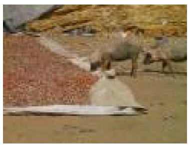
Peanut seeds

Click on the "Nutritional aspects" tab for recommendations for ruminants, pigs, poultry, rabbits, horses, fish and crustaceans

Common names

Peanut, groundnut, goober, earthnut, Chinese nut [English], arachide, cacahuète, cacahouète, pistache de terre, pois de terre [French], pinotte [French/Canada], Erdnuß [German], arachide [Italian], amendoim, alcagoita, caranga, mandobi [Portuguese], avellana americana, cacahuete, cocos, maní [Spanish], karanga, mjugu nyasa, mnjugu nyasa [Swahili], grondboontjie [Afrikaans], podzemnice olejná [Czech], jordnød [Dansk], kacang tanah [Indonesian, Malay], kacang brol [Javanese], földimogyoró [Hungarian], pinda, aardnoot, grondnoot, olienoot of apennoot [Dutch], Orzacha podziemna, orzech ziemny, orzech arachidowy, fistaszki [Polish], mani [Tagalog], yer fıstığı [Turk], lạc, đậu phộng, đậu phụng [Vietnamese], [Amharic], فول سوداني [Arabic], [Bengali], بادام‌زمینی , پسته‌شامی [Persian], [Khmer], 땅콩 [Korean], [Hindi], אגוז אדמה [Hebrew], [kannada], [Malayalam], [Nepali], ラッカセイ [Japanese], [Punjabi], Ара́хис культу́рный, арахис подзе́мный, земляно́й оре́х [Russian], [Tamil], [Telugu], ถั่วลิสง [Thai], مونگ پھلی [Urdu], 花生 [Chinese]

Products:

- Peanuts, whole peanuts, full-fat peanuts, groundnuts, whole groundnuts, full-fat groundnuts
- Peanuts in the shell, in-shell peanuts

Species

Arachis hypogaea L. [Fabaceae]

Feed categories

- Plant products and by-products
- Legume seeds and by-products
- Oil plants and by-products

Related feed(s)

- Peanut forage
- Peanut skins
- Peanut hulls
- Peanut meal

Description

The fruit (pod, nut) of the peanut (*Arachis hypogaea* L.) is made of an external shell (or hull) (21-29%) and of the nut itsef (79-71%), which consists of a thin hull ("skin", seed coat) (2-3%), the kernel (69-73%) and the germ (2.0-3.5%) (van Doosselaere, 2013). The term "peanut" may refer to the whole fruit (including the shell), to the kernel with its thin coat, or to the kernel without the thin coat. Peanuts are nutrient- and energy-rich products that are mainly used for food, but whole cull peanuts or decorticated peanuts are occasionally sold for feed. Like other peanut products, peanuts can be contaminated by aflatoxins and should be tested before being fed to livestock.

Morphology and cultivation

Peanut is an annual herbaceous plant growing 30 to 50 cm tall. The peanut plant can be erect or prostrate with a well developed taproot and many lateral roots and nodules. The leaves are opposite and pinnate with four leaflets; each leaflet is 1 to 7 cm long and 1 to 3 cm across. The flowers are 1.0 to 1.5 cm across, bright yellow or yellowish orange with reddish veining. They are borne in axillary clusters on the stems above ground and last for just one day. One to several flowers may be present at each node and are usually more abundant at lower nodes. The first flowers appear at 4 to 6 weeks after planting and maximum flower production occurs 6 to 10 weeks after planting. Eight to 14 days after pollination, a short stalk at the base of the ovary elongates to form a thread-like structure known as a "peg". This pushes the ovary down 5 to 8 cm into the soil, where it develops into a pod. Pods are 3 to 7 cm long, normally containing one to four seeds. Pods reach maximum size after 2 to 3 weeks in the soil, maximum oil content in 6 to 7 weeks, and maximum protein content after 5 to 8 weeks. The peanut crop matures after 7 to 9 weeks in the soil, which is indicated by maximum levels of protein, oil, dry matter, and presence of darkened veining and brown splotching inside the pod. Peanuts usually require a minimum of 100 to 150 days from planting to maturity depending on the variety. Flowering continues over a long period and pods are in all stages of development at harvest. Pegs will eventually rot in the soil and the resulting loose pods are lost during the harvest (Putnam, 1991).

Uses

About 41% of the world peanut production is used for oil production, whereas 45% is used directly as human food (Fletcher, 2016). Peanut kernels, usually cooked or toasted, are appreciated worldwide as a flavourful snack food, nutritionally dense due to its high energy, protein and fat content. Peanuts are also the primary ingredient of many finished products such as peanut butter, confections, and nutritional bars, and are used in numerous dishes (Davis et al., 2016). Peanuts are usually too valuable to be used as animal feed. However, whole or shelled peanuts, or even roasted peanuts are sometimes fed to livestock. In 2001, for instance, raw peanuts in excess of the peanut quota in the US were sold on the feed market. Likewise, abnormal peanuts, or peanuts with a higher aflatoxin content than that permitted by the food regulations, have been used as feed ingredients for cattle. Peanuts meant for oil production, or for the manufacture of confectionary or peanut butter may also be available for livestock (Myer et al., 2001; Hill, 2002). In the US, it has been estimated that less than 1% of the annual production is fed as raw peanuts to cattle (Hill, 2002).

