

USING OATS AS FEED FOR DOMESTIC ANIMALS



EN 2013



OATS

Oat cultivation and the use of oats for animal food have long traditions in Finland. Oats account for more than a quarter of all grain produced in Finland. Finland's clean soil and cool climate are well suited for oat cultivation. The short but light growing season, along with the right cultivars and good cultivation techniques, produce top-quality oats in terms of weight and kernel size, well suited for both human consumption and animal feed.

The variety of oats cultivated in Finland is covered. The animal feed industry uses both covered and dehulled oats. Finnish oats are white in colour and perfect for both milling and feed purposes.

Oats are used relatively extensively in the Nordic region and the southern parts of the United States as feed for domestic animals. Dehulled oats are comparable to corn and wheat as feed. Because of their good feed value and

protein, content oats have beneficial health effects. Oats can also be mixed with other grains.

Oats can be used for both ruminants and monogastric animals. Oats are suited for the feeding of pets, such as cats and dogs, and game animals, and can be added to animal feeds as a cereal ingredient. The fat content of oats

increases their energy content, which is an important attribute in horse feeds. In pet foods, oats prevent allergies and do not irritate the intestine. Oats improve

fur shine, reduce diarrhoea, and are well suited for the prevention of gluten absorption disorders.

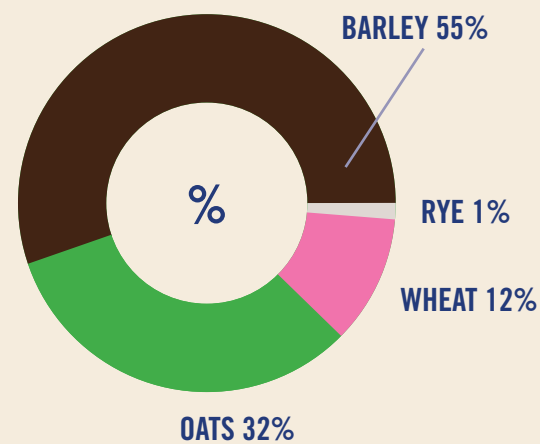
Finland has good export and storage capacity, the grain is dry, clean, and safe to buy and to use. Oats have been exported to the United States and Europe since the 1980s. During the 2011–2012 harvest year, Finland exported 363,000 tonnes of oats.



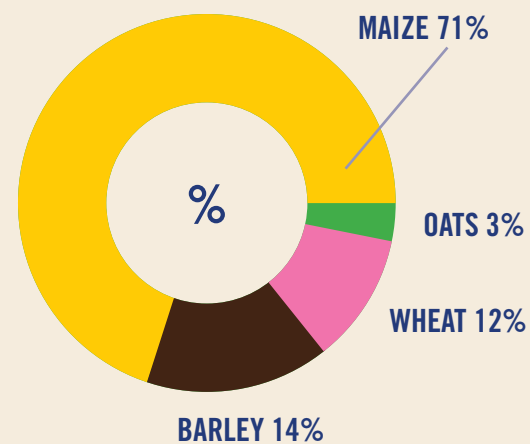
PRODUCTION AND USE OF FINNISH OATS

In 2011, the Finnish oats harvest totalled 1,043,000 tonnes. Of that, 326,000 tonnes were used as farm feed. Industry bought 200,000 tonnes of oats from farmers. Of that, 63,000 tonnes was used by the food industry and 137,000 tonnes by the animal feed industry. During the 2010–2011 harvest year, oats exports came to 267,000 tonnes.

THE SHARE OF DIFFERENT CEREALS IN FEED USE IN FINLAND



THE SHARE OF DIFFERENT CEREALS IN FEED USE IN THE WORLD



PRODUCTION AND USE OF FINNISH OATS:

| | |
|------------------|-------------|
| Oats production: | 1,043,000 t |
| Farms: | 326,000 t |
| Industry: | 200,000 t |
| Food industry: | 63,000 t |
| Feed industry: | 137,000 t |

OATS EXPORT

| | |
|-----------|-----------|
| 2010/2011 | 267,000 t |
| 2009/2010 | 400,000 t |
| 2008/2009 | 297,000 t |
| 2007/2008 | 387,000 t |
| 2006/2007 | 360,000 t |

QUALITY CHAIN OF FINNISH OATS

WINTER FROSTS
KILL DISEASES
AND PESTS

CLEAN SOIL AND WORLD'S
CLEANEST P-FERTILIZERS >
NO HEAVY METALS

WARM-AIR DRYING PREVENTS GROWTH
OF HARMFUL MOULDS AND ENSURES
GOOD KEEPING QUALITIES

ON-FARM STORAGES
AND TRACEABLE
PRODUCTION PROCESS





OATS AS FEED

The chemical composition of oats is well balanced, nutritionally valuable and safe.

