

References

- Beever, D.E. 2006. "The impact of controlled nutrition during the dry period on dairy cow health, fertility and performance." *Anim Reprod.Sci.* 96:212-226.
Abstract: Average dairy herd fertility is declining, with more serves per successful conception, extended calving intervals and increased culling due to failure to rebreed, all adding significant costs to milk production. Genetics, management and nutrition have all contributed to this decline in fertility; the paper focuses primarily on nutritional issues. The extent of body condition loss after calving and its possible impact on fertility is considered, with evidence that this phenomenon is common in many herds irrespective of average milk yields. Body tissue mobilisation after calving increases the flux of non-esterified fatty acids to the liver and pathways of fatty acid metabolism are considered. Particular attention is given to the effects of high plasma non-esterified fatty acid levels on fat accumulation in liver cells and possible impacts on nitrogen and glucose metabolism. Current nutritional practices with early lactation cows which aim to stimulate milk yield and peak milk production but have been shown to exacerbate body condition loss, are reviewed. The paper also considers cow health issues during the peri-parturient period and how these may affect milk yield and fertility. It is concluded that current feeding practices for dry cows, with the provision of increasing amounts of the lactation ration during the Close-up period to accustom the rumen microbes and offset the expected reduction in feed intake as pregnancy reaches term, have largely failed to overcome peri-parturient health problems, excessive body condition loss after calving or declining fertility. From an examination of the energy and protein requirements of dry cows, it is suggested that current Close-up feeding practices can lead to luxury intakes of nutrients that can increase fat deposition in the viscera and the liver. Under such conditions, metabolism of nutrients by the cow may be compromised. In contrast, limited feeding throughout the whole dry period has been shown to prevent many of the problems which can affect peri-parturient cows. A new feeding strategy based on a low energy: high fibre ration (9MJ metabolisable energy and 130g crude protein/kg ration dry matter) containing high levels of chopped straw and offered ad libitum as a total mixed ration throughout the whole dry period is proposed. The performance of 32 dairy farms in France where this strategy has been adopted for at least 3 years is provided, with positive outcomes now being obtained by UK and Irish dairy farmers. Independent US research evidence has confirmed some of these benefits whilst limited data on cow fertility is presented. It is hypothesised that luxury feeding during the dry period can cause cows to become insulin resistant leading to an increased risk of type II diabetes. Such cows are likely to have poorer fertility whilst possible mechanisms which increase the risk of peri-parturient health problems are discussed. Further research to understand the mechanisms of these effects is required and is currently ongoing. However the magnitude of the effects noted on an increasing number of dairy farms suggests this approach to feeding the dry cow is capable of bringing real benefits to many dairy herds in terms of fewer health problems, reduced body condition loss and improved fertility
- Butler, W.R. 2000. "Nutritional interactions with reproductive performance in dairy cattle." *Anim Reprod.Sci.* 60-61:449-457.
Abstract: Increased capability for milk production has been associated with a decline in fertility of lactating cows. Nutritional requirements increase rapidly with milk production after calving and result in negative energy balance (NEBAL). NEBAL delays the time of first ovulation through inhibition of LH pulse frequency and low levels of blood glucose, insulin and insulin-like growth factor-I (IGF-I) that collectively restrain estrogen production by dominant follicles. Up-regulation of LH pulses and peripheral IGF-I in association with the NEBAL nadir facilitates ovulation. NEBAL reduces serum progesterone concentrations and fertility. Diets high in crude protein support high milk yield, but are also associated with lower reproductive performance. High protein can result in elevated plasma urea concentrations that affect the uterine environment and

fertility. Nutritional interactions resulting in poor fertility of high producing dairy cows include the antecedent effects of NEBAL and effects of high dietary protein

