[Template:Other uses](/wiki/Template:Other_uses" \o "Template:Other uses) [Template:Taxobox](/wiki/Template:Taxobox) [thumb|right|Landscape with *Chenopodium quinoa* near Cachilaya,](/wiki/File:Lanscape_with_Chenopodium_quinoa_Cachilaya_Bolivia_Lake_Titicaca.JPG) [Lake Titicaca](/wiki/Lake_Titicaca), [Bolivia](/wiki/Bolivia)

**Quinoa** ([Template:IPAc-en](/wiki/Template:IPAc-en), from [Quechua](/wiki/Quechuan_languages) [*Template:Lang*](/wiki/Template:Lang) or [*Template:Lang*](/wiki/Template:Lang))[[1]](#cite_note-1) is a species of the [goosefoot](/wiki/Chenopodium) [genus](/wiki/Genus) (***Chenopodium quinoa***), a [grain](/wiki/Grain) [crop](/wiki/Crop) grown primarily for its edible [seeds](/wiki/Seed). It is a [pseudocereal](/wiki/Pseudocereal), similar in some respects to [buckwheat](/wiki/Buckwheat), rather than a true [cereal](/wiki/Cereal), as it is not a member of the [true grass family](/wiki/Poaceae). As a [chenopod](/wiki/Chenopodioideae), quinoa is closely related to species such as [beetroots](/wiki/Beetroot), [spinach](/wiki/Spinach) and [tumbleweeds](/wiki/Tumbleweed). As a member of the [Amaranthaceae](/wiki/Amaranthaceae) family, it is related to and resembles [amaranth](/wiki/Amaranth), which is also a pseudocereal. After harvest, the seeds must be processed to remove the coating containing the bitter-tasting [saponins](/wiki/Saponin). The seeds are in general cooked the same way as rice and can be used in a wide range of dishes. The leaves are eaten as a [leaf vegetable](/wiki/Leaf_vegetable), much like [amaranth](/wiki/Amaranth), but commercial availability of quinoa greens is limited.

The nutrient composition is favourable compared with common cereals. Quinoa seeds contain [essential amino acids](/wiki/Essential_amino_acid) like [lysine](/wiki/Lysine) and acceptable quantities of calcium, phosphorus, and iron.[[2]](#cite_note-2) It is high in protein, and is tolerant of dry soil. The [Food and Agriculture Organization](/wiki/Food_and_Agriculture_Organization) of the United Nations (FAO) declared 2013 to be the International Year of Quinoa.[[3]](#cite_note-3) *Chenopodium formosanum* is a Taiwanese variant of Red quinoa that is [endemic](/wiki/Endemism) to Taiwan, and is widely grown in Eastern and Southern [Taiwanese Aboriginal](/wiki/Taiwanese_aborigines) cultures.

Quinoa originated in the [Andean](/wiki/Andes) region of [Peru](/wiki/Peru), [Bolivia](/wiki/Bolivia), [Ecuador](/wiki/Ecuador), [Colombia](/wiki/Colombia) and [Chile](/wiki/Chile),[[4]](#cite_note-4) and was domesticated 3,000 to 4,000 years ago for human consumption in the [Lake Titicaca](/wiki/Lake_Titicaca) basin, though archaeological evidence shows a non-domesticated association with pastoral herding some 5,200 to 7,000 years ago.[[5]](#cite_note-5) Similar *Chenopodium* species, such as pitseed goosefoot ([*Chenopodium berlandieri*](/wiki/Chenopodium_berlandieri)) and fat hen ([*Chenopodium album*](/wiki/Chenopodium_album)), were grown and domesticated in North America as part of the [Eastern Agricultural Complex](/wiki/Eastern_Agricultural_Complex) before [maize](/wiki/Maize) agriculture became popular.[[6]](#cite_note-6) Fat hen, which has a widespread distribution in the [Northern Hemisphere](/wiki/Northern_Hemisphere), produces edible seeds and greens much like quinoa, but in smaller quantities.