OATS DIFFER FROM OTHER CEREALS:

- High protein content and well-balanced amino acid composition
- Oat oil is of good quality and improves the energy value of oats
- High vitamin B1 content

Oats have a number of characteristics, which increase their feed value. The feed value of oats depends on the kernel size. Generally, large and heavy kernels contain more energy than small and light kernels. On average, the hull accounts for 23–30% of an oat kernel.

Fat content of oats is higher than that of other cereals, which increases the energy content in feed. The digestibility of starch of oats has been observed to be better than that of some other cereals, such as maize or barley.

The fatty acids content of oats is more favourable than that in other cereals, and oats have a high content of fat

that is rich in oleic and linoleic acids. Oats contain vitamins B1, B2 and B6, and vitamins A, K and E. Oats also contain valuable minerals, micronutrients, antioxidants and sterols.

The high oil content raises the energy value of oats. Compared to barley or maize, oats have 1–3 percentage points more crude protein. Compared with other cereals, oats have a more balanced amino acid composition and a higher concentration of essential amino acids, such as lysine.

Dehulling oats or using naked oats significantly improves feed value and palatability. Naked oats are excellently suited for poultry, horses and, due to their high energy content, piglets and lactating sows.

Of all cereals, oats have the highest fat content. Kernel fat content can vary between 2% and 12%. The fatty acid composition of oats is highly unsaturated. Palmitic, oleic and linoleic acids form 95% of the fatty acids of oats. Myristic, stearic and linolenic acids are found in small quantities. Compared to wheat and barley, oats contain more oleic acid and less linolenic acid.

FEED VALUES OF DIFFERENT CEREALS

| | OATS | DEHULLED OATS | BARLEY | MAIZE | WHEAT |
|------------------|------|---------------|--------|-------|-------|
| g/kg DM | | | | | |
| Ash | 38 | 22 | 29 | 15 | 20 |
| Crude protein | 134 | 162 | 126 | 100 | 125 |
| Crude fat | 60 | 94 | 22 | 46 | 22 |
| Crude fibre | 103 | 22 | 49 | 24 | 23 |
| Starch | 460 | 650 | 600 | 710 | 680 |
| g/kg DM | | | | | |
| Calcium | 0,8 | 0,6 | 0,5 | 0,3 | 0,5 |
| Magnesium | 1,3 | 1,5 | 1,4 | 1,2 | 1,6 |
| Sodium | 0,2 | 0,1 | 0,1 | 0,1 | 0,1 |
| Phosphorus | 4 | 5,2 | 4,1 | 3,1 | 4,5 |
| MJ/kg DM | | | | | |
| ME value cow | 12,3 | 14,2 | 13,2 | 14,5 | 13,7 |
| ME value horse | 11 | 13 | 11,12 | 11,59 | 11,59 |
| ME value chicken | 12,8 | 16,7 | 13,1 | 15,9 | 14,7 |
| ME value pig | 9,8 | 13 | 10,7 | 11,9 | 11,4 |

Feed values of oats and dehulled oats compared to barley, maize and wheat.

AMINO ACID CONTENT OF DIFFERENT CEREALS

| | OATS | DEHULLED OATS | WHEAT | BARLEY | MAIZE |
|---------------|------|---------------|-------|--------|-------|
| Lysine | 4,2 | 4,3 | 2,8 | 3,4 | 2,8 |
| Threonine | 3,5 | 3,4 | 3 | 3,3 | 3,8 |
| Methionine | 1,7 | 2,8 | 1,6 | 1,7 | 2,3 |
| Cysteine | 2,8 | 2,9 | 2,2 | 2,5 | 2,1 |
| Argenine | 6 | 7,2 | 4,5 | 5 | 4,5 |
| Histidine | 2,2 | 2,4 | 2,3 | 2,4 | 2,6 |
| Isoleucine | 3,8 | 4 | 3,5 | 3,2 | 3,7 |
| Leucine | 7,1 | 7,6 | 6,6 | 6,8 | 11,5 |
| Valine | 5,4 | 5,4 | 4,5 | 5,1 | 5 |
| Phenylalanine | 5 | 4 | 4,5 | 5 | 4,5 |

The essential amino acid content of oats, wheat and barley, g/100 g crude protein.