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Abstract: Three chick experiments and two cecectomized rooster experiments were conducted to determine P bioavailability and amino acid (AA) digestibility in two low phytate corns (LP), a high protein corn (HP), and a corn containing both low phytate and high protein content (HP/LP) compared with conventional corn (CONV). From 8 to 20 or 21 d of age, 1-wk-old New Hampshire x Columbian chicks were fed a cornstarch-dextrose-soybean meal (SBM) basal diet containing 0.10% available P or the basal diet supplemented with two concentrations of P (0.05 or 0.06% and 0.10 or 0.12%) from KH₂PO₄ or two concentrations of the corns (20 or 21% and 40 or 42%). Bioavailability of P based on tibia bone ash was much higher for LP than for CONV; values ranged from 21 to 40% for CONV and from 59 to 95% for LP. Digestibility of AA in cecectomized roosters indicated no significant differences ($P > 0.05$) between CONV and HP in the first rooster experiment. Digestibilities of eight AA, including lysine, methionine, and arginine, in LP and HP/LP were higher ($P < 0.05$) than those in CONV in the second rooster experiment. The results of this study indicated that the P in LP was two to three times more bioavailable than the P in CONV and that the digestibilities of AA in HP/LP were equal to or higher than those in CONV
- Hussain, I., M.A. Khan, and E.A. Khan. 2006. "Bread wheat varieties as influenced by different nitrogen levels." *J. Zhejiang Univ. Sci. B.* 7:70-78.
Abstract: Experiment was conducted to determine the effect of different nitrogen levels on four bread wheat varieties (*Triticum aestivum* L.) viz. Inqilab-91, Daman-98, Dera-98 and Punjab-96 at Gomal University, Dera Ismail Khan (NWFP), Pakistan during 2000 approximately 2001. The experiment was laid out in split plot design having four replications using a net plot size of 2 m x 5 m. Nitrogen doses used were 0, 50, 100, 150 and 200 kg/ha. The results showed that different nitrogen levels had significant effects on plant height, total number of plants/m², number of grains/spike, number of spike m², spike weight, biological yield, grain yield and grain protein content. Maximum plant height, total number of plants/m², number of spikes/m², spike weight, biological yield and grain protein content were observed at 200 kg N/ha. Among wheat varieties Daman-98 had maximum plant height, spike weight, grains/spike, 1000-grain weight, biological yield and grain yield. Inqilab-91 had heavier grains and the most grain protein content, while Dera-98 had the maximum plant population and spikes/m². Grain yield and biological yield were statistically similar at doses of 150 kg N/ha and 200 kg N/ha. However, dose of 200 kg N/ha, compared to dose of 150 Kg N/ha, significantly increased the protein content
- Johnson, V.A. and P.J. Mattern. 1978. "Improvement of wheat protein quality and quantity by breeding." *Adv. Exp. Med. Biol.* 105:301-316.
Abstract: Substantial genetic variability for grain protein content in wheat has been identified. In appropriate combinations known genes can increase protein content of wheat grain by 5 percentage points. Productive high protein experimental lines with good agronomic traits and satisfactory processing attributes have been identified. A high protein hard red winter variety developed in Nebraska was released for commercial production in 1975 under the name "Lancota". The high protein of Lancota resides entirely in the starchy endosperm portion of the kernel and is fully transmissible to white milled flour. The high protein of Lancota results from elevated NO₃ reductase activity, increased N-absorption by the roots, and more complete translocation of N to the grain. Despite strong environmental influence on wheat protein level, genes for high protein have been demonstrated to effectively increase protein content in many different production environments. Lysine % of protein decreases but lysine % of grain increases as protein is increased. Genetic variability for lysine of sufficient magnitude to overcome

the normal depression of lysine % of protein as protein is increased has been uncovered. Experimental lines have been developed in the ARS-Nebraska program in which genes for high protein and high lysine were combined. The lines have been widely distributed for use in other breeding programs

- Kalinova, J. and J. Moudry. 2006. "Content and quality of protein in proso millet (*Panicum miliaceum* L.) varieties." *Plant Foods Hum. Nutr.* 61:45-49.
Abstract: Proso millet belongs to the oldest cereals that human is using. Eight varieties of proso millet were cultivated in Ceske Budejovice from 1998 to 2000 and Cerveny Dvur from 1999 to 2000. The crude protein content was determined according to Kjehladl method and amino acid content was determined chromatographically after acid and oxidative acid hydrolysis. Although the protein content of proso (11.6% of dry matter) was similar to wheat, the grain of proso was significant richer in essential amino acids (leucine, isoleucine, methionine) than wheat. Hence, the protein quality of proso (Essential Amino Acid Index) was higher (51%) compared to wheat. The proso grain contained about 3.3 g kg⁻¹ of the limiting amino acid-lysine. Significant differences in protein and its quality were found among the evaluated proso varieties. The varieties Toldanskoe and Lipetskoe were the most different from the others in protein and amino acid content and Amino Acid Score of individual acids. They had the lowest content and quality of protein. The seed coat of these varieties was red. The amino acid and protein content was significantly influenced by weather during the year. Dry conditions caused an increase of protein but its quality was decreased
- Kirby, S.R., G.M. Pesti, and J.H. Dorfman. 1993. "An investigation of the distribution of the protein content of samples of corn, meat and bone meal, and soybean meal." *Poult. Sci.* 72:2294-2298.
Abstract: This study examines the critical assumption of a normal distribution for protein content in feedstuffs. Data were collected from broiler feed mills on the nutrient content of corn, meat and bone meal, and soybean meal. Tests of normality for protein within each feedstuff were performed by each of two methods: 1) the Shapiro-Wilk test (n < 50) or Kolmogorov-Smirnov test (n > 50); and 2) the D'Agostino-Pearson K2 test. Results indicate that protein is non-normally distributed in corn and in meat and bone meal, but protein is normally distributed in soybean meal
- Krishnan, H.B., J.O. Bennett, W.S. Kim, A.H. Krishnan, and T.P. Mawhinney. 2005. "Nitrogen lowers the sulfur amino acid content of soybean (*Glycine max* [L.] Merr.) by regulating the accumulation of Bowman-Birk protease inhibitor." *J. Agric. Food Chem.* 53:6347-6354.
Abstract: Soybeans in general contain 35-40% protein. Efforts are underway to increase further this protein content, thus enhancing their nutritive value. Even though higher protein is a desirable characteristic, whether such an increase will be accompanied by enhanced protein quality is not known. Soybean protein quality could be significantly improved by increasing the concentration of the sulfur-containing amino acids, cysteine and methionine. To ascertain if a correlation existed between protein quantity and quality, a comparison of the amino acids of soybeans differing in protein content was made. Soybeans with higher protein content had a significantly lower percentage of sulfur amino acids, while those with lower protein exhibited a higher content of cysteine and methionine. Nitrogen application elevated the protein content but lowered that of the sulfur amino acids. Transmission electron microscopy examination of thin sections of low protein soybean seeds revealed several protein storage vacuoles that were partially filled with storage proteins. Fluorescence two-dimensional difference gel electrophoresis of soybean seed proteins revealed that nitrogen application favored the accumulation of the beta-subunit of beta-conglycinin while decreasing the accumulation of Bowman-Birk protease inhibitor (BBI), a protein rich in cysteine. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis of 60% 2-propanol-extracted proteins showed a drastic reduction in the accumulation of BBI with increasing protein content. Northern blot analysis indicated that nitrogen had a negative influence on the expression of the