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## Biology[[edit](/index.php?title=(none)&action=edit&section=1)]

[thumb|left|Quinoa seeds](/wiki/File:QuinoaGrains.jpg) [thumb|right|Quinoa plant before flowering|324x324px](/wiki/File:Chenopodium_quinoa_before_flowering.jpg) *Chenopodium quinoa* is a [dicotyledonous](/wiki/Dicotyledon) annual plant usually about [Template:Convert](/wiki/Template:Convert) high. It has broad, generally pubescent, powdery, smooth (rarely) to lobed leaves normally arranged alternately. The woody central [stem](/wiki/Plant_stem) is branched or unbranched depending on the variety and may be green, red or purple. The flowering [panicles](/wiki/Panicle) arise from the top of the plant or from leaf axils along the stem. Each panicle has a central axis from which a secondary axis emerges either with flowers (amaranthiform) or bearing a tertiary axis carrying the flowers (glomeruliform).[[7]](#cite_note-7) The green [hypogynous](/wiki/Ovary_(plants)) flowers have a simple [perianth](/wiki/Petal) and are generally self-fertilizing.[[7]](#cite_note-7)[[8]](#cite_note-8) The fruits are about [Template:Convert](/wiki/Template:Convert) in diameter and of various colors—from white to red or black, depending on the [cultivar](/wiki/Cultivar).[[9]](#cite_note-9)

### Natural distribution[[edit](/index.php?title=(none)&action=edit&section=2)]

*Chenopodium quinoa* is believed to have been domesticated in the Peruvian Andes from wild or weed populations of the same species.[[10]](#cite_note-10) There are non-cultivated quinoa plants (*Chenopodium quinoa* var. *melanospermum*) that grow in the area it is cultivated; these may either be related to wild predecessors, or they could be descendants of cultivated plants.[[11]](#cite_note-11)

### Saponin content[[edit](/index.php?title=(none)&action=edit&section=3)]

[thumb|153x153px|left|Red quinoa, cooked](/wiki/File:Red_quinoa.png) In their natural state, the seeds have a coating of bitter-tasting [saponins](/wiki/Saponin), making them [unpalatable](/wiki/Unpalatable). Most of the grain sold commercially has been processed to remove this coating.[[12]](#cite_note-12) This bitterness has beneficial effects during cultivation, as it is unpopular with birds and therefore requires minimal protection.<ref name=AlternativeFieldCropsManual>[Template:Cite web](/wiki/Template:Cite_web)</ref> The genetic control of bitterness involves quantitative inheritance; lowering the saponin content through selective breeding to produce sweeter, more palatable varieties is complicated by about 10% cross-pollination.[[13]](#cite_note-13) The [toxicity category rating](/wiki/Toxicity_category_rating) of quinoa saponins treats them as mild eye and respiratory irritants and as a low gastrointestinal irritant.[[14]](#cite_note-14)<ref name=Biopesticides>[Template:Cite web](/wiki/Template:Cite_web)</ref> The saponin is a toxic [glycoside](/wiki/Glycoside), a main contributor to its [hemolytic](/wiki/Hemolysis) effects when combined directly with blood cells. In South America, quinoa saponin has many uses, including as a detergent for clothing and washing and as an antiseptic for skin injuries.[[14]](#cite_note-14) High levels of [oxalic acid](/wiki/Oxalic_acid) are in the leaves and stems of all species of the [*Chenopodium*](/wiki/Chenopodium) genus, and are also in the related genera of the [*Amaranthaceae*](/wiki/Amaranthaceae) family.[[15]](#cite_note-15) The risks associated with quinoa are minimal, provided it is properly prepared and the leaves are not eaten to excess.

## Nutritional value[[edit](/index.php?title=(none)&action=edit&section=4)]

[Template:Nutritional value](/wiki/Template:Nutritional_value) Nutritional evaluations indicate that raw (uncooked) quinoa is a rich source of [protein](/wiki/Protein), [dietary fiber](/wiki/Dietary_fiber), several [B vitamins](/wiki/B_vitamins) and [dietary minerals](/wiki/Dietary_minerals), [nutrients](/wiki/Nutrients) whose contents are substantially reduced by cooking (table).[[14]](#cite_note-14)[[16]](#cite_note-16) Analysis shows its protein is relatively high in [essential amino acids](/wiki/Essential_amino_acids).[[17]](#cite_note-17){| class="wikitable sortable" |+Table of amino acids [[18]](#cite_note-18)! colspan="2" |Amino Acids and protein in Quinoa |- !Essential Amino Acid !Quinoa mg/g protein |- |Methionine + Cystine |21 |- |Lysine |51 |- |Tryptophan |8 |- |Valine |45 |- |Threonine |30 |- |Phenylalanine + tyrosine |74 |- |Histadine |25 |- |Isoleucine |37 |- |Leucine |64 |} In a [Template:Convert](/wiki/Template:Convert) serving, *cooked* quinoa provides 120 [calories](/wiki/Calories) and is a moderate source (10-19% of the [Daily Value](/wiki/Daily_Value), DV) of protein, dietary fiber, [folate](/wiki/Folate), and the dietary minerals, [iron](/wiki/Iron), [zinc](/wiki/Zinc), [magnesium](/wiki/Magnesium_in_biological_systems), [phosphorus](/wiki/Phosphorus), and [manganese](/wiki/Manganese) (table).