Distribution

Peanut is native from South America. It was cultivated in Peru at least as early as 1500 BCE and probably earlier. The Incas already used its for its seeds, that were eaten toasted, and its oil. After the arrival of Europeans in America, peanut was spread worldwide. An oil mill was established in Spain in 1800 and West Africa became the primary source of peanut exportation in the 19th century (Pattee, 2005). Peanut is a now a major crop widely distributed throughout tropical, subtropical, and warm temperate areas in Asia, Africa, Oceania, North and South America, and Europe (Freeman et al., 1999). In 2014, peanut cultivation covered 25.7 million ha worldwide, including 13.1 million ha in Africa (51%), 11.2 million ha in Asia (44%) and 1.3 million ha in the Americas (5%) (FAO, 2016).

- Peanut is cultivated throughout Africa. Sudan, Nigeria, and Senegal are the main producers. In Western and Central Africa, peanut is cultivated in semi-arid areas: growing season 75-150 days, annual rainfall 300-1200 mm. In Southern and Eastern Africa, peanut is also grown abobe over 1500 m with rainfall 300-1000 mm.
- In Asia, most of the production occurs in India and China though peanut is also grown in Indonesia, Myanmar, Bangladesh, and Vietnam. In India, about 80% of the peanut area is rainfed, grown in southern, western, and parts of central India during the southwest monsoon. The remaining 20% is irrigated, grown in the postrainy season and in summer in southern, eastern and central India. In China, peanut is grown in rotation with wheat and maize. 25% of the productio comes from the Shandong province in northern China. Growing condition are diverse: rainfall ranging from 400 to 2000 mm, 150 to 300 frost-free days per year.
- Argentina and Brazil together account for 66% of the peanut produced in Latin America and the Caribbean. The crop is grown mainly in semi-arid regions.
- In the USA, production is concentrated in the southeast, in the Virginia-Carolina area, and the southwest.
- In Europe, peanut is grown only in Bulgaria and small parts of Greece, Spain, and Yugoslavia (Freeman et al., 1999).

Even though crushing peanuts for oil and meal remains a major use for peanut production, direct utilisation for food has been steadily increasing since the 1970s. About 45% of the world peanut production was used for food in 2010-2013, but 60% or above of the production goes to the food market in North America, Southern Africa, West Africa, Southeastern Asia, but that only the case for 41% of the production in Eastern Asia and 13% in Southwestern Asia (Fletcher et al., 2016). The worldwide production of peanuts (with shells) was 40 million tons in 2015. 40% was produced in China alone, 19% in the other Asian countries, 18% in Africa and 11% in the Americas (USDA, 2016). Assuming that 45% goes to food, it can be estimated that 18 million t of peanuts are produced for the food market.

Forage management

Peanut cultivation falls under two broad categories (Freeman et al., 1999).

- **Low-input systems**. In most countries in Africa and Asia, peanut is grown by smallholder farmers as a semi-subsistence crop, grown primarily for food, but small quantities are sold for cash after meeting household consumption requirements. The crop is cultivated under rainfed conditions, with no inputs other than land and labour. It is is subjected to drought stress and to high levels of pest and disease infestation. Average yields are about 700 kg/ha and can vary substantially from year to year.
- **High-input systems**. In the USA, Australia, Argentina, Brazil, China, and South Africa peanut is produced on a commercial scale using improved varieties, modern crop management practices, irrigation, and high levels of inputs such as fertilizer, herbicides, and pesticides. Farm operations are generally mechanized. Yields in these systems are considerably higher (2-4 t/ha) and more stable than in low-input systems.

Environmental impact

Peanut helps improve soil fertility through biological nitrogen fixation, and can thus contribute to significant improvements in the sustainability of cropping systems (Freeman et al., 1999).

Datasheet citation

Heuzé V., Thiollet H., Tran G., Bastianelli D., Lebas F., 2016. *Peanut seeds*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/55 *Last updated on October 4, 2016, 9:47*

Image credits

- Gilles Tran, AFZ
- Denis Bastianelli, CIRAD

Peanut seeds

Nutritional attributes

Peanut kernels are a very rich source of lipids (and therefore energy) as they contain about 45-50% oil and are also a rich source of protein (26-34%). Kernel composition can vary substantially as a function of market type, cultivar, growing environment, storage conditions, maturity, kernel size, and specific thermal processing conditions, among other factors. Peanut protein is deficient in lysine, methionine and threonine and diets. Oleic acid (C18:1); linoleic acid (C18:2) and palmitic acid (C16:0) account for more than 90% of the fatty acids of peanut oil (Davis et al., 2016). Peanut oil contains about 50% oleic acid and 30% linoleic acid but there are large variations in their respective proportions: reported values for oleic acid range from 35 to 82% and values for linoleic acid range from 3 to 43%, due to natural variations and also to the existence of oleic-rich (and linoleic-poor) varieties (Davis et al., 2016; Pattee, 2005). Peanut kernels contain minimum amounts of fibre and can be a good source of calcium and vitamin E (Davis et al., 2016).