BBI gene. Our results indicate that the negative correlation between total protein and sulfur amino acid content is mostly mediated by the differential accumulation of BBI

Lacaze, X. and P. Roumet. 2004. "Environment characterisation for the interpretation of environmental effect and genotype x environment interaction." *Theor. Appl. Genet.* 109:1632-1640.

Abstract: Increasing attention is being paid to environment characterisation as a means of identifying the environmental factors determining grain protein content (GPC) in durum wheat. New insights in crop physiology and agronomy have led to the development of crop simulation models. Those models can reconstruct plant development for past cropping seasons. One major advantage of these models is that they can also indicate the intensity of limiting factors affecting plants during particular developmental stages. The main environmental factors determining GPC in durum wheat can be investigated by introducing the intensity of limiting factors into genotype x environment (GxE) models. In our case, limiting factors corresponding to water deficit and nitrogen availability were calculated for the development period between booting and heading. These variables were then introduced into a clustering model. This model is an extension of factorial regression applied to discrete environment and genotypic variables. This procedure effectively described the environment main effect: around 30.9% of the sum of squares of the environment main effect was accounted for, using less than 33% of the degrees of freedom. It also partially accounted for GxE interaction. Our methodology, coupling the use of crop simulation and GxE analysis models, is of potential value for improving our understanding of the main development stages and identification of environmental limiting factors for the development of GPC

Ling, P.R., K.J. Hamawy, L.L. Moldawer, N. Istfan, B.R. Bistran, and G.L. Blackburn. 1986. "Evaluation of the protein quality of diets containing medium- and long-chain triglyceride in healthy rats." *J. Nutr.* 116:343-349.

Abstract: In this study, protein efficiency ratio and net protein utilization together with the kinetic estimates of protein turnover were used to compare the effect of different protein and fat sources in healthy rats. Male Sprague-Dawley CD rats were pair-fed different diets for 14 d. All diets were isonitrogenous and isocaloric, containing 10.4% protein, 10.9-11.4% fat, 31.9-32.8% carbohydrate and 43.5-44.5% moisture (wt/wt). After 14 d of feeding, protein efficiency ratio, net protein utilization, weight gain, intake, fat and protein content in the whole-body and fractional synthetic rates in various tissues were determined. Animals given diets containing medium-chain triglycerides (MCT) demonstrated decreased weight gain and fat content compared to the pair-fed controls receiving long-chain triglycerides (LCT). No difference was seen in protein content, net protein utilization and fractional synthetic rates in the liver and whole body of these MCT-fed rats when compared to those given LCT. Protein efficiency ratios in both of the MCT groups fed MCT + casein and MCT + soy protein were lower than those in the groups given LCT + casein. Although this study did not include a group for LCT and soy protein, these results suggest that MCT reduces the fat deposition without affecting the whole-body protein content. This may have implications for the treatment of obesity. Secondly, the protein efficiency ratio may not be a useful indicator of dietary protein quality when the fat source is MCT

MacLean, W.C., Jr., G.L. Klein, G.L. de Romana, E. Massa, and G.G. Graham. 1978. "Protein quality of conventional and high protein rice and digestibility of glutinous and non-glutinous rice by preschool children." *J. Nutr.* 108:1740-1747.

