33]	-0.0082(0.011) [-0.022 - 0.014]	-0.030,0.013	0.448
		DK RR/YG	0.31(0.0090) [0.29 - 0.33]			
		DK RR	0.34(0.0090) [0.32 - 0.37]	-0.028(0.011) [-0.077 - 0.0076]	-0.050,-0.0064	0.012
		LH YG	0.30(0.0090) [0.28 - 0.33]	-0.023(0.011) [-0.040 - -0.013]	-0.045,-0.0017	0.035
		LH RR/YG	0.28(0.0090) [0.26 - 0.29]			
		LH RR	0.32(0.0090) [0.28 - 0.40]	-0.040(0.011) [-0.12 - -0.0024]	-0.061,-0.018	<0.001
	22:0 behenic (% Total FA)	DK YG	0.16(0.013) [0.14 - 0.17]	-0.0080(0.017) [-0.057 - 0.014]	-0.042,0.026	0.635
		DK RR/YG	0.15(0.013) [0.097 - 0.16]			
		DK RR	0.16(0.013) [0.14 - 0.18]	-0.011(0.016) [-0.050 - 0.011]	-0.044,0.021	0.485
		LH YG	0.15(0.013) [0.083 - 0.20]	-0.045(0.017) [-0.10 - 0.0035]	-0.079,-0.011	0.010
		LH RR/YG	0.11(0.013) [0.075 - 0.17]			
		LH RR	0.12(0.013) [0.090 - 0.18]	-0.013(0.016) [-0.066 - 0.073]	-0.046,0.020	0.426

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	4.18(0.15) [3.62 - 4.61]	0.29(0.21) [-0.25 - 0.72]	-0.13,0.72	0.173
		DK RR/YG	4.48(0.15) [3.99 - 4.92]			
		DK RR	4.14(0.15) [3.37 - 4.93]	0.33(0.18) [-0.58 - 0.69]	-0.035,0.70	0.074
		LH YG	4.43(0.15) [4.00 - 5.18]	-0.23(0.21) [-1.47 - 0.66]	-0.66,0.20	0.285
		LH RR/YG	4.20(0.15) [3.71 - 4.73]			
		LH RR	3.88(0.15) [3.39 - 4.47]	0.32(0.18) [-0.34 - 0.82]	-0.046,0.69	0.084
	Neutral Detergent Fiber (% DW)	DK YG	11.42(0.50) [10.34 - 13.30]	0.88(0.64) [-1.01 - 2.88]	-0.41,2.17	0.174
		DK RR/YG	12.30(0.50) [11.27 - 14.07]			
		DK RR	11.61(0.50) [10.13 - 13.66]	0.69(0.62) [-0.96 - 1.81]	-0.56,1.95	0.269
		LH YG	11.94(0.50) [10.55 - 13.48]	-1.08(0.64) [-3.95 - 0.94]	-2.37,0.21	0.097
		LH RR/YG	10.85(0.50) [9.53 - 12.17]			
		LH RR	11.78(0.50) [9.85 - 13.50]	-0.93(0.62) [-3.40 - 1.69]	-2.19,0.32	0.139

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Calcium (% DW)	DK YG	0.0048(0.00043) [0.0034 - 0.0063]	-0.00022(0.00040) [-0.0020 - 0.0013]	-0.0010,0.00058	0.586
		DK RR/YG	0.0046(0.00043) [0.0033 - 0.0065]			
		DK RR	0.0043(0.00043) [0.0030 - 0.0052]	0.00033(0.00040) [-0.00062 - 0.0013]	-0.00048,0.0011	0.417
		LH YG	0.0068(0.00043) [0.0056 - 0.0086]	-0.0017(0.00040) [-0.0022 - -0.0010]	-0.0025,-0.00094	<0.001
		LH RR/YG	0.0050(0.00043) [0.0038 - 0.0064]			
		LH RR	0.0049(0.00043) [0.0036 - 0.0057]	0.00011(0.00040) [-0.00057 - 0.00097]	-0.00070,0.00091	0.790
	Copper (% DW)	DK YG	0.00020(0.00002) [0.00014 - 0.00041]	-0.00003(0.00002) [-0.00024 - 0.00003]	-0.00008,0.00001	0.155
		DK RR/YG	0.00016(0.00002) [0.00011 - 0.00021]			
		DK RR	0.00016(0.00002) [0.00010 - 0.00032]	0(0.00002) [-0.00011 - 0.00005]	-0.00004,0.00005	0.847
		LH YG	0.00019(0.00002) [0.00014 - 0.00031]	0(0.00002) [-0.00004 - 0.00005]	-0.00004,0.00005	0.788
		LH RR/YG	0.00020(0.00002) [0.00014 - 0.00026]			
		LH RR	0.00016(0.00002) [0.00000 - 0.00026]	0.00004(0.00002) [0 - 0.00009]	0,0.00009	0.078

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Iron (% DW)	DK YG	0.0022(0.00016) [0.0018 - 0.0026]	-0.00006(0.00012) [-0.00057 - 0.00054]	-0.00030,0.00018	0.629
		DK RR/YG	0.0022(0.00016) [0.0014 - 0.0030]			
		DK RR	0.0021(0.00016) [0.0016 - 0.0028]	0.00008(0.00011) [-0.00025 - 0.00076]	-0.00013,0.00029	0.458
		LH YG	0.0020(0.00016) [0.0015 - 0.0026]	0.00004(0.00012) [-0.00023 - 0.00031]	-0.00020,0.00028	0.742
		LH RR/YG	0.0021(0.00016) [0.0015 - 0.0028]			
		LH RR	0.0020(0.00016) [0.0013 - 0.0025]	0.00003(0.00011) [-0.00074 - 0.00027]	-0.00019,0.00024	0.789
	Magnesium (% DW)	DK YG	0.12(0.0042) [0.10 - 0.13]	0.0014(0.0049) [-0.025 - 0.040]	-0.0084,0.011	0.768
		DK RR/YG	0.12(0.0042) [0.093 - 0.14]			
		DK RR	0.12(0.0042) [0.12 - 0.13]	-0.0038(0.0049) [-0.027 - 0.026]	-0.014,0.0061	0.439
		LH YG	0.12(0.0042) [0.11 - 0.14]	-0.0028(0.0049) [-0.030 - 0.0089]	-0.013,0.0071	0.575
		LH RR/YG	0.12(0.0042) [0.11 - 0.13]			
		LH RR	0.11(0.0042) [0.098 - 0.13]	0.0083(0.0049) [0.00008 - 0.020]	-0.0015,0.018	0.095

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Manganese (% DW)	DK YG	0.00054(0.00002) [0.00043 - 0.00063]	0(0.00003) [-0.00007 - 0.00016]	-0.00006,0.00006	0.926
		DK RR/YG	0.00054(0.00002) [0.00046 - 0.00059]			
		DK RR	0.00054(0.00002) [0.00042 - 0.00059]	0(0.00003) [-0.00011 - 0.00014]	-0.00006,0.00006	0.957
		LH YG	0.00069(0.00002) [0.00056 - 0.00076]	-0.00017(0.00003) [-0.00030 - -0.00007]	-0.00023,-0.00011	<0.001
		LH RR/YG	0.00052(0.00002) [0.00045 - 0.00058]			
		LH RR	0.00048(0.00002) [0.00040 - 0.00055]	0.00004(0.00003) [-0.00007 - 0.00013]	-0.00002,0.00010	0.150
	Phosphorus (% DW)	DK YG	0.32(0.012) [0.29 - 0.34]	0.0064(0.014) [-0.060 - 0.092]	-0.021,0.034	0.640
		DK RR/YG	0.32(0.012) [0.27 - 0.38]			
		DK RR	0.31(0.012) [0.29 - 0.37]	0.012(0.013) [-0.034 - 0.080]	-0.014,0.038	0.358
		LH YG	0.34(0.012) [0.29 - 0.39]	-0.0038(0.014) [-0.078 - 0.043]	-0.031,0.024	0.780
		LH RR/YG	0.33(0.012) [0.31 - 0.38]			
		LH RR	0.33(0.012) [0.26 - 0.41]	0.0072(0.013) [-0.035 - 0.048]	-0.019,0.033	0.576

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Potassium (% DW)	DK YG	0.39(0.019) [0.36 - 0.47]	-0.014(0.021) [-0.077 - 0.090]	-0.057,0.029	0.521
		DK RR/YG	0.38(0.019) [0.34 - 0.45]			
		DK RR	0.37(0.019) [0.34 - 0.52]	0.0068(0.021) [-0.11 - 0.092]	-0.035,0.049	0.745
		LH YG	0.37(0.019) [0.33 - 0.41]	-0.016(0.021) [-0.057 - 0.042]	-0.059,0.027	0.447
		LH RR/YG	0.35(0.019) [0.31 - 0.40]			
		LH RR	0.38(0.019) [0.33 - 0.57]	-0.027(0.021) [-0.18 - 0.041]	-0.069,0.015	0.202
	Zinc (% DW)	DK YG	0.0022(0.00022) [0.0016 - 0.0028]	0.00002(0.00012) [-0.00037 - 0.00060]	-0.00022,0.00026	0.872
		DK RR/YG	0.0022(0.00022) [0.0013 - 0.0031]			
		DK RR	0.0021(0.00022) [0.0014 - 0.0031]	0.00005(0.00011) [-0.00054 - 0.00056]	-0.00018,0.00028	0.655
		LH YG	0.0024(0.00022) [0.0017 - 0.0037]	0(0.00012) [-0.00029 - 0.00048]	-0.00024,0.00024	0.995
		LH RR/YG	0.0024(0.00022) [0.0015 - 0.0035]			
		LH RR	0.0023(0.00022) [0.0013 - 0.0034]	0.00008(0.00011) [-0.00013 - 0.00026]	-0.00016,0.00031	0.515

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscellaneous	Phytic Acid (% DW)	DK YG	0.78(0.052) [0.25 - 0.97]	0.081(0.073) [-0.14 - 0.72]	-0.066,0.23	0.274
		DK RR/YG	0.86(0.052) [0.75 - 0.98]			
		DK RR	0.84(0.052) [0.66 - 1.12]	0.027(0.066) [-0.24 - 0.32]	-0.11,0.16	0.681
		LH YG	0.91(0.052) [0.78 - 1.03]	-0.011(0.073) [-0.24 - 0.16]	-0.16,0.14	0.882
		LH RR/YG	0.90(0.052) [0.79 - 1.00]			
		LH RR	0.86(0.052) [0.68 - 0.96]	0.036(0.066) [-0.17 - 0.20]	-0.097,0.17	0.589
	Trypsin Inhibitor (TIU/mg DW)	DK YG	5.63(0.39) [4.37 - 6.65]	-0.56(0.42) [-2.86 - 1.18]	-1.40,0.29	0.193
		DK RR/YG	5.07(0.39) [3.40 - 6.74]			
		DK RR	5.12(0.39) [3.96 - 6.81]	-0.049(0.42) [-2.22 - 1.09]	-0.90,0.80	0.908
		LH YG	5.39(0.39) [4.01 - 6.46]	-0.10(0.42) [-1.14 - 1.25]	-0.95,0.75	0.806
		LH RR/YG	5.28(0.39) [4.51 - 7.05]			
		LH RR	4.62(0.39) [3.61 - 5.08]	0.66(0.42) [-0.51 - 2.27]	-0.19,1.51	0.122