It is [gluten](/wiki/Gluten)-free and considered easy to digest. Because of these characteristics, it is being considered as a possible crop in [NASA's](/wiki/NASA) [Controlled Ecological Life Support System](/wiki/Controlled_Ecological_Life_Support_System) for long-duration human occupied space flights.[[19]](#cite_note-19) It has a notably short germination period: only 2–4 hours in [water](/wiki/Water) is enough to make it sprout, as opposed to 12 hours with [wheat](/wiki/Wheat).[[20]](#cite_note-20) This process softens the seeds, making them suitable for [salads](/wiki/Salad) and other foods.

## Cultivation[[edit](/index.php?title=(none)&action=edit&section=5)]

### Climate requirements[[edit](/index.php?title=(none)&action=edit&section=6)]

[thumb|Harvested quinoa seeds|left](/wiki/File:Harvested_seeds_of_homegrown_Chenopodium_quinoa.jpg) The plant's growth is highly variable due to a high complexity of different subspecies, varieties and [landraces](/wiki/Landrace) (domesticated plants or animals adapted to the environment in which they originated). However, in general it is undemanding and altitude-hardy. It is grown from coastal regions to over [Template:Convert](/wiki/Template:Convert) in the Andes near the equator, with most of the cultivars being grown between [Template:Convert](/wiki/Template:Convert) and [Template:Convert](/wiki/Template:Convert). Depending on the variety, optimal growing conditions are in cool climates with temperatures that vary between [Template:Convert](/wiki/Template:Convert) during the night to near [Template:Convert](/wiki/Template:Convert) during the day. Some cultivars can withstand lower temperatures without damage. Light frosts normally do not affect the plants at any stage of development, except during flowering. Mid-summer frosts during flowering, often occurring in the Andes, lead to sterilization of the pollen. Rainfall conditions are highly variable between the different cultivars, ranging from [Template:Convert](/wiki/Template:Convert) during growing season. Growth is optimal with well-distributed rainfall during early growth and development and dry conditions during seed maturation and harvesting.[[7]](#cite_note-7) Quinoa has been cultivated in the United States, primarily in the high elevation [San Luis Valley](/wiki/San_Luis_Valley) (SLV) of [Colorado](/wiki/Colorado) where it was introduced in 1982.[Template:Citation needed](/wiki/Template:Citation_needed) In this high-altitude desert valley, maximum summer temperatures rarely exceed [Template:Convert](/wiki/Template:Convert) and night temperatures are about [Template:Convert](/wiki/Template:Convert). Due to the short growing season, North American cultivation requires short-maturity varieties, typically of Bolivian origin.

Several countries within Europe, including France, England, Holland, Belgium, Germany and Spain now have successfully grown quinoa on a commercial scale.[[21]](#cite_note-21) Within the UK, crops are grown as population and mechanically harvested in September.[[22]](#cite_note-22)

### Sowing[[edit](/index.php?title=(none)&action=edit&section=7)]

Quinoa plants do best in sandy, well-drained soils with a low nutrient content, moderate salinity, and a soil pH of 6 to 8.5.

The [seedbed](/wiki/Seedbed) must be well prepared and drained to avoid waterlogging. In the Andes, the seeds are normally broadcast over the land and raked into the soil. Sometimes it is sown in containers of soil and transplanted later.

### Cultivation management[[edit](/index.php?title=(none)&action=edit&section=8)]

Yields are maximised when [Template:Convert](/wiki/Template:Convert) [N](/wiki/Nitrogen)/hectare is available.[Template:Citation needed](/wiki/Template:Citation_needed) The addition of phosphorus does not improve yield. In eastern North America, it is susceptible to a [leaf miner](/wiki/Leaf_miner) that may reduce crop success and which also affects the common weed and close relative [*Chenopodium album*](/wiki/Chenopodium_album), but *C. album* is much more resistant.