Mahmoud, A.A., S.S. Natarajan, J.O. Bennett, T.P. Mawhinney, W.J. Wiebold, and H.B. Krishnan. 2006. "Effect of six decades of selective breeding on soybean protein composition and quality: a biochemical and molecular analysis." *J. Agric. Food Chem.* 54:3916-3922.
Abstract: To evaluate the extent of the genetic change and its effects on the seed protein composition of soybean cultivars released during the past 60 years, representative

ancestral cultivars and those derived from selective breeding were grown in a side-by-side comparison. Total seed protein content, determined by combustion analysis of nitrogen, revealed a decline in the protein content after decades of selection and breeding. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis comparison of protein profiles of the soybean cultivars indicated that relative expression of most of the seed storage proteins had not varied substantially from the ancestral lines to the present commercial cultivars. There was noticeably less beta-subunit of beta-conglycinin, a protein devoid of sulfur amino acids, in the modern cultivars represented by Mustang, Pioneer 93B09, and Asgrow 3602. Comparison of the amino acid profiles of soybean seed, a benchmark of the protein's nutritional quality, revealed that the ancestral progenitor, *G. soja*, was significantly higher in cysteine, glutamic acid, histidine, and arginine than either the ancestral or the modern cultivars. Selective breeding over the past 60 years minimally affected the overall amino acid composition. The degree of divergence in the DNA sequence of the genes encoding glycinin and beta-conglycinin in the ancestral and modern cultivars was investigated using Southern hybridization and the polymerase chain reaction. Even though some restriction fragment polymorphisms could be detected, overall, the banding patterns were remarkably similar among the ancestral cultivars and those derived from them, suggesting a high degree of conservation of seed-storage protein genes. The results of our study suggest that selection and breeding for yield during the past 60 years had no major influence on the protein composition, ostensibly because of limited genetic diversity among the parental lines

Matthaus, K., S. Danicke, W. Vahjen, O. Simon, J. Wang, H. Valenta, K. Meyer, A. Strumpf, H. Ziesenib, and G. Flachowsky. 2004. "Progression of mycotoxin and nutrient concentrations in wheat after inoculation with *Fusarium culmorum*." *Arch. Anim Nutr.* 58:19-35.

Abstract: The objective of this study was to follow the mycotoxin formation and changes in nutrient composition of wheat (cv. Ritmo) artificially inoculated with *Fusarium culmorum*. From anthesis until harvest, samples were taken once a week from the inoculated and control plots. The investigations were focused on monitoring the progression of the contamination of the wheat kernels with deoxynivalenol (DON) and zearalenone (ZON). Both the uncontaminated control kernels and the contaminated kernels were examined also for the presence of zearalenone-4-beta-D-glucopyranoside and several trichothecenes at harvest. Furthermore, the impact of the *Fusarium* inoculation on some nutrients as starch, crude protein, amino acid composition, crude ash, non starch polysaccharides (NSP) as well as viscosity and thousand seed weight (TSW) was examined. Also proteolytic and amylolytic activity as well as the NSP-degrading enzyme activities of inoculated and control samples were analysed at the time of harvest. DON was detected in higher concentrations and in earlier stages, while ZON was found later and in smaller amounts. On average 7.79 mg/kg DM of DON and 100 microg/kg DM of ZON were found in the inoculated kernels at the time of harvest. Neither in the contaminated nor in the control samples glucose conjugates of ZON (Zearalenone-4-beta-D-glucopyranoside) were detected. Moreover, the infection with *Fusarium culmorum* had pronounced effects on some quality parameters. The crude protein content of the inoculated kernels showed significantly higher values over the whole period compared to the control kernels. The protein content of the inoculated kernels amounted 13.9% DM at harvest, while only a concentration of 12.5% DM was detected in the control samples. Similarly, in almost all stages of development the crude ash content of inoculated samples was higher than in control samples. These distinct differences in kernel composition resulted possibly from the changes of the thousand seed weight. In the present work the grain harvested from the control plots showed a significantly higher TSW (24.2 g) as compared to their inoculated counterparts (15.5 g). Despite lower extract viscosity of inoculated samples at time of harvest, the content of soluble NSP of inoculated plots was higher than in control samples at the same time. Moreover, inoculation resulted in markedly increased activities of protease, amylase and

several NSP-degrading enzyme activities. This would suggest that the cell wall penetrating properties of the fungus itself and/or that the fungus induced alterations of the metabolic activity of the embryo or other constituents of the wheat kernel could be responsible

Mitchell, G.V., M.Y. Jenkins, and E. Grundel. 1989. "Protein efficiency ratios and net protein ratios of selected protein foods." *Plant Foods Hum. Nutr.* 39:53-58.