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscellaneous	Vitamin E (mg/g DW)	DK YG	0.014(0.00078) [0.013 - 0.017]	-0.00025(0.00092) [-0.0027 - 0.0012]	-0.0021,0.0016	0.782
		DK RR/YG	0.014(0.00078) [0.011 - 0.018]			
		DK RR	0.013(0.00083) [0.011 - 0.014]	0.00094(0.00096) [-0.0018 - 0.0028]	-0.00000,0.0029	0.334
		LH YG	0.0073(0.00078) [0.0063 - 0.010]	-0.00013(0.00092) [-0.00075 - 0.00040]	-0.0020,0.0017	0.886
		LH RR/YG	0.0072(0.00078) [0.0059 - 0.010]			
		LH RR	0.0063(0.00083) [0.0050 - 0.0073]	0.00092(0.00096) [-0.00011 - 0.0018]	-0.0010,0.0029	0.343
Proximate	Ash (% DW)	DK YG	1.38(0.067) [1.18 - 1.58]	0.021(0.087) [-0.28 - 0.34]	-0.15,0.20	0.805
		DK RR/YG	1.40(0.067) [1.21 - 1.52]			
		DK RR	1.40(0.067) [1.31 - 1.58]	0.0035(0.087) [-0.17 - 0.18]	-0.17,0.18	0.967
		LH YG	1.38(0.067) [1.28 - 1.57]	0.050(0.087) [-0.46 - 0.23]	-0.13,0.22	0.571
		LH RR/YG	1.43(0.067) [1.10 - 1.55]			
		LH RR	1.41(0.067) [1.12 - 2.14]	0.012(0.087) [-1.04 - 0.42]	-0.16,0.19	0.890

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Carbohydrates (% DW)	DK YG	84.67(0.38) [83.17 - 86.89]	-0.57(0.41) [-1.46 - 0.15]	-1.40,0.26	0.175
		DK RR/YG	84.11(0.38) [82.73 - 85.43]			
		DK RR	84.43(0.38) [83.62 - 85.74]	-0.33(0.41) [-1.95 - 1.09]	-1.16,0.50	0.432
		LH YG	84.55(0.38) [83.77 - 85.04]	0.39(0.41) [-0.89 - 1.42]	-0.43,1.22	0.342
		LH RR/YG	84.94(0.38) [83.89 - 85.65]			
		LH RR	85.87(0.38) [83.56 - 87.92]	-0.93(0.41) [-2.44 - 1.10]	-1.76,-0.10	0.028
	Moisture (% FW)	DK YG	11.29(1.00) [7.55 - 14.10]	0.34(0.56) [-0.35 - 1.20]	-0.79,1.47	0.544
		DK RR/YG	11.63(1.00) [7.20 - 14.50]			
		DK RR	9.73(1.00) [5.52 - 13.60]	1.89(0.56) [0.28 - 5.08]	0.77,3.02	0.001
		LH YG	11.27(1.00) [7.72 - 14.70]	-0.11(0.56) [-1.56 - 1.23]	-1.24,1.02	0.846
		LH RR/YG	11.16(1.00) [7.49 - 14.20]			
		LH RR	9.68(1.00) [5.08 - 14.00]	1.48(0.56) [-0.30 - 4.82]	0.35,2.61	0.011

TABLE 6. EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Protein (% DW)	DK YG	10.48(0.36) [8.58 - 12.19]	0.60(0.36) [-0.20 - 0.89]	-0.13,1.33	0.104
		DK RR/YG	11.08(0.36) [9.41 - 12.64]			
		DK RR	10.76(0.36) [9.39 - 11.58]	0.31(0.35) [-0.29 - 1.95]	-0.40,1.03	0.377
		LH YG	10.86(0.36) [10.22 - 11.84]	-0.086(0.36) [-0.67 - 1.12]	-0.82,0.65	0.812
		LH RR/YG	10.78(0.36) [9.61 - 11.78]			
		LH RR	10.24(0.36) [8.62 - 12.32]	0.54(0.35) [-0.56 - 1.66]	-0.18,1.25	0.135
	Total Fat (% DW)	DK YG	3.47(0.12) [3.15 - 3.78]	-0.057(0.17) [-0.91 - 0.62]	-0.39,0.28	0.731
		DK RR/YG	3.41(0.12) [2.45 - 3.90]			
		DK RR	3.41(0.12) [2.77 - 3.93]	0.0077(0.16) [-0.87 - 1.05]	-0.32,0.34	0.962
		LH YG	3.21(0.12) [2.92 - 3.54]	-0.36(0.17) [-0.85 - 0.018]	-0.69,-0.023	0.036
		LH RR/YG	2.86(0.12) [2.48 - 3.19]			
		LH RR	2.48(0.12) [1.98 - 3.02]	0.38(0.16) [-0.24 - 0.68]	0.049,0.71	0.025

TABLE 7. COMBINED US/EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	25.14(1.17) [19.34 - 30.07]	0.86(0.78) [-4.23 - 4.87]	-0.68,2.41	0.270
		DK RR/YG	26.00(1.18) [19.31 - 34.95]			
		DK RR	26.35(1.18) [18.61 - 32.95]	-0.35(0.79) [-5.24 - 2.05]	-1.92,1.22	0.658
		LH YG	24.88(1.17) [17.44 - 35.67]	0.20(0.78) [-3.70 - 2.95]	-1.35,1.74	0.799
		LH RR/YG	25.08(1.18) [17.80 - 31.97]			
		LH RR	25.98(1.18) [18.14 - 32.01]	-0.90(0.79) [-7.12 - 3.81]	-2.47,0.67	0.256
	Neutral Detergent Fiber (% DW)	DK YG	40.33(1.45) [31.57 - 48.15]	2.55(1.07) [-3.20 - 6.48]	0.43,4.67	0.019
		DK RR/YG	42.88(1.47) [34.04 - 51.00]			
		DK RR	42.21(1.47) [32.51 - 47.86]	0.67(1.08) [-6.96 - 4.80]	-1.49,2.82	0.538
		LH YG	40.69(1.45) [32.14 - 49.32]	0.73(1.07) [-3.42 - 5.34]	-1.39,2.86	0.492
		LH RR/YG	41.42(1.47) [32.20 - 50.53]			
		LH RR	43.19(1.47) [32.04 - 51.87]	-1.77(1.08) [-14.10 - 4.48]	-3.92,0.39	0.106

TABLE 7. COMBINED US/EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Ash (% DW)	DK YG	4.37(0.31) [3.01 - 5.96]	-0.34(0.26) [-1.39 - 1.49]	-0.86,0.19	0.204
		DK RR/YG	4.03(0.31) [2.27 - 5.01]			
		DK RR	3.90(0.31) [2.14 - 5.50]	0.13(0.27) [-1.23 - 1.00]	-0.40,0.66	0.616
		LH YG	4.98(0.31) [2.46 - 7.48]	-0.56(0.26) [-3.50 - 1.33]	-1.09,-0.040	0.035
		LH RR/YG	4.42(0.31) [2.93 - 6.10]			
		LH RR	4.69(0.31) [2.35 - 8.28]	-0.28(0.27) [-2.34 - 1.99]	-0.81,0.25	0.302
	Carbohydrates (% DW)	DK YG	85.06(0.49) [83.37 - 86.93]	0.38(0.42) [-0.87 - 1.48]	-0.47,1.22	0.376
		DK RR/YG	85.43(0.50) [83.53 - 87.94]			
		DK RR	85.52(0.50) [80.93 - 88.34]	-0.085(0.41) [-1.79 - 2.83]	-0.91,0.74	0.837
		LH YG	84.05(0.49) [81.90 - 86.60]	0.57(0.42) [-1.54 - 3.04]	-0.27,1.41	0.182
		LH RR/YG	84.62(0.50) [82.16 - 87.68]			
		LH RR	84.49(0.50) [79.72 - 88.27]	0.13(0.41) [-2.41 - 3.93]	-0.70,0.95	0.758

TABLE 7. COMBINED US/EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Moisture (% FW)	DK YG	68.22(2.16) [55.00 - 77.60]	-0.87(1.01) [-6.00 - 6.70]	-2.88,1.14	0.393
		DK RR/YG	67.35(2.18) [50.00 - 78.00]			
		DK RR	65.02(2.18) [43.80 - 76.80]	2.33(1.03) [-1.20 - 14.10]	0.28,4.37	0.026
		LH YG	69.80(2.16) [59.40 - 78.50]	-0.99(1.01) [-6.60 - 5.00]	-3.00,1.02	0.328
		LH RR/YG	68.81(2.18) [52.80 - 77.30]			
		LH RR	67.17(2.18) [48.50 - 77.30]	1.63(1.03) [-1.90 - 7.80]	-0.41,3.67	0.115
	Protein (% DW)	DK YG	8.43(0.37) [6.82 - 10.35]	-0.16(0.24) [-1.17 - 1.21]	-0.63,0.32	0.517
		DK RR/YG	8.27(0.37) [6.16 - 10.80]			
		DK RR	8.26(0.37) [5.95 - 10.87]	0.016(0.23) [-0.92 - 1.11]	-0.44,0.47	0.943
		LH YG	8.76(0.37) [6.97 - 10.72]	0.073(0.24) [-1.12 - 0.88]	-0.41,0.55	0.760
		LH RR/YG	8.84(0.37) [7.03 - 11.17]			
		LH RR	8.48(0.37) [5.98 - 10.63]	0.35(0.23) [-0.79 - 1.91]	-0.10,0.81	0.125

TABLE 7. COMBINED US/EU FORAGE: FIBER, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Total Fat (% DW)	DK YG	2.15(0.16) [1.18 - 2.83]	0.11(0.17) [-1.06 - 0.72]	-0.23,0.45	0.524
		DK RR/YG	2.26(0.16) [1.18 - 3.18]			
		DK RR	2.32(0.16) [1.73 - 3.27]	-0.064(0.17) [-1.52 - 1.23]	-0.41,0.28	0.710
		LH YG	2.21(0.16) [1.47 - 3.22]	-0.085(0.17) [-1.10 - 1.13]	-0.42,0.25	0.619
		LH RR/YG	2.12(0.16) [0.73 - 2.80]			
		LH RR	2.33(0.16) [1.54 - 3.04]	-0.21(0.17) [-1.95 - 1.04]	-0.55,0.14	0.238