FATTY ACID CONTENT OF DIFFERENT CEREALS

| FATTY ACIDS | OATS | BARLEY | WHEAT | MAIZE |
|---------------------|---------|---------|---------|---------|
| Palmitic acid 16:0 | 13 - 26 | 2 - 3 | 3 - 5 | 9 - 12 |
| Stearic acid 18:0 | 1 - 4 | 6 - 7 | 6 - 7 | 1 - 3 |
| Oleic acid 18:1 | 25 - 53 | 20 - 29 | 20 - 30 | 29 - 37 |
| Linoleic acid 18:2 | 24 - 48 | 19 - 34 | 21 - 40 | 45 - 57 |
| Linolenic acid 18:3 | 1 - 3 | 1 - 3 | 1 - 4 | 0,5 - 2 |

Fatty acid content of different cereals, g/100 g.



HORSES

- Oats are well suited as horse feed, and they are the main feed grain of horses. Compared with other cereals (wheat, rye and barley) oats have a high lysine and fat content.
- The digestibility of protein and starch of oats is better than that of maize.

Oats have a number of attributes that make it a better feed for horses compared with other cereals. The fat content of oats increases the energy content and reduces the amount of starch in feeding. Starch in oats is mainly made of easily digestible amylose, which quickly breaks into glucose in the small intestine. Oats are suitable for use as the sole concentrated feed for horses.

Oats are a commonly used grain in horse feeds in Europe and North America, and they compete on the same feed market as maize. Finnish oats are in demand as horse feed, especially in the United States, Germany and the United Kingdom.



COWS

OATS ARE RECOMMENDED FOR COWS BECAUSE THEY:

- Increase milk yields
- Produce healthier milk fat
- Are palatable to cows

Due to their high energy content and palatability, dehulled oats are excellently suited for the feed mixes of calves. Dehulled oats are used in the feeds for both the starting and the growing-finishing stages of animal production.

Although oats contain less metabolic energy, compared to other cereals oats in cows' feed give increased milk yields and energy corrected milk yields (ECM).

The fact that oats have an increasing effect on milk production is likely, and largely, due to high fat content and the efficient use of nutrients in oats.

OATS HAVE A BENEFICIAL IMPACT ON THE NUTRITIONAL QUALITY OF MILK FAT:

- The proportion of saturated fatty acids of cow's milk fat is reduced and that of the unsaturated fatty acids is increased
- Increased content of oleic acids (C18:1) and stearic acids (C18:0)
- Reduced palmitic acid (C16:0) content
- Reduced content of myristic (C14:0) and lauric (12:0) acids, resulting in softer milk fat

On Finnish farms, every feed mix contains either oats or oats with another cereal. The use of barley and oats as a mixture is the most common and favourable practice on farms, typically in equal portions. The recommended amount of wheat is about 30% of the mix. The maximum amount of grain that can be used in the daily ration is 8–10 kilograms, and a single portion must not exceed 4 kilograms.

FEED MIXES FOR DAIRY COWS

| | | | | | |
|--------|------|-----|-----|-----|-----|
| Oats | 100% | 70% | 70% | 50% | 60% |
| Barley | | 30% | | 50% | 20% |
| Wheat | | | 30% | | 20% |

Use of different cereals in the feeding of cows in Finland.



SHEEP

- Sheep can digest whole oats.
- Lambs can best utilise a barley-oats mix, 20–30% of which is oats.

Sheep feeds are mainly based on hay, silage and grain. Of the cereals, oats and barley are the most used and are palatable for sheep. Grains need not be ground or squashed because sheep can digest whole grains with the help of its first two compartments of the ruminant stomach.

A lamb eats about 0.5–3 kilograms of feed per day, of which oats may account for a maximum of 1.5 kilograms; the amount depends greatly on the feed as well as the age, size and growth rate of the lamb. Wheat is also palatable and can account for 20–50% of the mixes. When using higher quantities it may cause digestion disorders.

Due to their high starch content, cereal grains pose an acidosis risk. A cereal-based diet should be introduced gradually over a period of 10 to 20 days to allow the rumen time to adapt. The risk of acidosis in descending order is wheat, barley and oats. Of these, oats is the most suitable for sheep.

| | LAMBS | SHEEP | PREGNANT EWES | SUCKLING EWES |
|-------------|-------|-------|---------------|---------------|
| Barley (kg) | 2.2 | 3 | 4.1 | 9.5 |
| Oats (kg) | 2.6 | 3.5 | 4.9 | 11 |
| Hay (kg) | 4 | 5.4 | 7.4 | 14 |

Weekly use of different cereals in the feeding of sheep.