Abstract: As a part of a cooperative study initiated to assess both in vitro and in vivo protein quality methods, the protein efficiency ratio (PER) and net protein ratios (NPR) of 15 different protein sources were determined. Male weanling Sprague-Dawley rats were fed a 10% protein diet. Fourteen-day NPR and relative NPR (RNPR) values and 14- and 28-day PER and relative PER (RPER) values were calculated for each protein source. When protein quality values were expressed relative to ANRC casein, the 14- and 28-day PER data ranked the protein sources essentially in the same order. RPER values of nonfat dried skim milk (unheated) and tuna were more than 100% that of casein; nonfat dried skim milk (heated), chickpeas, and breakfast sausage were between 50 and 70% of that of casein; and pinto beans and rice-wheat gluten cereal did not support substantial growth of the rat. The NPR method did not always rank the protein sources in the same order as the PER method. For the poor quality proteins, RNPR values were much higher than the RPER values; however, the RNPR and RPER values agreed closely for high quality protein sources

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Momma, K., W. Hashimoto, S. Ozawa, S. Kawai, T. Katsube, F. Takaiwa, M. Kito, S. Utsumi, and K. Murata. 1999. "Quality and safety evaluation of genetically engineered rice with soybean glycinin: analyses of the grain composition and digestibility of glycinin in transgenic rice." *Biosci. Biotechnol. Biochem.* 63:314-318.

Abstract: The composition of nutritionally and physiologically important molecules in transgenic rice with the soybean glycinin gene was determined and compared with that of a non-transgenic control. Except for the levels of protein, amino acids and moisture, no marked differences were found between the two kinds of rice. The protein content of the transgenic rice was about 20% higher than the control (control, 6.5 g/100 g; transgenic, 8.0 g/100 g) with a concomitantly lower moisture content. This increased protein content mainly resulted from the increased glycinin expressed in the transgenic rice, and the protein was susceptible to gastric and intestinal digestion juices. In parallel with the increased protein content, some important amino acids lacking in quantity in normal rice were replenished

Moran, J.R., R. Vaughan, S. Stroop, S. Coy, H. Johnston, and H.L. Greene. 1983. "Concentrations and total daily output of micronutrients in breast milk of mothers delivering preterm: a longitudinal study." *J. Pediatr. Gastroenterol. Nutr.* 2:629-634.

Abstract: The number of preterm infants fed their own mother's milk appears to be increasing as a result of information suggesting certain benefits over milk from human milk banks or proprietary formulas. It is also apparent that the nutritional requirements of term and preterm infants differ. Thus, the finding of various deficiencies in small preterm infants indicates that studies which examine the nutrient content of milk from mothers who deliver prematurely are important to aid in suggesting appropriate supplementation. In order to provide appropriate recommendations, nutrient content must be assayed during the period of exclusive milk feedings. Accordingly, the concentrations and total daily output of breast milk zinc and copper, and vitamins A, C, and E, were examined in a group of 13 mothers delivering at or before 32 weeks gestation. Collections of a total 24-h output were obtained every 7 days for the first 7 weeks after delivery. Concentrations of all micronutrients were similar to those reported previously during the first 5 weeks of lactation. Most striking, however, was the progressive decline in total

output as well as concentration of zinc. After the first 2 weeks of lactation, levels of copper and vitamins A, C, and E were not affected by the duration of lactation. There was substantial variation between mothers in daily output of all the micronutrients. The low output of these micronutrients suggests that some attempt should be made at monitoring the mineral and vitamin status of small preterm infants fed exclusively human milk for the first 3 months of life.(ABSTRACT TRUNCATED AT 250 WORDS)

- Naef,A., T.Zesiger, and G.Defago. 2006. "Impact of transgenic Bt maize residues on the mycotoxigenic plant pathogen *Fusarium graminearum* and the biocontrol agent *Trichoderma atroviride*." *J. Environ. Qual.* 35:1001-1009.
Abstract: Transformation of maize with genes encoding for insecticidal crystal (Cry) proteins from *Bacillus thuringiensis* (Bt) could have an impact on the saprophytic survival of plant pathogens and their antagonists on crop residues. We assessed potential effects on the mycotoxin deoxynivalenol (DON)-producing wheat and maize pathogen *Fusarium graminearum* and on the biocontrol agent *Trichoderma atroviride*. Purified Cry1Ab protein caused no growth inhibition of these fungi on agar plates. Cry1Ab concentrations above levels common in Bt maize tissue stimulated the growth of *F. graminearum*. The fungi were also grown on gamma-radiation-sterilized leaf tissue of four Bt maize hybrids and their non transgenic isolines collected at maize maturity on a field trial in 2002 and 2003. Both fungi degraded the Cry1Ab protein in Bt maize tissue. Fungal biomass quantification with microsatellite-based polymerase chain reaction (PCR) assays revealed differential fungal growth on leaf tissue of different maize varieties but no consistent difference between corresponding Bt and non-Bt hybrids. Generally, year of maize tissue collection had a greater impact on biomass production than cultivar or Bt transformation. The mycotoxin DON levels observed in maize tissue experiments corresponded with patterns in *F. graminearum* biomass, indicating that Bt transformation has no impact on DON production. In addition to bioassays, maize leaf tissue was analyzed with a mass spectrometer-based electronic nose, generating fingerprints of volatile organic compounds. Chemical fingerprints of corresponding Bt and non-Bt leaf tissues differed only for those hybrid pairs that caused differential fungal biomass production in the bioassays. Our results suggest that Cry1Ab protein in maize residues has no direct effect on *F. graminearum* and *T. atroviride* but some corresponding Bt/non-Bt maize hybrids differ more in composition than Cry protein content alone, which can affect the saprophytic growth of fungi on crop residues
- Nieto,R., J.F.Aguilera, I.Fernandez-Figares, and C.Prieto. 1997. "Effect of a low protein diet on the energy metabolism of growing chickens." *Arch. Tierernahr.* 50:105-119.
Abstract: Two slaughter experiments were carried out to determine whether the protein content of the diet has an influence upon the efficiency of utilization of ME in fast growing chickens. A normal-protein diet (NPD, 204 g CP/kg DM: 14.7 MJ ME/kg DM) based on soybean meal as the sole source of protein was given at four different levels of intake (ad libitum or restricted at about 90, 65 and 40% ad lib) to 10-d-old animals for 2 weeks. In a parallel experiment the chickens were fed ad libitum a low protein diet (LPD, 66 g CP/kg DM: 15.0 MJ ME/kg DM) based on soybean meal. The intake of metabolizable energy ranged from 1675 to 777 and 1770 to 832 kJ/kgW^{0.75} per day for NPD and LPD treatments, respectively. Mean values of energy retention, gross efficiency of energy utilization and energy retained as protein were significantly ($P < .05$) lower and heat production (expressed as both kJ/kgW^{0.75} per day and kJ/kg body protein content^{0.75} per day) was significantly higher ($P < .05$) for the chickens fed on LPD. These findings support the concept of dietary-induced thermogenesis in response to reductions in dietary protein concentration. It is concluded that the increased heat production found in the birds fed on the low-protein diet can be explained by both an increase in energy requirements for maintenance (MEM) and a sharp decrease in the efficiency of utilization of ME of growth (k(g))