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	alanine (% Total AA)	DK YG	7.65(0.054) [7.33 - 7.92]	0.067(0.049) [-0.099 - 0.31]	-0.030,0.16	0.171
		DK RR/YG	7.72(0.054) [7.36 - 8.00]			
		DK RR	7.73(0.054) [7.51 - 8.12]	-0.013(0.045) [-0.27 - 0.14]	-0.10,0.078	0.779
		LH YG	7.76(0.054) [7.41 - 8.00]	-0.13(0.049) [-0.43 - 0.12]	-0.23,-0.037	0.007
		LH RR/YG	7.63(0.054) [7.10 - 8.01]			
		LH RR	7.57(0.054) [7.29 - 7.87]	0.057(0.045) [-0.29 - 0.37]	-0.034,0.15	0.214
	arginine (% Total AA)	DK YG	4.60(0.10) [4.02 - 5.21]	-0.054(0.11) [-0.88 - 0.58]	-0.27,0.16	0.621
		DK RR/YG	4.54(0.10) [3.73 - 5.22]			
		DK RR	4.50(0.10) [3.92 - 4.95]	0.047(0.10) [-0.41 - 0.88]	-0.16,0.25	0.646
		LH YG	4.47(0.10) [3.93 - 4.88]	0.057(0.11) [-0.40 - 0.48]	-0.16,0.27	0.596
		LH RR/YG	4.53(0.10) [3.81 - 5.29]			
		LH RR	4.64(0.10) [4.04 - 5.36]	-0.11(0.10) [-0.78 - 0.45]	-0.31,0.093	0.286

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	aspartic acid (% Total AA)	DK YG	6.69(0.060) [6.38 - 7.61]	-0.086(0.064) [-0.72 - 0.25]	-0.21,0.041	0.183
		DK RR/YG	6.60(0.060) [6.32 - 6.89]			
		DK RR	6.60(0.060) [6.34 - 6.94]	0.00059(0.061) [-0.30 - 0.33]	-0.12,0.12	0.992
		LH YG	6.68(0.060) [6.40 - 6.91]	-0.081(0.064) [-0.24 - 0.18]	-0.21,0.046	0.205
		LH RR/YG	6.60(0.060) [6.30 - 6.82]			
		LH RR	6.78(0.060) [6.37 - 7.21]	-0.18(0.061) [-0.77 - 0.15]	-0.30,-0.058	0.004
	cystine (% Total AA)	DK YG	2.13(0.056) [1.77 - 2.27]	0.011(0.066) [-0.19 - 0.31]	-0.12,0.14	0.865
		DK RR/YG	2.14(0.056) [1.80 - 2.54]			
		DK RR	2.07(0.056) [1.81 - 2.25]	0.069(0.062) [-0.24 - 0.44]	-0.055,0.19	0.272
		LH YG	2.09(0.056) [1.72 - 2.42]	0.075(0.066) [-0.42 - 0.27]	-0.057,0.21	0.260
		LH RR/YG	2.17(0.056) [1.74 - 2.67]			
		LH RR	2.26(0.056) [1.96 - 2.72]	-0.089(0.062) [-0.80 - 0.65]	-0.21,0.035	0.155

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	glutamic acid (% Total AA)	DK YG	19.21(0.15) [18.40 - 20.04]	0.25(0.13) [-0.27 - 0.77]	-0.014,0.51	0.062
		DK RR/YG	19.46(0.15) [18.50 - 20.06]			
		DK RR	19.39(0.15) [18.90 - 20.00]	0.070(0.12) [-0.50 - 0.60]	-0.18,0.32	0.569
		LH YG	19.31(0.15) [18.58 - 20.23]	-0.18(0.13) [-1.18 - 0.37]	-0.45,0.081	0.171
		LH RR/YG	19.13(0.15) [18.04 - 20.28]			
		LH RR	18.94(0.15) [17.91 - 19.78]	0.20(0.12) [-0.53 - 1.06]	-0.050,0.44	0.115
	glycine (% Total AA)	DK YG	3.89(0.073) [3.40 - 4.21]	0.016(0.066) [-0.20 - 0.41]	-0.12,0.15	0.805
		DK RR/YG	3.91(0.073) [3.44 - 4.49]			
		DK RR	3.83(0.073) [3.58 - 4.12]	0.085(0.060) [-0.17 - 0.52]	-0.035,0.20	0.162
		LH YG	3.69(0.073) [3.43 - 4.05]	0.11(0.066) [-0.23 - 0.37]	-0.020,0.24	0.095
		LH RR/YG	3.80(0.073) [3.52 - 4.31]			
		LH RR	3.94(0.073) [3.56 - 4.50]	-0.14(0.060) [-0.63 - 0.14]	-0.26,-0.020	0.022

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	histidine (% Total AA)	DK YG	2.83(0.040) [2.59 - 2.96]	-0.042(0.037) [-0.12 - 0.14]	-0.12,0.032	0.259
		DK RR/YG	2.79(0.040) [2.52 - 3.00]			
		DK RR	2.80(0.040) [2.65 - 2.98]	-0.0063(0.034) [-0.21 - 0.13]	-0.074,0.061	0.851
		LH YG	2.85(0.040) [2.71 - 3.07]	0.033(0.037) [-0.15 - 0.27]	-0.042,0.11	0.383
		LH RR/YG	2.88(0.040) [2.73 - 3.15]			
		LH RR	2.93(0.040) [2.59 - 3.26]	-0.042(0.034) [-0.23 - 0.18]	-0.11,0.026	0.222
	isoleucine (% Total AA)	DK YG	3.64(0.069) [3.32 - 3.85]	-0.12(0.085) [-0.53 - 0.37]	-0.29,0.050	0.160
		DK RR/YG	3.51(0.069) [3.11 - 3.89]			
		DK RR	3.65(0.069) [3.34 - 4.04]	-0.13(0.069) [-0.39 - 0.28]	-0.27,0.0026	0.054
		LH YG	3.64(0.069) [3.14 - 4.12]	0.055(0.085) [-0.51 - 0.76]	-0.12,0.23	0.521
		LH RR/YG	3.70(0.069) [3.20 - 3.97]			
		LH RR	3.66(0.069) [2.97 - 4.11]	0.032(0.069) [-0.28 - 0.67]	-0.10,0.17	0.640

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	leucine (% Total AA)	DK YG	12.99(0.17) [12.18 - 14.07]	0.11(0.16) [-0.70 - 1.10]	-0.21,0.43	0.486
		DK RR/YG	13.10(0.17) [12.07 - 14.09]			
		DK RR	13.22(0.17) [12.43 - 14.04]	-0.12(0.14) [-0.94 - 0.44]	-0.40,0.17	0.421
		LH YG	13.37(0.17) [12.35 - 14.27]	-0.13(0.16) [-1.07 - 0.65]	-0.45,0.18	0.407
		LH RR/YG	13.24(0.17) [11.69 - 14.03]			
		LH RR	12.93(0.17) [11.74 - 13.81]	0.31(0.14) [-0.57 - 1.48]	0.020,0.59	0.036
	lysine (% Total AA)	DK YG	3.14(0.079) [2.70 - 3.37]	-0.068(0.076) [-0.29 - 0.41]	-0.22,0.084	0.374
		DK RR/YG	3.08(0.079) [2.61 - 3.75]			
		DK RR	3.02(0.079) [2.64 - 3.42]	0.052(0.073) [-0.25 - 0.62]	-0.093,0.20	0.473
		LH YG	3.00(0.079) [2.77 - 3.37]	0.13(0.076) [-0.052 - 0.49]	-0.022,0.28	0.093
		LH RR/YG	3.13(0.079) [2.72 - 3.83]			
		LH RR	3.29(0.079) [2.85 - 4.08]	-0.16(0.073) [-0.74 - 0.22]	-0.30,-0.014	0.031

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	methionine (% Total AA)	DK YG	2.08(0.065) [1.73 - 2.35]	0.065(0.071) [-0.13 - 0.20]	-0.077,0.21	0.364
		DK RR/YG	2.15(0.065) [1.82 - 2.36]			
		DK RR	2.03(0.065) [1.66 - 2.25]	0.12(0.067) [-0.14 - 0.46]	-0.018,0.25	0.087
		LH YG	2.02(0.065) [1.64 - 2.27]	0.0052(0.071) [-0.53 - 0.45]	-0.14,0.15	0.942
		LH RR/YG	2.02(0.065) [1.67 - 2.63]			
		LH RR	2.12(0.065) [1.68 - 2.72]	-0.096(0.067) [-0.63 - 0.69]	-0.23,0.036	0.151
	phenylalanine (% Total AA)	DK YG	5.12(0.042) [4.84 - 5.45]	0.015(0.046) [-0.23 - 0.33]	-0.078,0.11	0.745
		DK RR/YG	5.14(0.042) [4.93 - 5.39]			
		DK RR	5.14(0.042) [4.95 - 5.37]	-0.0041(0.041) [-0.13 - 0.12]	-0.085,0.077	0.920
		LH YG	5.11(0.042) [4.88 - 5.40]	0.045(0.046) [-0.25 - 0.27]	-0.048,0.14	0.334
		LH RR/YG	5.16(0.042) [4.78 - 5.37]			
		LH RR	5.08(0.042) [4.71 - 5.34]	0.079(0.041) [-0.22 - 0.45]	-0.0026,0.16	0.057

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	proline (% Total AA)	DK YG	8.55(0.085) [8.27 - 8.89]	0.13(0.093) [-0.14 - 0.49]	-0.052,0.32	0.155
		DK RR/YG	8.68(0.085) [8.40 - 8.99]			
		DK RR	8.67(0.085) [8.11 - 9.24]	0.015(0.088) [-0.38 - 0.61]	-0.16,0.19	0.869
		LH YG	8.76(0.085) [8.19 - 9.22]	0.17(0.093) [-0.55 - 0.58]	-0.019,0.35	0.077
		LH RR/YG	8.93(0.085) [8.19 - 9.31]			
		LH RR	8.74(0.085) [7.63 - 9.30]	0.18(0.088) [-0.43 - 0.76]	0.0050,0.36	0.043
	serine (% Total AA)	DK YG	5.01(0.17) [4.57 - 5.38]	-0.081(0.20) [-2.72 - 0.46]	-0.49,0.32	0.687
		DK RR/YG	4.93(0.17) [2.62 - 5.63]			
		DK RR	4.95(0.17) [4.26 - 5.40]	-0.019(0.17) [-1.64 - 0.56]	-0.35,0.31	0.909
		LH YG	4.88(0.17) [3.70 - 5.41]	-0.23(0.20) [-3.20 - 1.29]	-0.64,0.17	0.248
		LH RR/YG	4.64(0.17) [2.09 - 5.44]			
		LH RR	4.63(0.17) [3.21 - 5.56]	0.0086(0.17) [-1.12 - 1.03]	-0.32,0.34	0.958