OTHER ANIMALS

- Oats are suitable for feeding pets and game.
- In pet foods, all grain material can be replaced by dehulled and cooked oats.

Oats make a suitable ingredient for pet foods. Good attributes of oats in the feeding of pets include thin hull, large grain and high fat content.

BENEFITS OF OATS IN PET FOODS:

- Can suit animals allergic for other cereals
- Improve fur shine
- Helps to keep normal intestine functions
- Can suit animals suffering from gluten absorption disorder

Compared with other cereals, it has been noted that dehulled oats are a very suitable option for grain material for dog foods. Dehulled oats have a higher nutritional value than rice.



PIGS

- Dehulled oats are excellently suited for the feeding of piglets and lactating sows. They are very digestible and have high energy, protein and fat content.
- Oat hulls is an excellent feed for pregnant sows.

In swine feeding, the most important contribution of feed grains is to provide dietary energy, starch and protein. High-weight grains have greater feeding value than lower-weight grains with a greater proportion of starch. Hull content explains energy value of oats better than weight. The dietary energy value of dehulled oats is better than that of wheat, making oats well suited for high-energy feeds.

HEALTH EFFECTS OF OATS:

- Helps to keep normal intestine functions
- Can reduce risk of constipation in sows

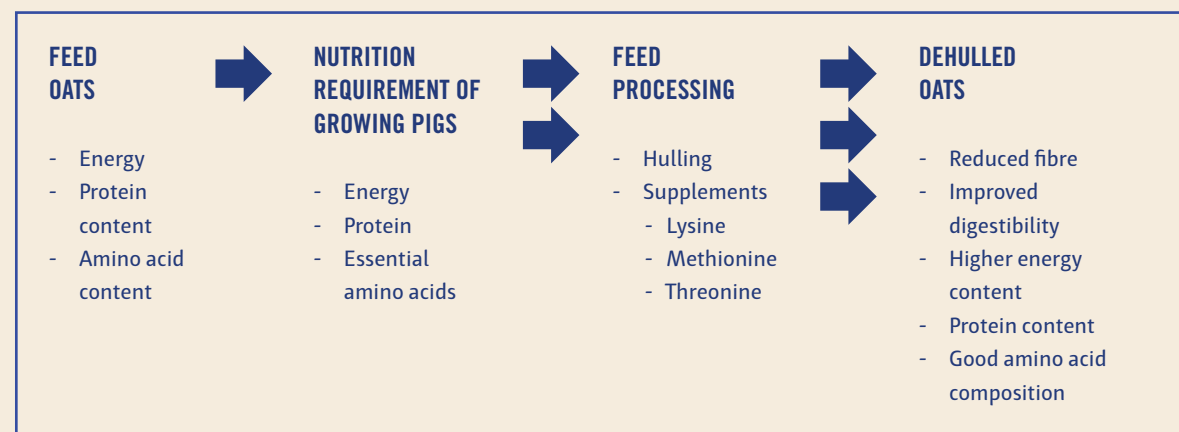
Dehulled oats is an excellent feed for piglets and lactating sows; palatability and digestibility of the high energy and protein content are very good. Oats with hulls are excellently suited for pregnant sows but in other production phases the use of oats is limited because it fills up the gastrointestinal tract and its compartments, and because of the quantity and quality of fat in oats. Oats in swine diets have helped to minimise stress behaviour in pigs. ▶



OATS ARE ALWAYS RECOMMENDED FOR USE AS A MIX WITH OTHER CEREALS, AS SHOWN IN THE FOLLOWING TABLE.

| | PIGS UNDER 25 KG | GROWING PIGS UNDER 55 KG | GROWING PIGS OVER 55 KG | GESTATING SOWS | LACTATING SOWS |
|---------------|------------------|--------------------------|-------------------------|-----------------|-----------------|
| Barley | 30% | No restrictions | No restrictions | No restrictions | No restrictions |
| Oats | < 15 | < 40% | < 40% | No restrictions | < 40% |
| Dehulled oats | < 25% | < 15% | < 10% | < 40% | < 25% |
| Wheat | No restrictions | No restrictions | No restrictions | 15% | No restrictions |

Recommended blends of cereals in the feeding of pigs.





POULTRY

- Whole oats are suitable for poultry feeding.
- Naked oats provide a competitive alternative to wheat in feeds.
- The energy level of naked oats or dehulled oats can be higher than that of wheat.
- The amino acid content of dehulled oats is better for birds than that of other cereals.
- Research suggests that the digestibility of oats fat is 95% and that of barley 83%. In poultry diets, fats improve feed utilisation.