Rao, M.S., A.S. Bhagsari, and A.I. Mohamed. 1998. "Yield, protein, and oil quality of soybean genotypes selected for tofu production." *Plant Foods Hum. Nutr.* 52:241-251.
Abstract: The soyfood industry prefers some soybean [(*Glycine max* L. (Merr.))] cultivars over others based on chemical constituents, physical traits, and processing quality of the seed. However, soybean cultivars possessing the combination of desirable agronomic traits and biochemical characteristics that enhance the quality of soyfoods have not been identified in the USA. Thus, this research was conducted with the objective of determining yield, seed protein, and fatty acid composition of soybean genotypes selected for tofu production. Twelve soybean genotypes were planted in plots arranged in a randomized complete block design with four replications at the Agricultural Research Station, Fort Valley State University, Georgia, USA during 1994 and 1995. Seed yield ranged from 1.6 to 3.0 metric tons/ha. The protein content varied between 314.2 and 480.7 g/kg seed. Both BARC-8 and BARC-9 had significantly higher protein content than other genotypes. These two genotypes also showed significant year by genotype interactions for some fatty acids. V71-370 had the highest oleic acid concentration and a high ratio (0.92) of monounsaturated to polyunsaturated fatty acids. The concentration of linoleic and linolenic acids ranged from 406.5 to 531.0 and 37.1 to 63.0 g/kg oil, respectively. Seed yield was correlated with biomass, harvest index, and filled pods per m². In this study, V71-370 was found to be relatively superior in oil quality with fatty acid composition desirable for human consumption. The significant variation for seed yield and biochemical characteristics observed among the few genotypes examined in this study indicates the potential for breeding high yielding soybean cultivars suitable for soyfoods. Therefore, there is a need for evaluation of soybean germplasm for agronomic traits that contribute to seed yield and biochemical characteristics including fatty acid profiles that enhance soyfood quality before initiating development of suitable cultivars for tofu

Sorensen, A. and C.H. Knight. 2002. "Endocrine profiles of cows undergoing extended lactation in relation to the control of lactation persistency." *Domest. Anim Endocrinol.* 23:111-123.
Abstract: We conducted an experiment in dairy cows investigating the effects of calving season, milking frequency and nutrition on lactation persistency. Cows calved in the Spring (n=12) or Winter (n=12). Commencing in lactation week 9 one udder-half of each cow was milked thrice-daily and half of each calving group received additional concentrate at a fixed rate of 3kg per day above that of the control cows. As reported elsewhere, between lactation weeks 9 and 33 persistency (measured as the slope of decline in milk yield) was significantly improved by frequent milking (P<0.001), by calving in the Winter (P<0.001) and by additional concentrate (P<0.05). The cows were rebred after week 33. When analysis of persistency was extended up to week 20 of the recurring pregnancy only the frequency effect remained significant. Persistency was unaffected by the pregnancy up until pregnancy week 20 but was then greatly reduced (P<0.001). In this paper we report hormone concentrations. GH was unaffected by nutrition but was consistently elevated in the Winter calving group relative to the Spring. IGF1 and prolactin were both unaffected by nutrition and calving season, IGF1 tended to increase as lactation progressed but changes in prolactin were related to time of year more than stage of lactation. Insulin was not affected by nutrition and was lower in Winter calvers, but only during early lactation. Prior to rebreeding, lactation persistency was correlated (slightly) with [GH] but not with [IGF1] or [insulin] and was correlated significantly with changes in GH, IGF1 (both positive) and insulin (negative). In conclusion, whilst bovine lactation persistency is plastic and amenable to beneficial manipulation, the details of its endocrine control remain to be elucidated