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	threonine (% Total AA)	DK YG	3.65(0.058) [3.45 - 3.80]	-0.055(0.068) [-0.97 - 0.17]	-0.19,0.081	0.420
		DK RR/YG	3.59(0.058) [2.76 - 3.91]			
		DK RR	3.58(0.058) [3.34 - 3.76]	0.0072(0.059) [-0.58 - 0.20]	-0.11,0.12	0.902
		LH YG	3.54(0.058) [3.22 - 3.71]	-0.046(0.068) [-1.07 - 0.41]	-0.18,0.090	0.500
		LH RR/YG	3.49(0.058) [2.52 - 3.80]			
		LH RR	3.53(0.058) [3.06 - 3.81]	-0.044(0.059) [-0.54 - 0.27]	-0.16,0.073	0.458
	tryptophan (% Total AA)	DK YG	0.60(0.020) [0.48 - 0.68]	0.0033(0.020) [-0.16 - 0.13]	-0.036,0.043	0.867
		DK RR/YG	0.60(0.020) [0.47 - 0.74]			
		DK RR	0.58(0.020) [0.47 - 0.67]	0.021(0.017) [-0.084 - 0.079]	-0.013,0.056	0.225
		LH YG	0.58(0.020) [0.50 - 0.76]	0.0000(0.020) [-0.094 - 0.15]	-0.030,0.050	0.614
		LH RR/YG	0.59(0.020) [0.47 - 0.75]			
		LH RR	0.60(0.020) [0.49 - 0.70]	-0.012(0.017) [-0.10 - 0.12]	-0.046,0.023	0.501

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Amino Acid	tyrosine (% Total AA)	DK YG	3.46(0.13) [2.68 - 3.95]	-0.055(0.19) [-1.29 - 1.23]	-0.42,0.31	0.768
		DK RR/YG	3.41(0.13) [2.60 - 3.98]			
		DK RR	3.49(0.13) [2.86 - 4.02]	-0.082(0.18) [-1.10 - 1.06]	-0.43,0.27	0.640
		LH YG	3.47(0.13) [2.32 - 3.97]	0.055(0.19) [-1.08 - 1.32]	-0.31,0.42	0.765
		LH RR/YG	3.53(0.13) [2.89 - 3.85]			
		LH RR	3.49(0.13) [2.39 - 3.98]	0.036(0.18) [-1.04 - 1.18]	-0.31,0.39	0.836
	valine (% Total AA)	DK YG	4.76(0.091) [4.44 - 4.99]	-0.11(0.11) [-0.52 - 0.82]	-0.32,0.10	0.301
		DK RR/YG	4.65(0.091) [4.09 - 5.37]			
		DK RR	4.76(0.091) [4.30 - 5.17]	-0.11(0.088) [-0.53 - 0.29]	-0.28,0.068	0.226
		LH YG	4.77(0.091) [4.22 - 5.15]	0.068(0.11) [-0.62 - 0.71]	-0.14,0.28	0.523
		LH RR/YG	4.83(0.091) [4.23 - 5.25]			
		LH RR	4.86(0.091) [3.96 - 5.45]	-0.024(0.088) [-0.45 - 0.75]	-0.20,0.15	0.786

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	16:0 palmitic (% Total FA)	DK YG	9.66(0.063) [9.37 - 9.89]	-0.047(0.070) [-0.24 - 0.33]	-0.19,0.093	0.506
		DK RR/YG	9.61(0.063) [9.27 - 10.22]			
		DK RR	9.41(0.063) [9.13 - 9.62]	0.20(0.070) [-0.045 - 0.72]	0.063,0.34	0.005
		LH YG	9.30(0.063) [9.04 - 9.53]	-0.19(0.070) [-0.45 - 0.091]	-0.33,-0.050	0.008
		LH RR/YG	9.11(0.063) [8.79 - 9.36]			
		LH RR	9.03(0.063) [8.71 - 9.45]	0.082(0.070) [-0.17 - 0.33]	-0.058,0.22	0.248
	18:0 stearic (% Total FA)	DK YG	1.89(0.047) [1.57 - 2.29]	0.20(0.035) [-0.025 - 0.55]	0.14,0.27	<0.001
		DK RR/YG	2.09(0.047) [1.78 - 2.48]			
		DK RR	2.20(0.047) [1.93 - 2.51]	-0.10(0.035) [-0.33 - 0.074]	-0.17,-0.035	0.003
		LH YG	1.78(0.047) [1.64 - 2.00]	0.032(0.035) [-0.066 - 0.20]	-0.037,0.10	0.354
		LH RR/YG	1.81(0.047) [1.62 - 2.02]			
		LH RR	1.86(0.047) [1.72 - 2.00]	-0.050(0.035) [-0.16 - 0.024]	-0.12,0.019	0.153

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:1 oleic (% Total FA)	DK YG	31.07(0.78) [24.17 - 37.38]	1.41(0.76) [-2.89 - 7.70]	-0.092,2.92	0.065
		DK RR/YG	32.48(0.78) [25.01 - 38.66]			
		DK RR	33.32(0.78) [28.88 - 36.02]	-0.84(0.76) [-5.54 - 2.89]	-2.34,0.67	0.270
		LH YG	24.72(0.78) [22.56 - 27.47]	-1.24(0.76) [-2.80 - -0.16]	-2.74,0.27	0.105
		LH RR/YG	23.48(0.78) [21.05 - 25.72]			
		LH RR	23.00(0.78) [20.69 - 26.05]	0.49(0.76) [-0.83 - 2.09]	-1.02,1.99	0.521
	18:2 linoleic (% Total FA)	DK YG	55.53(0.84) [48.72 - 62.50]	-1.55(0.79) [-8.48 - 3.02]	-3.13,0.031	0.054
		DK RR/YG	53.98(0.84) [47.36 - 61.14]			
		DK RR	53.20(0.84) [49.91 - 57.79]	0.78(0.79) [-3.15 - 5.87]	-0.80,2.36	0.329
		LH YG	62.21(0.84) [59.41 - 64.85]	1.49(0.79) [0.19 - 3.07]	-0.088,3.07	0.063
		LH RR/YG	63.70(0.84) [61.42 - 66.70]			
		LH RR	64.13(0.84) [61.23 - 66.89]	-0.42(0.79) [-2.17 - 0.67]	-2.00,1.16	0.596

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	18:3 linolenic (% Total FA)	DK YG	0.96(0.019) [0.89 - 1.06]	-0.053(0.021) [-0.21 - 0.058]	-0.094,-0.012	0.011
		DK RR/YG	0.91(0.019) [0.76 - 0.99]			
		DK RR	0.92(0.019) [0.88 - 1.03]	-0.0064(0.021) [-0.12 - 0.084]	-0.047,0.035	0.757
		LH YG	1.11(0.019) [1.02 - 1.33]	0.00090(0.021) [-0.15 - 0.083]	-0.040,0.042	0.965
		LH RR/YG	1.11(0.019) [1.04 - 1.20]			
		LH RR	1.14(0.019) [0.99 - 1.31]	-0.028(0.021) [-0.13 - 0.089]	-0.069,0.013	0.178
	20:0 arachidic (% Total FA)	DK YG	0.41(0.0000) [0.34 - 0.46]	0.023(0.010) [-0.028 - 0.13]	0.0030,0.044	0.025
		DK RR/YG	0.43(0.0000) [0.38 - 0.54]			
		DK RR	0.45(0.0000) [0.38 - 0.48]	-0.014(0.010) [-0.072 - 0.054]	-0.034,0.0067	0.186
		LH YG	0.39(0.0000) [0.35 - 0.44]	-0.034(0.010) [-0.064 - -0.0056]	-0.055,-0.014	0.001
		LH RR/YG	0.36(0.0000) [0.32 - 0.38]			
		LH RR	0.37(0.0000) [0.22 - 0.45]	-0.012(0.010) [-0.072 - 0.16]	-0.032,0.0083	0.242

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fatty Acid	20:1 eicosenoic (% Total FA)	DK YG	0.33(0.0074) [0.30 - 0.36]	-0.0033(0.0087) [-0.035 - 0.072]	-0.021,0.014	0.704
		DK RR/YG	0.33(0.0074) [0.29 - 0.41]			
		DK RR	0.34(0.0074) [0.32 - 0.37]	-0.015(0.0087) [-0.077 - 0.038]	-0.032,0.0025	0.091
		LH YG	0.31(0.0074) [0.28 - 0.34]	-0.019(0.0087) [-0.048 - 0.015]	-0.037,-0.0019	0.030
		LH RR/YG	0.29(0.0074) [0.26 - 0.33]			
		LH RR	0.31(0.0074) [0.22 - 0.40]	-0.022(0.0087) [-0.12 - 0.11]	-0.039,-0.0047	0.013
	22:0 behenic (% Total FA)	DK YG	0.15(0.0000) [0.10 - 0.18]	0.012(0.013) [-0.057 - 0.087]	-0.013,0.038	0.337
		DK RR/YG	0.16(0.0000) [0.097 - 0.22]			
		DK RR	0.17(0.0000) [0.14 - 0.19]	-0.0045(0.012) [-0.050 - 0.040]	-0.028,0.019	0.710
		LH YG	0.17(0.0000) [0.083 - 0.20]	-0.044(0.013) [-0.10 - 0.030]	-0.070,-0.018	0.001
		LH RR/YG	0.12(0.0000) [0.075 - 0.20]			
		LH RR	0.16(0.0000) [0.090 - 0.22]	-0.035(0.012) [-0.13 - 0.073]	-0.058,-0.011	0.005

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Fiber	Acid Detergent Fiber (% DW)	DK YG	4.16(0.14) [3.43 - 5.45]	0.21(0.18) [-0.51 - 0.79]	-0.15,0.56	0.256
		DK RR/YG	4.37(0.14) [3.43 - 4.94]			
		DK RR	4.38(0.14) [3.37 - 5.71]	-0.012(0.17) [-1.42 - 0.69]	-0.35,0.32	0.941
		LH YG	4.34(0.14) [3.89 - 5.18]	-0.17(0.18) [-1.47 - 0.66]	-0.53,0.19	0.338
		LH RR/YG	4.17(0.14) [3.54 - 4.73]			
		LH RR	4.07(0.14) [3.25 - 5.78]	0.099(0.17) [-1.59 - 1.39]	-0.24,0.44	0.560
	Neutral Detergent Fiber (% DW)	DK YG	11.61(0.39) [10.04 - 15.03]	0.63(0.43) [-1.44 - 2.88]	-0.21,1.48	0.140
		DK RR/YG	12.24(0.39) [10.68 - 14.07]			
		DK RR	11.80(0.39) [10.13 - 13.66]	0.44(0.42) [-0.96 - 1.81]	-0.39,1.27	0.295
		LH YG	11.61(0.39) [9.66 - 14.32]	-0.28(0.43) [-3.95 - 1.69]	-1.13,0.57	0.513
		LH RR/YG	11.33(0.39) [9.53 - 13.85]			
		LH RR	11.63(0.39) [9.85 - 13.91]	-0.30(0.42) [-3.40 - 1.69]	-1.13,0.53	0.472