Cull peanuts used whole contain the fibrous shells, so the fibre content of the pod can be as high as ADF 26 % and in any case variable. Protein and lipid content are lower than for the dehulled kernels (Myer et al., 2009b).

Potential constraints

Aflatoxins

Peanuts are particularly vulnerable to contamination by fungi *Aspergillus flavus* and *Aspergillus parasiticus.* These fungi produce aflatoxins, that are known to cause cancers in humans, increase incidents of hepatitis viruses B and C, lower the immune response, impair growth in children and cause childhood cirrhosis. In poultry and livestock, aflatoxin can cause feed refusal, loss of weight, reduced egg production, and contamination of milk (ICRISAT, 2016). Aflatoxin contamination may occur in the field, after peanuts are dug but before harvest, during transport, and during storage. Either elevated temperatures or drought stress alone increased aflatoxin production, but high temperatures appeared to have a greater impact. Key requirements of postharvest management of aflatoxin are control of seed moisture and insects. Both *A. flavus* and *A. parasiticus* are xerophiles and can grow and produce aflatoxin at relative moisture around 85%. Storage below this moisture or at 10°C will prevent aflatoxin production in storage (Payne, 2016).

In 1960, aflatoxin-contaminated peanut meal from Brazil fed to poultry killed thousands of turkey poults in the United Kingdom, drawing attention to these contaminants (FAO, 1979). New regulatory measures in importer countries such as European Union member states led to a significant restriction of the trade of peanut and peanut products, and particularly of those produced in sub-Saharan Africa (Waliyar et al., 2007; ICRISAT, 2016). As of 2016, the maximum authorised content in the EU for aflatoxin B1 in feed materials is 0.02 mg/kg (20 ppb or µg/kg) (Commission Directive 2003/100/EC).

Since the 1980s, the reduction of aflatoxins in peanut products have been the subject of considerable research focused on the following areas:

- Increase awareness of local populations about aflatoxin issues
- Implementation of pre-harvest, post-harvest and storage practices and technologies for mitigating contamination
- Identification/development and use of resistant peanut cultivars
- Biological control agents
- Methods for detoxifying peanut products

The objective of aflatoxin management in producing countries is both to decrease aflatoxin exposure in their populations and to increase the export of peanut products that are negatively impacted by aflatoxin regulations (Waliyar et al., 2007; ICRISAT, 2016). As of 2016, aflatoxin contamination in peanut production in tropical countries and particularly in low-input systems, still remains a major problem, as shown by many surveys conducted in China (Wu et al., 2016), Zambia (Bumbangi et al., 2016), Ethiopia (Chala et al., 2016), Nigeria (Ezekiel et al., 2013), Cameroon (Kana et al., 2013), India (Kolhe, 2016a) and Brazil (Oliveira et al., 2009). Aflatoxin contamination of peanut meal in these surveys sometimes reaches 100% with values well beyond international standards.

Progress in aflatoxin resistance breeding has been limited (Holbrook et al., 2016). Biological control using nonaflatoxigenic strains of *Aspergillus* has been shown to be effective in Argentina, Australia, the Philippines, and the US with reductions ranging from 85% to 98% (Payne, 2016). In Mali, a combined approach using resistant/tolerant cultivars, the application of lime and manure and better harvesting and drying techniques helped to reduce aflatoxin by 80-94% (ICRISAT, 2016).

Antinutritional factors

Like other legume seeds, peanuts contain substances with potential antinutritional effects, such as tannins, which are present in the seed coats (Sanders, 1979), lectins and trypsin inhibitors (Ahmed, 1986; Ahmed et al., 1988a; Ahmed et al., 1988a). These substances have received little attention, perhaps because the antinutritional factors in peanut seem less deleterious than those of other legumes. For instance, a comparison of soybean and peanut flour in rats showed that the raw peanut flour was much better tolerated than raw soybean flour even though lectin concentration and antitrypsic activity were similar in both seeds (Sitren et al., 1985). Peanut lectins can be fully inactivated by heat (moist heat being effective than dry heat) (Ahmed, 1986) so it is possible that regular conditions involved in peanut seeds and meal processing are enough to make peanut products safe for animal feeding. Still, tannins may be a contributing factor for low protein digestibility of peanut meals (Chiba, 2001).