In the Nordic region, oats are an important grain source for poultry feeds. Oats contain plenty of insoluble fibre. In their diet, birds need the presence of coarse insoluble fibre in order to improve the functioning of the gizzard and digestion, and to keep calm. If birds do not get enough fibre from feed, they get it by feather-pecking other birds.

Fullness of the gizzard is especially important for laying hens, since it is known to reduce feather-pecking behaviour. It is therefore recommended that chicken feed mixes contain around 20% oats. Towards the end of the laying period, the proportion of oats can be raised to 50% of the amount of grain.

| | CONTROL DIET (RICE) | COARSE OATS HULL |
|---|---------------------|------------------|
|  Gizzard contents excluding feathers, g DM | 0,67 | 3,58 |
| Feathers in gizzard g DM | 0,79 | 0,023 |
| TOTAL | 1,46 | 3,6 |

Oats hull (10%) in bird diet reduces the amount of feathers in the gizzard

Oat feed has changed the fatty acid composition of eggs so that it is much healthier for poultry. Oat feed can also affect egg taste, thickness of shell, firmness of the albumen and colour of the yolk. Optimal linoleic acid level improves growth, egg production, feed utilisation and yolk colour. For the production of maximal weight and number of eggs, the content of linoleic acid should be 1.6%–2.0%.

The egg-laying results (egg weight, output g/hen/day and egg-laying rate %) are improved when barley or wheat

is replaced with oats. In poultry diets, dietary fat of oats is very digestible and partly replaces the lowering of energy value caused by greater fibre content. 60% of dehulled oats

is the maximum amount in a feed mix, but with amino acid supplement, the portion of dehulled oats can be raised to 87% without a decrease in egg production.

THE EFFECT OF OATS ON LAYING PERFORMANCE, FEED INTAKE, FEED CONVERSION RATIO AND HEN'S WELFARE

| SHARE OF OATS IN FEED MIXES | 0% | 20% | 40% | 60% | 80% | 100% |
|------------------------------|------|-------|-------|-------|-------|-------|
| LAYING | | | | | | |
| Egg weight g | 59.8 | 60 | 59.4 | 59.7 | 59.7 | 59.1 |
| Egg output g/hen/day | 50.6 | 49.5 | 50.1 | 50.7 | 49.7 | 49.8 |
| Laying rate % | 84.7 | 82.8 | 84.6 | 85.2 | 83.5 | 84.5 |
| Shell % of egg weight | 9.2 | 9.2 | 9.1 | 9.1 | 9.2 | 9.2 |
| Yolk colour (points) | 9.5 | 9.4 | 9.1 | 9.1 | 9.3 | 9.3 |
| FEED INTAKE | | | | | | |
| Feed g/hen/day | 116 | 113.7 | 113.2 | 115.3 | 114.4 | 112.9 |
| Crude protein g/hen/day | 21.2 | 21 | 20.5 | 20.6 | 19.9 | 19.3 |
| Energy (ME) MJ/hen/day | 1.19 | 1.18 | 1.17 | 1.21 | 1.17 | 1.12 |
| FEED CONVERSION RATIO | | | | | | |
| Feed kg/kg of eggs | 2.29 | 2.3 | 2.26 | 2.28 | 2.31 | 2.27 |
| Crude protein g/kg of eggs | 419 | 426 | 410 | 407 | 401 | 387 |
| ME MJ/kg of eggs | 23.2 | 23.5 | 23.1 | 23.5 | 23.1 | 22.2 |
| HEN'S WELFARE | | | | | | |
| Mortality % | 8.9 | 5.7 | 5.5 | 5.6 | 6.9 | 2.2 |

Fullness of the gizzard is especially important for laying hens, since it is known to reduce feather-pecking behaviour. It is therefore recommended that chicken feed mixes contain around 20% oats. Towards the end of the laying period, the proportion of oats can be raised to 50% of the amount of grain.

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**IN FINLAND THERE ARE SEVERAL GRAIN DEALERS AND
OTHER ACTORS IN THE GRAIN INDUSTRY.**

**FURTHER INFORMATION:
WWW.VYR.FI
WWW.KAURAYHDISTYS.FI**

**THIS BROCHURE HAS BEEN PREPARED BY
THE FINNISH CEREAL COMMITTEE AND FINANCED BY
THE MINISTRY OF AGRICULTURE AND FORESTRY.**