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Calcium (% DW)	DK YG	0.0048(0.00029) [0.0034 - 0.0073]	-0.00005(0.00027) [-0.0020 - 0.0016]	-0.00059,0.00049	0.842
		DK RR/YG	0.0048(0.00029) [0.0033 - 0.0065]			
		DK RR	0.0042(0.00029) [0.0030 - 0.0053]	0.00057(0.00026) [-0.00062 - 0.0021]	0.00005,0.0011	0.030
		LH YG	0.0065(0.00029) [0.0054 - 0.0086]	-0.0014(0.00028) [-0.0022 - 0.00002]	-0.0020,-0.00089	<0.001
		LH RR/YG	0.0051(0.00029) [0.0038 - 0.0064]			
		LH RR	0.0051(0.00029) [0.0036 - 0.0063]	-0.00004(0.00026) [-0.00000 - 0.00097]	-0.00055,0.00048	0.888
	Copper (% DW)	DK YG	0.00020(0.00002) [0.00014 - 0.00041]	-0.00002(0.00002) [-0.00024 - 0.00005]	-0.00006,0.00001	0.217
		DK RR/YG	0.00018(0.00002) [0.00011 - 0.00026]			
		DK RR	0.00016(0.00002) [0.00010 - 0.00032]	0.00002(0.00002) [-0.00011 - 0.00009]	0,0.00006	0.163
		LH YG	0.00022(0.00002) [0.00014 - 0.00043]	0(0.00002) [-0.00020 - 0.00008]	-0.00004,0.00003	0.944
		LH RR/YG	0.00022(0.00002) [0.00014 - 0.00029]			
		LH RR	0.00017(0.00002) [0.00000 - 0.00026]	0.00005(0.00002) [0 - 0.00011]	0.00002,0.00009	0.003

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Iron (% DW)	DK YG	0.0022(0.00009) [0.0018 - 0.0026]	0.00003(0.00008) [-0.00057 - 0.00054]	-0.00012,0.00018	0.691
		DK RR/YG	0.0022(0.00009) [0.0014 - 0.0030]			
		DK RR	0.0021(0.00009) [0.0016 - 0.0028]	0.00009(0.00007) [-0.00025 - 0.00076]	-0.00006,0.00024	0.224
		LH YG	0.0020(0.00009) [0.0015 - 0.0027]	0.00001(0.00008) [-0.00085 - 0.00031]	-0.00014,0.00016	0.873
		LH RR/YG	0.0020(0.00009) [0.0015 - 0.0028]			
		LH RR	0.0020(0.00009) [0.0013 - 0.0025]	0.00003(0.00007) [-0.00074 - 0.00027]	-0.00011,0.00018	0.645
	Magnesium (% DW)	DK YG	0.12(0.0030) [0.099 - 0.13]	0.0043(0.0034) [-0.025 - 0.040]	-0.0026,0.011	0.217
		DK RR/YG	0.12(0.0030) [0.093 - 0.14]			
		DK RR	0.12(0.0030) [0.11 - 0.13]	-0.00084(0.0033) [-0.027 - 0.026]	-0.0074,0.0057	0.798
		LH YG	0.12(0.0030) [0.11 - 0.14]	-0.0064(0.0034) [-0.030 - 0.011]	-0.013,0.00042	0.065
		LH RR/YG	0.12(0.0030) [0.090 - 0.13]			
		LH RR	0.11(0.0030) [0.091 - 0.13]	0.0078(0.0033) [-0.0013 - 0.020]	0.0013,0.014	0.019

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Manganese (% DW)	DK YG	0.00052(0.00003) [0.00028 - 0.00083]	0.00001(0.00002) [-0.00007 - 0.00016]	-0.00003,0.00005	0.582
		DK RR/YG	0.00053(0.00003) [0.00031 - 0.00076]			
		DK RR	0.00054(0.00003) [0.00033 - 0.00068]	0(0.00002) [-0.00011 - 0.00014]	-0.00005,0.00004	0.787
		LH YG	0.00068(0.00003) [0.00045 - 0.00089]	-0.00016(0.00002) [-0.00030 - -0.00004]	-0.00020,-0.00012	<0.001
		LH RR/YG	0.00052(0.00003) [0.00028 - 0.00063]			
		LH RR	0.00047(0.00003) [0.00026 - 0.00058]	0.00005(0.00002) [-0.00007 - 0.00013]	0.00001,0.00000	0.013
	Phosphorus (% DW)	DK YG	0.32(0.0077) [0.29 - 0.34]	0.014(0.0087) [-0.060 - 0.092]	-0.0036,0.031	0.117
		DK RR/YG	0.33(0.0077) [0.27 - 0.38]			
		DK RR	0.31(0.0077) [0.29 - 0.37]	0.017(0.0083) [-0.034 - 0.080]	0.00011,0.033	0.048
		LH YG	0.34(0.0077) [0.29 - 0.39]	-0.0094(0.0087) [-0.078 - 0.047]	-0.027,0.0079	0.282
		LH RR/YG	0.33(0.0077) [0.28 - 0.38]			
		LH RR	0.32(0.0077) [0.26 - 0.41]	0.0083(0.0083) [-0.035 - 0.055]	-0.0083,0.025	0.322

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Mineral	Potassium (% DW)	DK YG	0.39(0.011) [0.36 - 0.47]	-0.00024(0.012) [-0.077 - 0.090]	-0.025,0.024	0.984
		DK RR/YG	0.39(0.011) [0.34 - 0.45]			
		DK RR	0.38(0.011) [0.34 - 0.52]	0.014(0.012) [-0.11 - 0.092]	-0.0097,0.038	0.239
		LH YG	0.37(0.011) [0.31 - 0.41]	-0.014(0.012) [-0.057 - 0.044]	-0.038,0.011	0.270
		LH RR/YG	0.35(0.011) [0.31 - 0.40]			
		LH RR	0.38(0.011) [0.33 - 0.57]	-0.025(0.012) [-0.18 - 0.041]	-0.049,-0.0011	0.040
	Zinc (% DW)	DK YG	0.0022(0.00013) [0.0016 - 0.0028]	0.00008(0.00007) [-0.00037 - 0.00060]	-0.00005,0.00022	0.220
		DK RR/YG	0.0022(0.00013) [0.0013 - 0.0031]			
		DK RR	0.0021(0.00013) [0.0014 - 0.0031]	0.00010(0.00007) [-0.00054 - 0.00056]	-0.00004,0.00024	0.144
		LH YG	0.0024(0.00013) [0.0017 - 0.0037]	0(0.00007) [-0.00029 - 0.00048]	-0.00014,0.00013	0.895
		LH RR/YG	0.0024(0.00013) [0.0015 - 0.0035]			
		LH RR	0.0023(0.00013) [0.0013 - 0.0034]	0.00009(0.00007) [-0.00013 - 0.00026]	-0.00004,0.00023	0.167

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscellaneous	Phytic Acid (% DW)	DK YG	0.82(0.041) [0.25 - 1.03]	0.11(0.049) [-0.14 - 0.72]	0.013,0.21	0.027
		DK RR/YG	0.93(0.041) [0.75 - 1.15]			
		DK RR	0.89(0.041) [0.66 - 1.39]	0.039(0.047) [-0.31 - 0.32]	-0.055,0.13	0.409
		LH YG	0.93(0.041) [0.78 - 1.19]	-0.030(0.049) [-0.26 - 0.16]	-0.13,0.069	0.551
		LH RR/YG	0.90(0.041) [0.72 - 1.11]			
		LH RR	0.88(0.041) [0.68 - 1.12]	0.017(0.047) [-0.17 - 0.20]	-0.076,0.11	0.711
	Trypsin Inhibitor (TIU/mg DW)	DK YG	5.10(0.26) [3.36 - 6.65]	-0.21(0.30) [-2.86 - 1.78]	-0.80,0.37	0.470
		DK RR/YG	4.88(0.26) [3.40 - 6.74]			
		DK RR	4.93(0.26) [3.96 - 6.81]	-0.048(0.30) [-2.22 - 1.09]	-0.64,0.54	0.870
		LH YG	5.14(0.26) [3.84 - 6.46]	0.044(0.30) [-1.36 - 2.14]	-0.54,0.63	0.881
		LH RR/YG	5.18(0.26) [4.46 - 7.05]			
		LH RR	4.76(0.26) [3.61 - 6.28]	0.42(0.30) [-1.37 - 2.27]	-0.17,1.01	0.158

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Miscellaneous	Vitamin E (mg/g DW)	DK YG	0.015(0.00050) [0.013 - 0.018]	-0.00000(0.00056) [-0.0032 - 0.0045]	-0.0012,0.0010	0.860
		DK RR/YG	0.015(0.00050) [0.011 - 0.018]			
		DK RR	0.013(0.00052) [0.011 - 0.016]	0.0016(0.00058) [-0.0018 - 0.0063]	0.00041,0.0027	0.008
		LH YG	0.0075(0.00050) [0.0060 - 0.010]	-0.00000(0.00056) [-0.0019 - 0.0014]	-0.0012,0.0010	0.864
		LH RR/YG	0.0074(0.00050) [0.0051 - 0.010]			
		LH RR	0.0068(0.00052) [0.0048 - 0.0095]	0.00059(0.00058) [-0.00070 - 0.0018]	-0.00056,0.0017	0.311
Proximate	Ash (% DW)	DK YG	1.40(0.047) [1.18 - 1.58]	-0.068(0.060) [-0.49 - 0.34]	-0.19,0.051	0.259
		DK RR/YG	1.33(0.047) [0.91 - 1.52]			
		DK RR	1.41(0.047) [1.26 - 1.58]	-0.080(0.060) [-0.58 - 0.18]	-0.20,0.039	0.184
		LH YG	1.37(0.047) [1.18 - 1.57]	0.010(0.060) [-0.46 - 0.23]	-0.11,0.13	0.866
		LH RR/YG	1.38(0.047) [1.06 - 1.55]			
		LH RR	1.37(0.047) [1.11 - 2.14]	0.011(0.060) [-1.04 - 0.42]	-0.11,0.13	0.848