Ruminants

Information about the use of peanuts in ruminants is limited. Trials conducted in Florida and Japan concluded that whole, raw peanuts may have potential as an energy and protein supplement for mature beef cows (Myer et al., 2009a; Myer et al., 2009b;

Saito et al., 2016).

Palatability

In the Florida trials, the peanuts were readily consumed by beef cows, but it took several hours for total consumption. In an earlier study, growing heifers did not readily consume whole peanuts, and the peanuts had to be blended with maize grain before they were readily consumed (Myer et al., 2009b).

Steers

In steers (265 kg) fed Bermuda grass hay, supplementation with 1.4 kg/d of either 50:50 maize and whole peanuts or 100% whole peanuts resulted in similar protein digestibility, but the 100% peanut supplementation reduced hay and diet DM intake and apparent digestibility of DM, ADF and NDF (Myer et al., 2009b).

Adult beef cows

In adult beef cows (573 kg) fed Bermuda grass hay, supplementation with 1.1 kg/d of either 50:50 maize and whole peanuts or 100% whole peanuts did not affect body condition score but live weight gain tended to be lower with the whole peanut supplement. Calf birth weight, survival rate and weaning weight and subsequent cow AI conception rate were not affected by treatment (Myer et al., 2009b).

Goats

In Japan, Shiba goats fed a diet containing 15% peanut kernels had a very high dietary lipid digestibility (83%) that could be partially attributed to the large proportion of unsaturated fatty acids, resulting in a high content in digestible nutrients. It was concluded that peanuts could be used as a high-energy and high-protein diet for ruminants (Saito et al., 2016).

Pigs

Whole peanuts can be a source of fat, protein and energy for pigs. However, attention should be paid to the low concentration in lysine and sulfur amino acids, to the high conent in unsaturated fatty acids, and to potential contamination by aflatoxins.

Growing pigs

Peanuts have been found as effective as added fat in improving feed efficiency, and peanut protein can be utilized efficiently when substituted for other protein supplements on a lysine basis. Maximum inclusion has been suggested to be 10% for diets of growing and finishing pigs (Newton et al., 1990). The includsion of 5% roasted peanuts was the optimum inclusion rate for weanling pigs (Haydon et al., 1987). The inclusion of 5% raw or roasted peanuts on an equal lysine basis (Newton et al., 1988) or addition of 10, 15, or 20% peanuts (Balogun et al., 1979b) had no effect on growth performance or nutrient digestibilities in growing pigs. Heat processing of whole peanuts reduced trypsin inhibitor activity, but it had no effect on pig performance (Balogun et al., 1979a). Pigs fed 20% peanuts had inferior carcass quality (soft fat) compared with those fed the soybean meal diet (Balogun et al., 1979b).

Sows

Peanuts are an excellent source of fat for sow diets. 12% raw and roasted peanuts could be substituted for 5% animal fat in lactation diets without any effect on reproductive performance (Haydon et al., 1990).

Hogging

Hogging, or hogging-off, is the practice of allowing pigs to feed on peanuts, which they root out of the soil when turned loose in the field. Hogging is not only used for cleaning up waste peanuts after harvesting, but fields have been planted for this purpose as a very cheap method of fattening pigs. This practice used to be common in the United States before the industrialisation of both peanut and pig production: in 1939, 25% of the peanut acreage in Georgia was used for hogging. In 2002, hogging-off had almost disappeared and only 3% of the acreage was grown for pig production (Hill, 2002; Thacker et al., 1992). It is necessary to supply the pigs with a mineral mixture that is high in salt and calcium. Ham from peanut-fed pigs is softer and juicier than normal ham. This can be counteracted, however, by finishing the pigs on a ration containing cottonseed meal, which has the opposite effect from peanuts (Sheely et al., 1942; Göhl, 1982).

Poultry

Information about the use of peanuts in poultry is limited. Peanut seeds probably have a good nutritive value, with high energy content provided by lipids, but their use as feed is not economically competitive. Two trials in the United States suggested that raw peanuts could be used as a partial source of protein in broiler diets. Broilers which were fed diets containing 12.5 or 25% raw peanuts had a heavier weight (4 weeks) and a better feed efficiency than those fed peanut meal, but their weight was lower than for the birds fed the maize/soybean control diet. In another trial, broilers fed a diet containing 10% raw peanuts were heavier than those fed the control diet, but there was no significant difference between the control diet and the diets containing 5%, 12.5% and 25% raw peanuts (Offiong et al., 1974).

Rabbits

No information seems available in the international literature on the use of peanut seeds in rabbit feeding. Nevertheless, any utilisation of this feed in rabbit feeding, including experimental studies, should take into account the deleterious effects of aflatoxin contamination in rabbits, as described for the peanut meal.