Stefanon, B., M. Colitti, G. Gabai, C.H. Knight, and C.J. Wilde. 2002. "Mammary apoptosis and lactation persistency in dairy animals." *J. Dairy Res.* 69:37-52.
Abstract: The decline in milk yield after peak lactation in dairy animals has long been a biological conundrum for the mammary biologist, as well as a cause of considerable lost income for the dairy farmer. Recent advances in understanding the control of the

mammary cell population now offer new insights on the former, and a potential means of alleviating the latter. The weight of evidence now indicates that a change in mammary cell number, the result of an imbalance between cell proliferation and cell removal, is a principal cause of declining production. Further, it suggests that the persistency of lactation, the rate of decline in milk yield with stage of lactation, is strongly influenced by the rate of cell death by apoptosis in the lactating gland. Mammary apoptosis was first demonstrated during tissue involution after lactation, but has now been detected during lactation, in mammary tissue of lactating mice, goats and cattle. Those factors that determine the rate of cell death by apoptosis are as yet poorly characterized, but include the frequency of milking in lactating goats. Initial evidence suggests that nutrition also is likely to influence cell survival after peak lactation, an important factor being the degree of oxidative stress imposed by feed and the tissue's ability to deal with, and prevent damage by, reactive oxygen species. Comparison of cows in calf or not pregnant during declining lactation also indicates a likely influence of reproductive hormones, with oestradiol and progesterone acting to preserve mammary ductal and alveolar integrity during the dry period, while allowing a degree of apoptosis and cell replacement. In each case, the molecular mechanisms controlling mammary cell survival (or otherwise) are as yet poorly defined. On the other hand, more persistent lactations are likely to benefit animal welfare through fewer calvings and by placing less emphasis on maximal production at peak lactation, and modelling of persistent lactation with longer calving intervals indicates their likely economic benefits. In these circumstances, there is considerable incentive to elucidate the determinants of mammary apoptosis, and the factors controlling the dynamic balance between cell proliferation and cell death in the lactating mammary gland

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Abstract: OBJECTIVE: To identify major food sources of 27 nutrients and dietary constituents for US adults. DESIGN: Single 24-hour dietary recalls were used to assess intakes. From 3,970 individual foods reported, 112 groups were created on the basis of similarities in nutrient content or use. Food mixtures were disaggregated using the US Department of Agriculture (USDA) food grouping system. SUBJECTS/SETTING: A nationally representative sample of adults aged 19 years or older (n = 10,638) from USDA's 1989-91 Continuing Survey of Food Intakes by Individuals. ANALYSES PERFORMED: For each of 27 dietary components, the contribution of each food group to intake was obtained by summing the amount provided by the food group for all respondents and dividing by total intake from all food groups for all respondents. RESULTS: This article updates previous work and is, to the authors' knowledge the first to provide such data for carotenenes, vitamin B-12, magnesium, and copper. Beef, yeast bread, poultry, cheese, and milk were among the top 10 sources of energy, fat, and protein. The following other major sources also contributed more than 2% to energy intakes: carbohydrate: yeast bread, soft drinks/soda, cakes/cookies/ quick breads doughnuts, sugars/syrups/jams, potatoes (white), ready-to-eat cereal, and pasta; protein: pasta; and fat: margarine, salad dressings/mayonnaise, and cakes/ cookies quick breads/doughnuts. Ready-to-eat cereals, primarily because of fortification, were among the top 10 food sources for 18 of 27 nutrients. APPLICATIONS/CONCLUSIONS: These analyses are the most current regarding food sources of nutrients and, because of disaggregation of mixtures, provide a truer picture of contributions of each food group

Triboi, E., P. Martre, and A.M. Triboi-Blondel. 2003. "Environmentally-induced changes in protein composition in developing grains of wheat are related to changes in total protein content." *J. Exp. Bot.* 54:1731-1742.