### Harvesting and handling[[edit](/index.php?title=(none)&action=edit&section=9)]

[thumb|left|Threshing quinoa in Peru](/wiki/File:Camino_a_Puno_Golpeando_quinoa.JPG) Quinoa grain is usually harvested by hand and rarely by machine, because the extreme variability of the maturity period of most Quinoa cultivars complicates mechanization. Harvest needs to be precisely timed to avoid high seed losses from shattering, and different panicles on the same plant mature at different times. The seed yield (often around 3 t/ha up to 5 t/ha) is comparable to wheat yields in the Andean areas. In the United States, varieties have been selected for uniformity of maturity and are mechanically harvested using conventional small grain combines. The plants are allowed to stand until they are dry[Template:Clarify](/wiki/Template:Clarify) and the grain has reached a moisture content below 10%. Handling involves threshing the seedheads and winnowing the seed to remove the [husk](/wiki/Husk). Before storage, the seeds need to be dried in order to avoid [germination](/wiki/Germination).[[7]](#cite_note-7) Dry seeds can be stored raw until washed or mechanically processed to remove the pericarp to eliminate the bitter layer containing saponins. [Template:Clear](/wiki/Template:Clear)

## History and culture[[edit](/index.php?title=(none)&action=edit&section=10)]

### Early history[[edit](/index.php?title=(none)&action=edit&section=11)]

Quinoa was first domesticated by [Andean](/wiki/Andes) peoples around 3,000 to 4,000 years ago.<ref name=Superfood>[Template:Cite web](/wiki/Template:Cite_web)</ref> It has been an important staple in the [Andean cultures](/wiki/Andean_civilizations) where the plant is indigenous but relatively obscure in the rest of the world.<ref name=Keen>[Template:Cite book](/wiki/Template:Cite_book)</ref> The [Incas](/wiki/Inca), who held the crop to be sacred,[[23]](#cite_note-23) referred to it as *chisaya mama* or "mother of all grains", and it was the Inca emperor who would traditionally sow the first seeds of the season using "golden implements".[[23]](#cite_note-23) During the [Spanish conquest of South America](/wiki/Conquistador), the colonists scorned it as "food for Indians",[[24]](#cite_note-24) and suppressed its cultivation, due to its status within indigenous religious ceremonies.[[25]](#cite_note-25) The [conquistadors](/wiki/Conquistador) forbade quinoa cultivation for a time[[26]](#cite_note-26) and the Incas were forced to grow wheat instead.[[27]](#cite_note-27)

### Rising popularity and crop value[[edit](/index.php?title=(none)&action=edit&section=12)]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| World Quinoa Production (thousand metric tons) | | | | | | |
| **|1961** | **1970** | **1980** | **1990** | **2000** | **2010** | **2014** |
| [Template:PER](/wiki/Template:PER) | 22.5 | 7.3 | 16.3 | 6.3 | 28.2 | 41.1 | 114.3 |
| [Template:BOL](/wiki/Template:BOL) | 9.2 | 9.7 | 8.9 | 16.1 | 23.8 | 36.1 | 77.4 |
| [Template:ECU](/wiki/Template:ECU) | 0.7 | 0.7 | 0.5 | 0.7 | 0.7 | 0.9 | 0.8 |
| **Total** | **|17.7** | **|23.0** | **|78.1** | **192.5** |  |  |  |
| Export price[[28]](#cite_note-28) USD/kg |  | $0.080 | $0.492 | $0.854 | $1.254 | $3.029 |  |
| *Source:* [*Food and Agriculture Organization of the United Nations*](/wiki/Food_and_Agriculture_Organization_of_the_United_Nations) *(FAO)* [[29]](#cite_note-29) | | | | | | | |