Datasheet citation

Heuzé V., Thiollet H., Tran G., Bastianelli D., Lebas F., 2016. *Peanut seeds*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/55 *Last updated on October 4, 2016, 9:47*

Image credits

- Gilles Tran, AFZ
- Denis Bastianelli, CIRAD

Peanut seeds

Tables of chemical composition and nutritional value

- Peanuts, without shells
- Peanuts, with shells

Avg: average or predicted value; SD: standard deviation; Min: minimum value; Max: maximum value; Nb: number of values (samples) used

Peanuts, without shells

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	95.5	2.7	90.0	99.0	10
Crude protein	% DM	29.5	2.5	25.6	34.0	11
Crude fibre	% DM	4.4	2.8	1.7	8.8	10
NDF	% DM	9.3		4.7	13.9	2
ADF	% DM	5.7				1
Lignin	% DM	2.2		0.8	3.5	2
Ether extract	% DM	47.6	3.6	43.5	52.6	6
Ash	% DM	2.6	0.3	2.2	3.3	10
Starch (polarimetry)	% DM	5.8				1
Total sugars	% DM	7.8				1
Gross energy	MJ/kg DM	29.3				*

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	0.8	0.2	0.6	0.9	3
Phosphorus	g/kg DM	4.6	1.2	3.3	6.0	4
Potassium	g/kg DM	7.1				1
Magnesium	g/kg DM	2.2				1

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	92.6				*
Energy digestibility, ruminants	%	98.4				*
DE ruminants	MJ/kg DM	28.8				*
ME ruminants	MJ/kg DM	23.0				*
Nitrogen digestibility, ruminants	%	89.9				1

Pig nutritive values	Unit	Avg	SD	Min	Max	Nb
Energy digestibility, growing pig	%	83.2				*
DE growing pig	MJ/kg DM	24.3				*
MEn growing pig	MJ/kg DM	23.5				*
NE growing pig	MJ/kg DM	19.0				*

The asterisk * indicates that the average value was obtained by an equation.

References

AFZ, 2011; CIRAD, 2008; Lim Han Kuo, 1967; Nehring et al., 1963; Pozy et al., 1996; Ravindran et al., 1994; Saito et al., 2016; Woodman, 1945

Last updated on 30/09/2016 17:11:37

Peanuts, with shells

Main analysis	Unit	Avg	SD	Min	Max	Nb
Dry matter	% as fed	92.9	0.2	92.7	93.1	3

Crude protein	% DM	20.4	3.8	16.2	23.4	3
Crude fibre	% DM	26.5		21.1	32.0	2
NDF	% DM	37.1		33.0	41.2	2
ADF	% DM	29.0		25.6	32.4	2
Lignin	% DM	10.6		8.8	12.3	2
Ether extract	% DM	31.9	12.3	17.7	39.1	3
Ash	% DM	4.0	2.0	2.7	6.3	3
Gross energy	MJ/kg DM	25.9				*

Minerals	Unit	Avg	SD	Min	Max	Nb
Calcium	g/kg DM	1.5		1.5	1.5	2
Phosphorus	g/kg DM	2.9		2.6	3.3	2
Potassium	g/kg DM	6.3		5.0	7.7	2
Sodium	g/kg DM	0.0				1
Magnesium	g/kg DM	1.5		1.5	1.5	2
Manganese	mg/kg DM	45				1
Zinc	mg/kg DM	25				1
Copper	mg/kg DM	6				1
Iron	mg/kg DM	250				1

Ruminant nutritive values	Unit	Avg	SD	Min	Max	Nb
OM digestibility, ruminants	%	85.6				*
Energy digestibility, ruminants	%	88.4				*
DE ruminants	MJ/kg DM	22.9				*
ME ruminants	MJ/kg DM	18.2				*
Nitrogen digestibility, ruminants	%	74.0				1

Pig nutritive values	Unit	Avg	SD	Min	Max	Nb
Energy digestibility, growing pig	%	48.4				*
DE growing pig	MJ/kg DM	12.5				*

The asterisk * indicates that the average value was obtained by an equation.

References

CIRAD, 1991; Myer et al., 2009; Neumark, 1970; Oyenuga, 1968

Last updated on 02/10/2016 18:44:33

Datasheet citation

Heuzé V., Thiollet H., Tran G., Bastianelli D., Lebas F., 2016. *Peanut seeds*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/55 *Last updated on October 4, 2016, 9:47*

Image credits

- Gilles Tran, AFZ
- Denis Bastianelli, CIRAD

Search Feedipedia Search

Automatic translation
Sélectionner une langue ▼

Feed categories
All feeds
Forage plants
- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants
Plant products/by-products
- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products
Feeds of animal origin
- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects
Other feeds
- Minerals
- Other products

Latin names
Plant and animal families
Plant and animal species

Resources
Broadening horizons
Literature search
Image search
Glossary
External resources
- Literature databases
- Feeds and plants databases
- Organisations & networks
- Books
- Journals