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Carbohydrates (% DW)	DK YG	84.74(0.32) [83.08 - 86.89]	-0.53(0.33) [-2.10 - 0.45]	-1.19,0.12	0.109
		DK RR/YG	84.20(0.32) [82.50 - 85.55]			
		DK RR	84.38(0.32) [83.10 - 85.74]	-0.18(0.31) [-1.95 - 1.27]	-0.80,0.44	0.560
		LH YG	84.11(0.32) [80.89 - 85.78]	1.08(0.33) [-0.89 - 3.15]	0.43,1.74	0.001
		LH RR/YG	85.19(0.32) [83.75 - 87.86]			
		LH RR	86.10(0.32) [83.56 - 88.91]	-0.90(0.31) [-2.44 - 1.10]	-1.52,-0.29	0.004
	Moisture (% FW)	DK YG	11.77(0.67) [7.55 - 14.50]	0.20(0.43) [-2.04 - 4.60]	-0.65,1.05	0.642
		DK RR/YG	11.97(0.67) [7.20 - 18.40]			
		DK RR	10.63(0.67) [5.52 - 13.60]	1.34(0.41) [-1.35 - 6.20]	0.52,2.16	0.001
		LH YG	11.78(0.67) [7.72 - 14.70]	-0.21(0.43) [-2.28 - 1.23]	-1.07,0.64	0.624
		LH RR/YG	11.57(0.67) [7.49 - 14.70]			
		LH RR	10.58(0.67) [6.08 - 14.50]	0.99(0.41) [-0.30 - 4.82]	0.17,1.81	0.018

TABLE 8. COMBINED US/EU GRAIN: AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, PROXIMATE CONTENT AND STATISTICAL SUMMARY

CATEGORY	COMPONENT	LINE	MEAN (STD. ERROR) [RANGE]	RR or YG DIFF. from RR/YG MEAN (STD. ERROR) [RANGE]	95% CI	P-VALUE
Proximate	Protein (% DW)	DK YG	10.59(0.31) [8.58 - 13.02]	0.38(0.30) [-0.36 - 0.90]	-0.21,0.98	0.200
		DK RR/YG	10.97(0.31) [9.41 - 12.79]			
		DK RR	10.79(0.31) [9.39 - 11.98]	0.19(0.25) [-0.94 - 1.95]	-0.31,0.69	0.447
		LH YG	11.31(0.31) [9.44 - 14.85]	-0.76(0.30) [-3.97 - 1.12]	-1.36,-0.17	0.013
		LH RR/YG	10.55(0.31) [8.02 - 11.78]			
		LH RR	10.00(0.31) [7.61 - 12.32]	0.55(0.25) [-0.56 - 1.66]	0.057,1.05	0.029
	Total Fat (% DW)	DK YG	3.28(0.11) [2.41 - 3.78]	0.22(0.15) [-0.91 - 1.69]	-0.094,0.52	0.168
		DK RR/YG	3.49(0.11) [2.45 - 4.18]			
		DK RR	3.42(0.11) [2.77 - 3.99]	0.071(0.14) [-0.87 - 1.05]	-0.21,0.35	0.618
		LH YG	3.21(0.11) [2.75 - 3.80]	-0.33(0.15) [-0.99 - 0.90]	-0.64,-0.024	0.035
		LH RR/YG	2.87(0.11) [2.26 - 3.65]			
		LH RR	2.54(0.11) [1.11 - 3.11]	0.34(0.14) [-0.36 - 1.15]	0.056,0.62	0.019

TABLE 9. SUMMARY OF ANALYTES WITH AT LEAST ONE SIGNIFICANT COMPARISON (P<0.05)

				P-VALUES					
				DK RR/YG vs.			LH RR/YG vs.		
COUNTRY	TISSUE	CATEGORY	COMPONENT	DK RR	DK YG	SAME SIGN	LH RR	LH YG	SAME SIGN
US	Forage	Fiber	Acid Detergent Fiber	0.641	0.027		0.796	0.411	
			Neutral Detergent Fiber	0.236	0.011		0.528	0.684	
		Proximate	Ash	0.803	0.713		0.159	0.015	
	Grain	Amino Acid	alanine	0.903	0.727		0.585	0.003	
			glycine	0.351	0.880		0.296	0.023	
			histidine	0.959	0.351		0.515	0.011	
			proline	0.230	0.676		0.042	0.020	*
		Fatty Acid	16:0 palmitic	0.035	0.803		0.743	0.038	
			18:0 stearic	0.051	<0.001		0.534	0.463	
			18:3 linolenic	0.116	0.001		0.264	0.292	
			20:0 arachidic	0.801	0.109		0.846	0.033	
			22:0 behenic	0.836	0.043		0.001	0.018	*
		Mineral	Calcium	0.007	0.664		0.505	0.003	
			Copper	0.079	0.745		0.015	0.726	
			Magnesium	0.548	0.133		0.105	0.037	
			Manganese	0.657	0.513		0.049	<0.001	
			Phosphorus	0.046	0.050		0.380	0.156	
			Potassium	0.046	0.170		0.048	0.349	
			Zinc	0.016	0.015	*	0.068	0.748	
		Miscellaneous	Phytic Acid	0.428	0.033		0.953	0.443	
			Vitamin E	<0.001	0.905		0.638	0.934	
		Proximate	Ash	0.028	0.055		0.889	0.677	
			Carbohydrates	0.980	0.317		0.068	<0.001	
			Protein	0.900	0.758		0.114	0.001	
EU	Forage	Fiber	Neutral Detergent Fiber	0.962	0.263		0.020	0.520	
		Proximate	Moisture	0.027	0.574		0.222	0.646	
	Grain	Amino Acid	aspartic acid	0.881	0.167		0.034	0.168	
			glycine	0.284	0.841		0.036	0.983	
			isoleucine	0.032	0.183		0.281	0.992	

TABLE 9. SUMMARY OF ANALYTES WITH AT LEAST ONE SIGNIFICANT COMPARISON (P<0.05)

				P-VALUES					
				DK RR/YG vs.			LH RR/YG vs.		
COUNTRY	TISSUE	CATEGORY	COMPONENT	DK RR	DK YG	SAME SIGN	LH RR	LH YG	SAME SIGN
EU	Grain	Amino Acid	leucine	0.441	0.444		0.047	0.687	
			phenylalanine	0.836	0.854		0.028	0.292	
		Fatty Acid	16:0 palmitic	0.039	0.549		0.244	0.125	
			18:0 stearic	0.027	<0.001		0.146	0.566	
			20:0 arachidic	0.035	0.088		0.012	0.006	*
			20:1 eicosenoic	0.012	0.448		<0.001	0.035	*
			22:0 behenic	0.485	0.635		0.426	0.010	
		Mineral	Calcium	0.417	0.586		0.790	<0.001	
			Manganese	0.957	0.926		0.150	<0.001	
		Proximate	Carbohydrates	0.432	0.175		0.028	0.342	
			Moisture	0.001	0.544		0.011	0.846	
			Total Fat	0.962	0.731		0.025	0.036	
COMBINED	Forage	Fiber	Neutral Detergent Fiber	0.538	0.019		0.106	0.492	
		Proximate	Ash	0.616	0.204		0.302	0.035	
			Moisture	0.026	0.393		0.115	0.328	
	Grain	Amino Acid	alanine	0.779	0.171		0.214	0.007	
			aspartic acid	0.992	0.183		0.004	0.205	
			glycine	0.162	0.805		0.022	0.095	
			leucine	0.421	0.486		0.036	0.407	
			lysine	0.473	0.374		0.031	0.093	
			proline	0.869	0.155		0.043	0.077	
		Fatty Acid	16:0 palmitic	0.005	0.506		0.248	0.008	
			18:0 stearic	0.003	<0.001		0.153	0.354	
			18:3 linolenic	0.757	0.011		0.178	0.965	
			20:0 arachidic	0.186	0.025		0.242	0.001	
			20:1 eicosenoic	0.091	0.704		0.013	0.030	*
			22:0 behenic	0.710	0.337		0.005	0.001	*
		Mineral	Calcium	0.030	0.842		0.888	<0.001	
			Copper	0.163	0.217		0.003	0.944	
			Magnesium	0.798	0.217		0.019	0.065	

TABLE 9. SUMMARY OF ANALYTES WITH AT LEAST ONE SIGNIFICANT COMPARISON (P<0.05)

				P-VALUES					
				DK RR/YG vs.			LH RR/YG vs.		
COUNTRY	TISSUE	CATEGORY	COMPONENT	DK RR	DK YG	SAME SIGN	LH RR	LH YG	SAME SIGN
COMBINED	Grain	Mineral	Manganese	0.787	0.582		0.013	<0.001	
			Phosphorus	0.048	0.117		0.322	0.282	
			Potassium	0.239	0.984		0.040	0.270	
		Miscellaneous	Phytic Acid	0.409	0.027		0.711	0.551	
			Vitamin E	0.008	0.860		0.311	0.864	
		Proximate	Carbohydrates	0.560	0.109		0.004	0.001	
			Moisture	0.001	0.642		0.018	0.624	
			Protein	0.447	0.200		0.029	0.013	
			Total Fat	0.618	0.168		0.019	0.035	

TABLE 10. FIBER AND PROXIMATE RANGES IN FORAGE FOR NON-TRANSGENIC CONTROL AND COMMERCIAL LINES

CATEGORY	COMPONENT	NON-TRANSGENIC RANGES		
		US	EU	COMBINED
Fiber	Acid Detergent Fiber (% DW)	[22.43 - 34.21]	[17.61 - 34.48]	[17.61 - 34.48]
	Neutral Detergent Fiber (% DW)	[35.69 - 50.72]	[29.60 - 46.57]	[29.60 - 50.72]
Proximate	Ash (% DW)	[3.64 - 6.01]	[2.03 - 7.49]	[2.03 - 7.49]
	Carbohydrates (% DW)	[81.73 - 87.17]	[81.54 - 88.92]	[81.54 - 88.92]
	Moisture (% FW)	[60.80 - 74.70]	[47.00 - 78.80]	[47.00 - 78.80]
	Protein (% DW)	[6.45 - 11.03]	[4.93 - 10.40]	[4.93 - 11.03]
	Total Fat (% DW)	[1.54 - 3.58]	[0.79 - 3.64]	[0.79 - 3.64]

TABLE 11. AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, AND PROXIMATE RANGES IN GRAIN FOR NON-TRANSGENIC CONTROL AND COMMERCIAL LINES