Abstract: Nitrogen (N) nutrition, post-anthesis temperature and drought-induced changes in the kinetics of accumulation of dry mass, total grain N and protein fractions (albumins-globulins, amphiphils, gliadins, and glutenins) contents were examined for winter wheat (*Triticum aestivum* L.). Crops were grown in controlled environment tunnels

in 1994 and 1998. In 1994, five post-anthesis temperatures averaging from 15-25 degrees C were applied during grain-filling. In 1998 two post-anthesis temperatures averaging 13 degrees C and 20 degrees C were applied and factorized with two post-anthesis water regimes. In 1994 crops also were grown in the field, where different application rates and timing of N nutrition were tested. When expressed in thermal time, the kinetics of accumulation of the protein fractions were not significantly affected by post-anthesis temperature or drought; whereas N nutrition significantly increased the rate and duration of accumulation of storage proteins. Albumin-globulin proteins accumulated during the early stage of grain development. The rate of accumulation of that fraction decreased significantly at c. 250 degrees Cd after anthesis, when the storage proteins (gliadins and glutenins) started to accumulate significantly. Single allometric relationships for the different environmental conditions exist between the quantity of each protein fraction and the total quantity of N per grain. From these results it was concluded that (1) the process of N partitioning is neither significantly affected by post-anthesis temperature or drought nor by the rate and timing of N nutrition and (2) at maturity, variations in protein fraction composition are mainly because of differences in the total quantity of N accumulated during grain-filling

Vaughan, D.A., M. Womack, R.T. Smith, and W.J. Wisler. 1980. "Protein quality of rice as affected by application of nitrogen fertilizer." *J. Agric. Food Chem.* 28:894-896.

Wang, J., E. Pawelzik, J. Weinert, Q. Zhao, and G.A. Wolf. 2004. "Effect of fungicide treatment on the quality of wheat flour and breadmaking." *J. Agric. Food Chem.* 52:7593-7600.
Abstract: Fungicides are applied to crop plants to ensure disease protection and improve growth. To assess the effects of five commercial foliar and spike fungicides in four different combinations on wheat (*Triticum aestivum* L.), various quality parameters and flour processing properties, including baking quality, were determined. Three commonly used wheat cultivars with different quality classes (E, B, and C) were tested. Falling number, crude protein content, water absorption ability, protease activity, viscosity, and the free amino acid content were mainly lower in the fungicide-treated grains than in the untreated grains. None of the fungicides caused any significant changes in the wet gluten content, dough properties, the mono- and oligosaccharide content, or the breadmaking quality. In general, the commercial fungicide treatments did not cause any statistically significant differences between the treated and the untreated samples with respect to the quality parameters analyzed, although there were indeed significant differences between the three cultivars themselves

Wu, Z. and L.D. Satter. 2000. "Milk production during the complete lactation of dairy cows fed diets containing different amounts of protein." *J. Dairy Sci.* 83:1042-1051.
Abstract: Milk production response to four different amounts of protein supplementation was measured in a complete lactation study utilizing 58 multiparous Holstein cows treated with bovine somatotropin. The four treatments were as follows (the first number is the dietary crude protein content (% of dry matter) during the first 16 wk of lactation and the second number is the protein content for wk 17 to 44 of lactation): 15.4-16.0, 17.4-16.0, 17.4-17.9, and 19.3-17.9. Diets were formulated to maximize the supply of amino acids to the intestine. High moisture ear corn was finely ground to promote ruminal fermentation and microbial protein synthesis, and roasted soybeans and expeller processed soybean meal were used as the protein supplements to provide relatively high amounts of rumen-undegradable protein. Alfalfa silage and corn silage (3:2) provided the forage. Milk production for the 308-d lactation for each of the treatment groups was 10,056, 10,831, 11,095, and 11,132 kg. Cows of this production level fed diets similar to those used in this experiment benefit from dietary protein of approximately 17.5% during the first 30 wk of lactation. A reduction in dietary protein to 16% can be made around wk 30 of lactation. This amount of dietary protein should, with prevailing feed prices, be compatible with maximum profit and a moderate amount of nitrogen excretion to the environment

Yeo, J.M., C.H. Knight, and D.G. Chamberlain. 2003. "Effects of changes in dietary amino acid balance on milk yield and mammary function in dairy cows." *J. Dairy Sci.* 86:1436-1444. Abstract: Two experiments were conducted to determine whether longer-term deficiencies in the supply of limiting amino acids would be accompanied by a decline in mammary function (total DNA, cell proliferation rate and activities of key enzymes), and whether this would adversely affect the cow's ability to respond to a return to a nutritionally adequate diet. The first experiment was performed in early/mid lactation, and the second, using the same cows, was carried out in mid/late lactation. A control group of six cows were given a grass silage-cereal diet containing fish meal as the sole protein supplement (amino acid adequate) throughout the experiments, whereas another group of six cows in treatment received the control diet for 2 wk (lactation wk 5 and 6) and then were changed to a diet in which the fish meal was replaced by an equivalent amount of protein as feather meal (amino acid deficient) for 6 wk before returning to the fish meal diet for 4 wk (Experiment 1). After a rest period of 5 wk, the experimental procedure was repeated (Experiment 2). Although there was a fall in milk yield as lactation advanced, leading to lower milk yields in Experiment 2, the marked difference in milk yield between treatments was similar for the two stages of lactation (21% vs 16% in Experiment 1 and 2, respectively). In both experiments, the marked fall of milk yield in cows given the feather meal diet was completely recovered by a return to the fish meal diet. Despite the markedly lower milk yield with the amino acid-deficient diet, however, there was no clear evidence of corresponding changes in measurements of mammary function