Peanut seeds

Description | Nutritional aspects | Nutritional tables | References

References

Ahmed, E. M. ; Ali, T. ; Sitren, H. S., 1988. Extraction and purification of lectin from florunner peanut seeds. Peanut Sci., 15 (2): 44-47

Ahmed, E. M. ; Applewhite, J. A., 1988. Characterization of trypsin inhibitor in Florunner peanut seeds (*Arachis hypogaea* L.). Peanut Sci., 15 (2): 81-84

Ahmed, E. M., 1986. Lectin quantitation in peanut and soybean seeds. Peanut Sci., 13 (1): 4-7

Akande, K. E. ; Doma, U. D. ; Agu, H. O. ; Adamu, H. M., 2010. Major antinutrients found in plant protein sources: their effect on nutrition. Pakistan J. Nutr., 9 (8): 827-832

ARIA, 2006. Explosion d'une citerne d'ammoniac le 24 mars 1992, Dakar, Sénégal. Ministère de l'environnement, ARIA, Fiche N°3485

Balogun, T. F. ; Koch, B. A., 1979. Raw or roasted groundnuts as a partial protein and energy source in rations for growing pigs. Trop. Agric., 56: 135-142

Balogun, T. F. ; Koch, B. A., 1979. Influence of trypsin inhibitor level and processing on the nutritional value of groundnuts for finishing pigs. Trop. Agric., 56: 245-251

Baughman, T. ; Grichar, J. ; Black, M. ; Woodward, J. ; Porter, P. ; New, L. ; Baumann, P. ; McFarland, M., 2012. Texas Peanut Production Guide. Texas A&M University

Blair, R., 2011. Nutrition and feeding of organic cattle. CAB Books, CABI

Bredon, R. M., 1957. Feeding of livestock in Uganda. Uganda Protectorate. Department of Veterinary Services and Animal Industry. Occasional Bulletin No. 1

Bumbangi, N. F. ; Muma, J. B. ; Choongo, K. ; Mukanga, M. ; Velu, M. R. ; Veldman, F. ; Hatloy, A. ; Mapatano, M. A., 2016. Occurrence and factors associated with aflatoxin contamination of raw peanuts from Lusaka district's markets, Zambia. Food Control, 68: 291-296

Ezekiel, C. N. ; Sulyok, M. ; Babalola, D. A. ; Warth, B. ; Ezekiel, V. C. ; Krska, R., 2013. Incidence and consumer awareness of toxigenic *Aspergillus* section Flavi and aflatoxin B 1 in peanut cake from Nigeria. Food Control, 30: 596-601

Chala, A. ; Mohammed, A. ; Ayalew, A. ; Skinnes, H., 2016. Natural occurrence of aflatoxins in groundnut (*Arachis hypogaea* L.) from eastern Ethiopia. Food control, 30: 602-605

Chiba, L. I., 2001. Proteins supplements. In: A. J. Lewis and L. L. Southern (eds.) Swine nutrition (second edition). p 35. CRC Press LLC, Boca Raton London New York Washington, D.C.

Chumpawadee, S., 2009. Degradation characteristics of tomato pomace, soybean hull and peanut pod in the rumen using nylon bag technique. Pakistan J. Nutr., 8 (11): 1717-1721

Cowart, D. ; Powell, S. ; Locke, M. ; Starling, R. ; Takash, J., 2016. Raw peanut processing. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 381-403

Dada, S. A., 2002. The utilization of water hyacinth (*Eichhornia crassipes*) by West African dwarf (WAD) growing goats. Afr. J. Biomed. Res., 4: 147-149

Davis, J. P. ; Dean, L. L., 2016. Peanut composition, flavor and nutrition. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 289-345

Dwivedi, S. L. ; Bertioli, D. J. ; Crouch, J. H. ; Valls, J. F. ; Upadhyaya, H. D. ; Fávero, A. ; Moretzsohn, M. ; Paterson, A. H., 2006. Peanut. In: Chittaranjan, K. (Ed.), Genome Mapping and Molecular Breeding in Plants, Vol. 2 Oilseeds, 115-151

Ekpenyong, T. E., 1986. Nutrient composition of tropical feedstuffs available for rabbit feeding. J. Appl. Rabbit Res., 9 (3): 100-102

Ezekiel, C. N. ; Sulyok, M. ; Babalola, D. A. ; Warth, B. ; Ezekiel, V. C. ; Krska, R., 2013. Incidence and consumer awareness of toxigenic Aspergillus section Flavi and aflatoxin B 1 in peanut cake from Nigeria. Food Control, 30: 596-601

FAO, 2016. FAOSTAT. Food and Agriculture Organization of the United Nations, Rome, Italy

Fletcher, S. M. ; Shi Zhaolin, 2016. An overview of world peanut markets. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 267-387

Freeman, H.A. ; Nigam, S. N. ; Kelly, T. G. ; Ntare, B. R. ; Subrahmaniyam, P. ; Boughton, D., 1999. The World groundnut economy: facts, trends, and outlook. Patancheru 502 324, Andhra Pradesh, India: ICRISAT, 52 pp.