CATEGORY	COMPONENT	NON-TRANSGENIC RANGES		
		US	EU	COMBINED
Amino Acid	alanine (% Total AA)	[7.06 - 7.93]	[7.31 - 8.19]	[7.06 - 8.19]
	arginine (% Total AA)	[3.98 - 5.17]	[4.00 - 5.48]	[3.98 - 5.48]
	aspartic acid (% Total AA)	[6.28 - 7.36]	[6.39 - 7.32]	[6.28 - 7.36]
	cystine (% Total AA)	[1.95 - 2.56]	[1.76 - 2.94]	[1.76 - 2.94]
	glutamic acid (% Total AA)	[17.41 - 19.91]	[17.94 - 20.10]	[17.41 - 20.10]
	glycine (% Total AA)	[3.37 - 4.62]	[3.37 - 4.61]	[3.37 - 4.62]
	histidine (% Total AA)	[2.66 - 3.30]	[2.58 - 3.35]	[2.58 - 3.35]
	isoleucine (% Total AA)	[3.40 - 4.02]	[2.95 - 4.08]	[2.95 - 4.08]
	leucine (% Total AA)	[11.33 - 14.04]	[12.00 - 14.42]	[11.33 - 14.42]
	lysine (% Total AA)	[2.67 - 3.85]	[2.63 - 3.83]	[2.63 - 3.85]
	methionine (% Total AA)	[1.76 - 2.48]	[1.61 - 2.89]	[1.61 - 2.89]
	phenylalanine (% Total AA)	[4.83 - 5.29]	[4.73 - 5.46]	[4.73 - 5.46]
	proline (% Total AA)	[8.25 - 9.90]	[8.03 - 9.48]	[8.03 - 9.90]
	serine (% Total AA)	[3.45 - 5.08]	[3.62 - 5.54]	[3.45 - 5.54]
	threonine (% Total AA)	[3.14 - 3.84]	[3.05 - 4.01]	[3.05 - 4.01]
	tryptophan (% Total AA)	[0.48 - 0.79]	[0.44 - 0.72]	[0.44 - 0.79]
	tyrosine (% Total AA)	[2.14 - 3.85]	[2.51 - 4.03]	[2.14 - 4.03]
	valine (% Total AA)	[4.58 - 5.46]	[3.94 - 5.37]	[3.94 - 5.46]
Fatty Acid	16:0 palmitic (% Total FA)	[8.92 - 13.82]	[8.79 - 10.72]	[8.79 - 13.82]

TABLE 11. AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, AND PROXIMATE RANGES IN GRAIN FOR NON-TRANSGENIC CONTROL AND COMMERCIAL LINES

CATEGORY	COMPONENT	NON-TRANSGENIC RANGES		
		US	EU	COMBINED
Fatty Acid	18:0 stearic (% Total FA)	[1.58 - 2.61]	[1.41 - 2.13]	[1.41 - 2.61]
	18:1 oleic (% Total FA)	[22.72 - 37.74]	[20.68 - 32.52]	[20.68 - 37.74]
	18:2 linoleic (% Total FA)	[48.04 - 63.78]	[53.82 - 66.07]	[48.04 - 66.07]
	18:3 linolenic (% Total FA)	[0.85 - 1.45]	[0.86 - 1.31]	[0.85 - 1.45]
	20:0 arachidic (% Total FA)	[0.38 - 0.56]	[0.32 - 0.46]	[0.32 - 0.56]
	20:1 eicosenoic (% Total FA)	[0.26 - 0.44]	[0.15 - 0.36]	[0.15 - 0.44]
	22:0 behenic (% Total FA)	[0.094 - 0.30]	[0.075 - 0.23]	[0.075 - 0.30]
Fiber	Acid Detergent Fiber (% DW)	[2.33 - 4.82]	[3.51 - 5.65]	[2.33 - 5.65]
	Neutral Detergent Fiber (% DW)	[8.19 - 15.13]	[9.59 - 16.08]	[8.19 - 16.08]
Mineral	Calcium (% DW)	[0.0035 - 0.0086]	[0.0026 - 0.0084]	[0.0026 - 0.0086]
	Copper (% DW)	[0.00012 - 0.00027]	[0.00009 - 0.00028]	[0.00009 - 0.00028]
	Iron (% DW)	[0.0011 - 0.0049]	[0.0014 - 0.0027]	[0.0011 - 0.0049]
	Magnesium (% DW)	[0.087 - 0.13]	[0.082 - 0.16]	[0.082 - 0.16]
	Manganese (% DW)	[0.00026 - 0.00075]	[0.00040 - 0.00078]	[0.00026 - 0.00078]
	Phosphorus (% DW)	[0.24 - 0.38]	[0.24 - 0.43]	[0.24 - 0.43]
	Potassium (% DW)	[0.32 - 0.48]	[0.29 - 0.53]	[0.29 - 0.53]
	Zinc (% DW)	[0.0015 - 0.0028]	[0.0015 - 0.0033]	[0.0015 - 0.0033]
Miscellaneous	Phytic Acid (% DW)	[0.55 - 1.28]	[0.53 - 1.29]	[0.53 - 1.29]

TABLE 11. AMINO ACID, FATTY ACID, FIBER, MINERAL, PHYTIC ACID, TRYPSIN INHIBITOR, VITAMIN E, AND PROXIMATE RANGES IN GRAIN FOR NON-TRANSGENIC CONTROL AND COMMERCIAL LINES

		NON-TRANSGENIC RANGES		
CATEGORY	COMPONENT	US	EU	COMBINED
Miscellaneous	Trypsin Inhibitor (TIU/mg DW)	[3.64 - 7.18]	[3.40 - 6.89]	[3.40 - 7.18]
	Vitamin E (mg/g DW)	[0.0059 - 0.022]	[0.0055 - 0.021]	[0.0055 - 0.022]
Proximate	Ash (% DW)	[0.81 - 1.60]	[0.99 - 1.82]	[0.81 - 1.82]
	Carbohydrates (% DW)	[83.40 - 89.59]	[83.12 - 88.88]	[83.12 - 89.59]
	Moisture (% FW)	[8.37 - 14.80]	[6.07 - 15.60]	[6.07 - 15.60]
	Protein (% DW)	[6.67 - 13.41]	[7.62 - 12.09]	[6.67 - 13.41]
	Total Fat (% DW)	[1.88 - 4.31]	[1.74 - 3.42]	[1.74 - 4.31]

Table 12. Literature and Reported Ranges for Components in Maize Forage and Grain

Tissue	Component[a]	Literature[b] Range (%)	Reported[c] Range (%)
Forage	*Proximates/Fiber*		
	Acid detergent fiber	not reported	21.4-29.2
	Ash	not reported	2.9-5.1
	Carbohydrates	not reported	84.6-89.1
	Moisture	not reported	68.7-73.5
	Neutral detergent fiber	not reported	39.9-46.6
	Total fat	not reported	1.4-2.1
	Protein	not reported	4.8-8.4
Grain	*Amino acids*		
	Alanine	6.4-9.9	7.3-8.8
	Arginine	2.9-5.9	3.6-5.0
	Aspartic Acid	5.8-7.2	6.3-7.5
	Cystine	1.2-1.6	1.8-2.7
	Glutamic Acid	12.4-19.6	19.5-22.8
	Glycine	2.6-4.7	3.2-4.2
	Histidine	2.0-2.8	2.8-3.3
	Isoleucine	2.6-4.0	3.2-4.3
	Leucine	7.8-15.2	12.6-15.8
	Lysine	2.0-3.8	2.6-3.5
	Methionine	1.0-2.1	1.3-2.6
	Phenylalanine	2.9-5.7	5.0-6.1
	Proline	6.6-10.3	8.7-10.1
	Serine	4.2-5.5	4.9-6.0
	Threonine	2.9-3.9	3.3-4.2
	Tryptophan	0.5-1.2	0.4-1.0
	Tyrosine	2.9-4.7	3.7-4.3
	Valine	2.1-5.2	4.2-5.3
	Fatty acids		
	16:0 Palmitic acid	7-19	9.9-12.0
	18:0 Stearic acid	1-3	1.4-2.2
	18:1 Oleic acid	20-46	20.6-27.5
	18:2 Linoleic acid	35-70	55.9-66.1
	18:3 Linolenic acid	0.8-2	0.8-1.1
	20:0 Arachidic acid	0.1-2	0.3-0.5
	20:1 Eicosenoic acid	not reported	0.2-0.3
	22:0 Behenic acid	not reported	0.1-0.3

Table 12. Literature and Reported Ranges for Components in Maize Forage and Grain (continued)

Tissue	Component[a]	Literature[b] Range (%)	Reported[c] Range (%)
Grain	*Proximates/Fiber*		
	Acid detergent fiber	3.3-4.3	3.1-5.3
	Ash	1.1-3.9	1.2-1.8
	Carbohydrates	not reported	not reported
	Moisture	7-23	9.4-15.8
	Neutral detergent fiber	8.3-11.9	9.6-15.3
	Total fat	3.1-5.7 2.9-6.1	2.4-4.2
	Protein	6.0-12.0 9.7-16.1	9.0-13.6
	Minerals		
	Calcium	0.01-0.1	0.003-0.006
	Copper	0.00009-0.001	not reported
	Iron	0.0001-0.01	not reported
	Magnesium	0.09-1.0	not reported
	Manganese	0.00007-0.0054	not reported
	Phosphorous	0.26-0.75	0.311-0.363
	Potassium	0.32-0.72	not reported
	Zinc	0.0012-0.003	not reported
	Phytic acid	up to 0.9%	not reported
	Trypsin inhibitor	not reported	not reported
	Vitamin E	0.017-0.047	0.008-0.012

[a]Units of all components as % dry wt. except: moisture as % fresh wt., amino acids as % total amino acids, fatty acids as % total fatty acids, trypsin inhibitor as trypsin inhibitor units/mg dry wt; and vitamin E as mg/g dry wt.

[b]Literature references as follows: amino acids, fatty acids (Watson, 1982); ADF, Ash, Moisture, NDF, Minerals, Vitamin E and phytic acid (Watson, 1987); protein and fat first values (Watson, 1987); protein and fat second values (Jugenheimer, 1976).

[c]Reported range references as follows: ADF, NDF and proximates in forage (Sanders *et al.*, 1996b; 1997a); amino acids, fatty acids and proximates in grain (Sanders and Patzer, 1995; Sanders *et al.*, 1996a,b; 1997a,b); ADF and NDF in grain (Sanders *et al.*, 1996b; 1997a,b); calcium, phosphorous and vitamin E in grain (Sanders and Patzer, 1995; Sanders *et al.*, 1996a; 1997b).

Attachment 1

Protocol and Protocol Amendment

Monsanto Study No: 99-01-50-01
Covance Study No: 6103-224

Study Title: Expression and Compositional Analyses of Tissues Collected from Insect-Protected and Roundup™ Tolerant Corn Lines (MON 810 x GA21) Grown in 1998 U.S. and E.U. Field Trials

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1.0 Purpose

The purpose of this study is to conduct expression and compositional analyses of tissues collected from two Insect-Protected (IP) and Roundup tolerant (or Roundup Ready®, RR) corn hybrid test lines developed by crossing the genetically-modified, single-trait parental lines by traditional breeding methods. Each test line contains genes that encode the expression of 1) the Cry1Ab protein from *Bacillus thuringiensis* subsp, *kurstaki* HD-1 which confers resistance to the European Corn Borer (ECB) and other lepidopteran insects, and 2) the modified maize 5-enolpyruvylyshikimate-3-phosphate synthase (mEPSPS) protein which confers tolerance to Roundup™ herbicide. The study also includes the analyses of genetically modified, parental IP corn reference lines derived from MON 810 and genetically modified, parental RR corn reference lines derived from GA21. Also included are unmodified control lines that have background genetics representative of the reference and test lines but do not express either the mEPSPS or the Cry1Ab protein.