The grain has become increasingly popular in the United States, Canada, Europe, Australia, China and Japan where it is not typically grown, increasing crop value.[[30]](#cite_note-30) Between 2006 and early 2013 quinoa crop prices tripled.[[31]](#cite_note-31) In 2011, the average price was US$3,115 per ton with some varieties selling as high as $8,000 per ton.[[32]](#cite_note-32) This compares with [wheat](/wiki/Wheat) prices of $9 per bushel (about $340 per ton). Since the 1970s, producers’ associations and cooperatives have worked toward greater producer control of the market. The higher prices make it harder for people to purchase, but also brings a livable income for farmers and enables many [urban refugees](/wiki/Urban_refugees) to return to working the land.[[33]](#cite_note-33) The popularity of quinoa grain in non-indigenous regions has raised concerns over [food security](/wiki/Food_security). Due to continued widespread poverty in regions where it is produced and because few other crops are compatible with the soil and climate in these regions, it has been suggested that the inflated price disrupts local access to food supplies.[[31]](#cite_note-31) In 2013, *The Guardian* compared it to asparagus cultivated in Peru, a cash crop criticized for excessive water use,[[34]](#cite_note-34) as "feeding our apparently insatiable 365-day-a-year hunger for this luxury vegetable[...]"[[31]](#cite_note-31) It has been suggested that, as people rise above subsistence-level income, they choose higher-status Western processed foods. However, anthropologist Pablo Laguna states that farmers are still saving a portion of the quinoa crop for their own use, and that the high prices affect nearby city dwellers more, but consumption in cities has traditionally been lower. According to Laguna, the net benefit of increased revenue for farmers outweighs the costs, saying that it is "very good news for small, indigenous farmers".[[35]](#cite_note-35)The transformation from a healthy staple food for farming families and communities into a product that is held to be worth too much to keep for oneself and one's family is an ongoing process. It is seen as a valuable resource that can bring in far greater amounts[Template:Clarify](/wiki/Template:Clarify) of cheap, low nutrient foods such as pasta and rice. It used to be seen as a peasant food that provided farming families with a very important source of nutrition, but now occupies a spectrum from an everyday food of urban Bolivia's middle class to a luxury food in the Peruvian capital of Lima where "it sells at a higher per pound price than chicken, and four times as much as rice".<ref name=complicated>[Template:Cite web](/wiki/Template:Cite_web)</ref> Efforts are being made in some areas to distribute it more widely and ensure that farming and poorer populations have access to it and have an understanding of its nutritional importance. These include incorporating it into free school breakfasts and in government provisions distributed to pregnant and nursing women in need.<ref name=complicated/>

### Kosher controversy[[edit](/index.php?title=(none)&action=edit&section=13)]

Quinoa has become popular in the Jewish community as a substitute for the [leavened grains](/wiki/Chametz) that are forbidden during the [Passover](/wiki/Passover) holiday. Several [kosher](/wiki/Kosher) certification organizations refuse to certify it as being kosher for Passover, citing reasons including its resemblance to prohibited grains or fear of cross-contamination of the product from nearby fields of prohibited grain or during packaging.[[36]](#cite_note-36) In December 2013, the [Orthodox Union](/wiki/Orthodox_Union), the world's largest [kosher certification agency](/wiki/Kosher_certification_agency), announced it would begin certifying quinoa as kosher for Passover.[[37]](#cite_note-37)

## International Year of Quinoa[[edit](/index.php?title=(none)&action=edit&section=14)]

[thumb|right|Logo of International Year of Quinoa 2013|alt=Logo of International Year of Quinoa 2013](/wiki/File:Official_Logo_for_the_International_Year_of_Quinoa.jpg) The [United Nations](/wiki/United_Nations) [General Assembly](/wiki/United_Nations_General_Assembly) declared 2013 as the "International Year of Quinoa" [[38]](#cite_note-38)[[39]](#cite_note-39)[[40]](#cite_note-40) in recognition of ancestral practices of the [Andean](/wiki/Andean) people, who have preserved it as food for present and future generations, through knowledge and practices of living in harmony with nature. The objective is to draw the world’s attention to the role that quinoa could play in providing food security, nutrition and poverty eradication, in support of achieving [Millennium Development Goals](/wiki/Millennium_Development_Goals).

## Gallery[[edit](/index.php?title=(none)&action=edit&section=15)]

<gallery class="center"> File:500g bag of quinoa.jpeg|500 g bag of quinoa File:Quinoa.jpg|Quinoa File:Reismelde.jpg|Quinoa plants File:Quinoa\_flower.JPG|Quinoa flower File:Dev\_black\_seed\_in\_quinoa\_flower.JPG|Developing black quinoa seed File:Quinoa-cornflakes.jpg|Quinoa flakes File:Chenopodium quinoa -red faro- MHNT.BOT.2007.43.66.jpg|Chenopodium quinoa -red faro- - [MHNT](/wiki/MHNT) </gallery>

## References[[edit](/index.php?title=(none)&action=edit&section=16)]

[Template:Reflist](/wiki/Template:Reflist)

## Further reading[[edit](/index.php?title=(none)&action=edit&section=17)]

* [Template:Cite journal](/wiki/Template:Cite_journal)
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## External links[[edit](/index.php?title=(none)&action=edit&section=18)]

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