Göhl, B., 1982. Les aliments du bétail sous les tropiques. FAO, Division de Production et Santé Animale, Roma, Italy

Haydon, K. D. ; Newton, G. L., 1987. Effect of whole-roasted peanuts fed in either simple or complex diets on starter pig performance. Swine Report, Univ. of Georgia, Athens, Special Publication No. 44:25

Haydon, K. D. ; Newton, G. L. ; Dove, C. R. ; Hobbs, S. E., 1990. Effect of roasted or raw peanut kernels on lactation performance and milk composition of swine. J. Anim. Sci., 68 (9): 2591-2597

Hill, G. M., 2002. Peanut by-products fed to cattle. Vet. Clin. Food Anim., 18 (2): 295–315

Holbrook, C. C. ; Burow, M. D. ; Chen, C. Y. ; Pandey, M. K. ; Liu Linfeng ; Chagoya, J. C. ; Chu Ye ; Ozias-Akins, P., 2016. Recent advances in peanut breeding and genetics. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 111-145

ICRISAT, 2016. Aflatoxin timeline. ICRISAT

Kana, J. R. ; Gnonlonfin, B. J. J. ; Harvey, J. ; Wainaina, J. ; Wanjuki, I. ; Skilton, R. A. ; Teguia, A., 2013. Assessment of aflatoxin contamination of maize, peanut meal and poultry feed mixtures from different agroecological zones in Cameroon. Toxins (Basel), 5 (5): 884–894

Kolhe, A. S., 2016. Natural occurence of alfatoxins in groundnut seeds, cakes and oil of Jalagon District of Maharashtra. In: Kolhe A. S., Mycoflora and biochemical alterations during chronic aflatoxicosis in domestic rabbits, Laxmi book publication, Solapur India., 38-44

Lau, A. ; Ako, H., Werner-Washburne, W., 1980. Survey of plants for enterokinase activity. Biochem. Biophys. Res. Comm., 92 (4): 1243-1249

Lebas F. ; Perez J. M., 1998. Mycotoxins and rabbit feeding. Cuniculture, 25: 17-22

Lim Han Kuo, 1967. Animal feeding stuffs. Part 3. Compositional data of feeds and concentrates. Malay. Agric. J., 46 (1): 63-79

List, G. R., 2016. Processing and food uses of peanut oil and protein. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 405-428

Myer, R. O. ; Gorbet, D. W., 1998. Raw cull (oil stock) peanuts as a fat source in diets for swine. Proc. Oil & Crop Science Society of Florida, 57: 92-95

Myer, R. O. ; Brendemuhl, J. H., 2001. Miscellaneous Feedstuffs. In: Swine Nutrition (eds. AJ Lewis and LL Southern), pp. 1-26, CRC Press, Boca Raton London New York Washington, D.C.

Myer, R. O. ; Hill, G. M. ; Hansen, G. R. ; Gorbet, D. W., 2009. Evaluation of whole, in-shell peanuts as a supplement feed for beef cows. 2009 Florida Beef Report

Myer, R. O. ; Hill, G. M. ; Hersom, M., 2009. Cull whole peanuts as a feed supplement for beef cows. AN212, Animal Sciences Department, UF/IFAS Extension

Myung, K. H. ; Kim, Y. S. ; Sun, S. S., 1986. Improving nutritive value of peanut straw by NaOH treatment. Korean J. Anim. Sci., 28 (2): 94-98

Naik, A. H., 1967. Chemical composition of Tanzania feedingstuffs. E. Afr. Agric. For. J., 32 (2): 201-205

Neumark, H., 1970. Personal communication. Volcani Institute of Agricultural Reseach, Israel

Newton, G. L. ; Haydon, K. A., 1988. Raw or roasted peanuts in growing-finishing diets. Swine Report, University of Georgia, Athens, Special Publication No. 56:41

Newton, G. L. ; Hale, O. M. ; Haydon, K. D., 1990. Peanut kernels. In: Nontraditional Feed Sources for Use in Swine Production, Thacker, P. A. and R. N. Kirkwood, Eds., Butterworths, Stoneham, MA, 285

Offiong, S. A. ; Flegal, C. J. ; Sheppard, C. C., 1974. The use of raw peanuts and peanut meal in practical chick diets. E. Afr. Agric. For. J., 39 (4): 344-348

Oil World, 2015. Oil World Annual 2015. ISTA Mielke GmbH, Hamburg

Oliveira, C. A. ; Gonçalves, N. B. ; Rosim, R. E. ; Fernandes, A. M., 2009. Determination of aflatoxins in peanut products in the northeast region of São Paulo, Brazil. Int. J. Mol. Sci., 10 (1): 174-183

Owusu-Domfeh, K. ; Christensen, D. A. ; Owen, B. D., 1970. Nutritive value of some Ghanaian feedstuffs. Can. J. Anim. Sci., 50: 1-14