2.0 Timelines

2.1 Proposed experimental start date: February, 1999

2.2 Proposed experimental termination date: April, 1999

3.0 Experimental design

3.1 Test, Control and Reference Substances

3.1.1 Test Substances

The test substances are the two IP/RR corn hybrid lines, DK591 RR/BTY and HC35RR1 x LH172Bt810, grown in 1998 U.S. (Production Plan 98-01-50-01) and E.U. (Study Plan 98-BTRR-01-It/Sp) field trials (see Appendix 1 for listing of field sites).

Any of the test hybrids may be deleted at any time during this study. The deletion and reason(s) for the deletion will be documented by amendment to the study protocol.

3.1.2 Control Substances

The control substances are the two non-transgenic corn hybrids, DK591 and LH198 x LH172, planted in the 1998 U.S. and E.U. field trials.

3.1.3 Reference Substances

The reference substances are the four genetically-modified, single-trait parental lines grown in U.S. and E.U. field trials used to produce the two test lines:

Single Trait Event	Single Trait Parental Reference Line	Combined Trait Test Line
GA21	DK591RR	DK591RR/BTY
MON 810	DK591BTY	-
GA21	HC35RR1 x LH172	HC35RR1 x LH172Bt810
MON 810	LH198 x LH172Bt810Sel2	-

Appropriate standards will be used in each assay (or analytical method) as reference standards for the analytical procedures or calibration of equipment. Commercial corn hybrids purchased from local growers in the U.S. will also be considered reference substances for the purposes of this study (Appendix 1).

3.2 Test, Control and Reference Substance (T/C/R) Characterization

For 1998 U.S. field trial samples, protein expression data in combination with chain-of-custody documentation will be used to verify the identity of the T/C/R substances. For 1998 E.U. field trial samples, protein expression data generated at Louvain-La-Neuve (LLN) under Study Plan 98-GMO-06, chain-of-custody documentation and GeneCheck™ or ELISA for the Cry1Ab protein may be used to verify the identity of T/C/R substances. If necessary, other tests such as polymerase chain reaction (PCR) assay and Roundup tolerance tests may be used to further confirm the identity of T/C/R substances.

3.3 Test System

There is no test system for this study which uses analytical methods to characterize the test hybrids. Validated Enzyme-Linked ImmunoSorbent Assays (ELISAs) will be performed to estimate the levels of Cry1Ab and mEPSPS proteins in tissue samples. Compositional analysis methods are validated assays which are currently used to evaluate nutritional parameters in corn products for commercial purposes.

3.4 Justification of Test System

There is no test system.

3.5 Procedure for Identification of Test System

There is no test system. The analytical methods to be used for the analysis of tissue samples are documented as Standard Operating Procedures (SOPs) or equivalent.

3.6 Description of Experimental Design

Leaf, forage and grain samples of the corn hybrids were collected at each of the six field sites as detailed in U.S. Production Plan 98-01-50-01 and at each of seven European field sites as detailed in Study Plan 98-BTRR-01-

It/Sp. E.U. forage samples were processed at LLN and shipped on dry ice to St. Louis. All other samples were processed in St. Louis according to SOPs BtM-PRO-067-01 and ES-93-ESOP-047-1 and stored at approximately -20°C or -80°C. Subsamples to be analyzed will be identified in worksheets and/or sample transfer forms (for Covance). Leaf samples will not be analyzed. Not all analyses will necessarily be performed on all samples from all lines.

3.7 Proposed Statistical Methods

The mean and range of the expression levels of the Cry1Ab and mEPSPS proteins (µg/g fresh tissue) in tissues collected from the test and reference lines grown in U.S. field trials (Production Plan 98-01-50-01) will be reported along with a standard deviation for that mean.

Statistical analysis of the composition data will be performed at Monsanto using established methods. Means and ranges will be computed across sites for each component analyzed. Mean component values of test and reference lines will be compared by appropriate methods in order to determine substantial equivalence.

3.8 Control of Bias

The T/C/R substances were produced under the same agronomic conditions at each site within each continent. The samples will be analyzed by site and the order of lines will be randomized to minimize assay bias. The samples will be analyzed, when appropriate, in the order designated on the Sample Transfer Form.

4.0 Protein Expression and Compositional Analyses

4.1 Protein Expression Analytical Methods at Monsanto

Extraction followed by ELISA will be used to determine the levels of Cry1Ab and mEPSPS proteins in forage and grain samples according to current versions of Standard Operating Procedures (SOPs) BR-ME-0093 and BR-ME-0026, respectively. Only samples produced in 1998 U.S. field trials (Production Plan 98-01-50-01) will be analyzed for protein expression under this protocol; samples produced in 1998 E.U. field trials (Study Plan 98-BTRR-01-F/It) will be analyzed separately at LLN under Study Plan 98-GMO-06.

4.2 Compositional Analyses at Covance

Processed forage and grain subsamples will be shipped on dry ice to Covance by overnight delivery. These samples will be labeled with the field study number, tissue type and a unique sample identifier. Samples

will be stored at approximately -20°C until analyzed. Covance may perform additional processing as necessary.

The following analyses will be performed on *forage* samples: proximates [moisture (M100), protein (PGEN), fat (FAAH), ash (ASHM)], acid detergent fiber (ADF) and neutral detergent fiber (NDFE). Carbohydrate (CHO) values will be estimated by calculation.

The following analyses will be performed on *grain* samples: proximates [moisture (M100), protein (PGEN), fat (FSOX), ash (ASHM)], acid detergent fiber (ADF), neutral detergent fiber (NDFE), amino acid composition (TAAP), fatty acid profile (FAPM), calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium, zinc (ICPL), phytic acid (VCXX) and trypsin inhibitor (MIXX). Carbohydrate (CHO) values will be estimated by calculation.

Any additional ELISA or compositional analyses or re-analyses will be documented and justified in the raw data file. Appropriate standards will be used in each assay as reference standards for the analytical procedures or calibration of equipment.

5.0 Records to be Maintained

5.1 Monsanto Facility

All Monsanto raw data including ELISA worksheets, computer printouts, and processing/extraction worksheets shall be archived at Monsanto upon completion of the study.

Records will be retained of all sample transfers, analysis, the protocol and all deviations and amendments thereto, and copies of all letters, memoranda, and other correspondence related to this study. Excess samples will be retained until notified of final disposition by the Sponsor.

5.2 Covance Facility

Original data or copies will be available at Covance to facilitate auditing the study during its progress and before acceptance of the final subreport. When the final subreport is completed, original study documentation, such as: paper data, computer printouts, chromatograms, worksheets, data sheets, notes by investigators, forms specified by SOP and magnetically encoded records, will be retained in the archives of Covance in accordance with 40 CFR Part 160.

Supporting facility records will be retained at Covance but will not be archived with the study data: refrigerator and freezer temperature records, instrument calibration and maintenance records.

5.3 Covance Final Subreport

A quality control checked and Quality Assurance accepted analytical subreport generated by the Covance Principal Investigator will be submitted to the Monsanto Study Director to be used in preparation of the final report. This will include a Quality Assurance accepted spreadsheet that summarizes the analytical results for each sample. A final subreport including a data summary spreadsheet, reference standards (where applicable) for each assay and Method Summaries will be submitted to the Study Director. The raw data and final subreport will be audited by the Quality Assurance Unit of Covance in accordance with Covance SOPs. One copy of the draft report and two copies of the final subreport will be provided.

6.0 Study Conduct Statement

6.1 Monsanto Facility

This study shall be conducted in accordance with the protocol. Any change, revision, or deviation from this protocol should be documented promptly according to the current version of SOP #GEN-POL-005 and communicated to the Study Director as soon as possible. All data and information will be recorded directly and promptly in indelible ink. The exceptions are electronically captured data, for which a printout will be generated and included with other study data. All entries will be dated on the day of entry and signed or initialed by the person entering the information. Computer printouts will be signed and dated by the person responsible for their generation. All data sheets must contain the Study number. Any change in entries will be made so as not to obscure the original entry, must indicate the reason for the change and must be dated and signed (or initialed) at the time of the change.

6.2 Covance

This experiment shall be conducted in accordance with the protocol and Covance SOPs. Any change, revision, or deviation from this protocol shall be documented promptly and communicated to the Study Director immediately. Covance Quality Assurance Unit will monitor the study conduct and audit the final subreport.

7.0 Confidentiality

No raw data, worksheets or other information summaries, reports, or other information related to this study may be revealed or released to any third party without prior notification and authorization of Monsanto.

8.0 GLP Compliance

This experiment will be conducted in compliance with the United States EPA FIFRA Good Laboratory Practice Regulations (40 CFR Part 160).

APPENDIX I

U.S. Field Sites (Production Plan 98-01-50-01)

Site Code	City	County	State
IA1	Webster City	Hamilton	Iowa
IA2	Bagley	Guthrie*	Iowa
IL1	Carlyle	Clinton	Illinois
IL2	Edwardsville	Jersey	Illinois
NE	York	York	Nebraska
IN	Noblesville	Hamilton	Indiana

*misidentified as Greene county in the Production Plan

E.U. (Study Plan 98-BTRR-01-It/Sp)

Site No.	City	Country
1	Fontellas	Spain
2	Castil de Vela	Spain
3	Sarinena	Spain
4	Sevilla	Spain
5	Paderno	Italy
6	Caorso	Italy
7	Bagnarola	Italy

U.S. Reference Commercial Hybrids

Site	Variety	Forage	Grain
IA1	Croplan 561	√	√
	Croplan 534	√	√
IA2	DK561SR	√	√
	Cargill 7800SR	√	√
IL1	Garst 8481IT	-	√
	Burris BX86AT	-	√
	Pioneer 3394	-	√
IL2	Pioneer 33V08	√	-
	Pioneer 32K61	√	-
	Garst 8541IT	√	-
NE	Pioneer 3394	√	√
	Pioneer 3374	√	√
IN	Pioneer 3394	√	√
	Pioneer 33A14	√	√

Monsanto Company Biotechnology Regulatory Sciences	SOP/Protocol Amendment Form SOP Ref.: GEN-POL-005

Study #/SOP#: 99-01-50-01 **Amendment #:** 1

Date Change Implemented: 22 March 1999

Page No/s. &/or Section/s: Page 6, Section 4.2

Protocol/SOP originally stated: The following analyses will be performed on *grain* samples: proximates....phytic acid (VCXX) and trypsin inhibitor (MIXX).

Amended as Follows: The following analyses will be performed on *grain* samples: proximates....phytic acid (VCXX), vitamin E (EFD2) and trypsin inhibitor (MIXX).

Reason for Amendment and what impact will result from this change: To add vitamin E to the list of components to be analyzed in grain. Additional composition data on grain samples will result from this change.

Signatures of Approval

Study Director:

Ravinder S Sidhu **Date:** 23 March 99

Sponsor/Testing Facilities Management Representative:

Date: 3/23/99

Signatures of Acknowledgment

Tammy Olson **Date:** 3/29/99

_____ **Date:** _____

_____ **Date:** _____