Oyenuga, V. A., 1968. Nigeria's foods and foodstuffs. Ibadan, University Press

Pattee, H. E., 2005. Peanut oil. In: Bailey's Industrial Oil and Fat Products, Sixth Edition, John Wiley & Sons, Inc

Payne, G. A., 2016. Mycotoxins and product safety. In: Stalker, H. T., Wilson R. F. (Eds), 2016, Peanuts Genetics, Processing, and Utilization. AOCS Press: 347-361

Piva, G. ; Galvano, F. ; Pietri, A. ; Piva, A., 1995. Detoxification methods of aflatoxins. A review. Nutr. Res., 15 (5): 767-776

Putnam, D. H. ; Oplinger, E. S. ; Teynor, T. M. ; Oelke, E. A. ; Kelling, K. A. ; Doll, J. D., 1991. Peanut. In: Alternative Field Crop Manual, University of Wisconsin-Exension, Cooperative Extension

Rosen, G. D., 1958. Groundnuts and groundnut meal. In: Processed plant protein foodstuffs. New York, Academic Press

Saito, C.; Asano, S.; Kato, C.; Kobayashi, S.; Musha, A.; Kuribayashi, H.; Moriguchi, S.; Seto, Y.; Kawashima, T.; Kobayashi, M.; Ishizaki, S.; Kajikawa, H., 2016. Nutritional values and antioxidative activities of whole peanuts and peanut skins for ruminant feeds. Anim. Sci. J., 87 (1): 54-60

Sanders, T. H., 1979. Effect of variety, location and year on tannin content of peanut seed coats. Peanut Sci., 6 (1): 62-64

Sangines, G. L. ; Corrales E. C. ; Perez Gil Romo, F., 1984. Protective effect of formaldehyde on protein of whole groundnut plant silage. Archivos Latinoamericanos de Nutricion, 34 (4): 724-734

Sen, K. C., 1938. The nutritive values of Indian cattle feeds and the feeding of animals. Indian Council of Agricultural Research, New Dehli, Bulletin No. 25, 1-30

Sheely, W. J. ; Becker, R. B. ; Mehrhof, N. R. ; Brown, H. L., 1942. Feeding peanut meal and hay to beef cattle, dairy cows, swine and poultry. Bulletin 115, August 1942, Agricultural Extension Service, Gainsville Florida

Shukla, P. C. ; Talpada, P. M. ; Desai, M. C. ; Valand, M. I. ; Desai, H. B., 1985. Composition and nutritive value of groundnut haulm as an industrial byproduct. Indian J. Anim. Nutr., 2 (2): 89-90

Singh, F.; Diwakar, B., 1993. Nutritive value and uses of pigeonpea and groundnut. Skill Dev. Series no. 14, ICRISAT, Patancheru, Andhra Pradesh, India

Singh, F. ; Diwakar, B., 1993. Nutritive value and uses of pigeonpea and groundnut. Skill Development Series no. 14, ICRISAT

Sitren, H. S. ; Ahmed, E. M. ; George, D. E., 1985. *In vivo* and *in vitro* assessment of antinutritional factors in peanut and soy. J. Food Sci., 50 (2): 418–423

Thacker, P. A. ; Kirkwood, R. N., 1992. Non traditional feeds for use in swine production. CRC Press, Taylor and Francis Group, Boca Raton, USA

USDA, 2016. Production, Supply and Distribution Online. Foreign Agricultural Service

Viroben, G. ; Fremy, J. M. ; Delort-Laval, J., 1983. Treatment of peanut meal with aqueous ammonia at ambient temperature: effect on reduction of aflatoxin M1 content in milk. Le Lait, 63 (625-626): 171-179

Waliyar, F. ; Ntare, B. R. ; Diallo, A. T. ; Kodio, O. ; Diarra, B., 2007. On-farm management of aflatoxin contamination of groundnut in West Africa: A synthesis report. Project Report, ICRISAT

Woodman, H. E., 1945. The composition and nutritive value of feeding stuffs. United Kingdom. Ministry of Agriculture, Fisheries and Food. Bulletin No. 124

Wu, F., Guclu, H., 2012. Aflatoxin regulations in a network of global maize trade. PLoS One 7, e45151

Wu, L. X. ; Ding, X. X. ; Li, P. W. ; Du, X. H. ; Zhou, H. Y. ; Bai, Y. Z. ; Zhang, L. X., 2016. Aflatoxin contamination of peanuts at harvest in China from 2010 to 2013 and its relationship with climatic conditions. Food Control, 60: 117-123

71 references found

Datasheet citation

Heuzé V., Thiollet H., Tran G., Bastianelli D., Lebas F., 2016. *Peanut seeds*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/55 *Last updated on October 4, 2016, 9:47*

Image credits

- Gilles Tran, AFZ
- Denis Bastianelli, CIRAD

Share / Save