100 Days Super Food Crop

QUINOA

CULTIVATION GUIDE

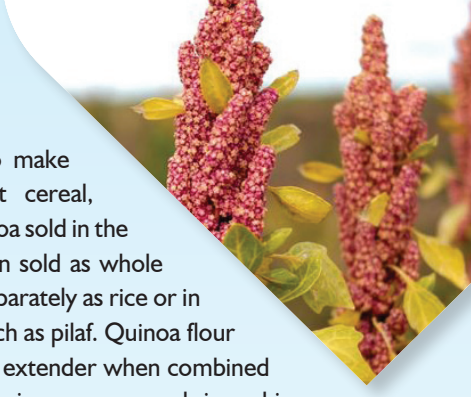
INTRODUTCION

Quinoa is a grain crop that is grown for its edible seeds and It is pronounced Keen-wah. It is an annual dicotyledonous plant and grows about 1 to 1.5 meter in height. Quinoa seeds are used as substitute of rice. Quinoa seeds are highly nutritional and have high percent of protein compared to other cereals. It is native to the Andes Mountains of Bolivia, Chile, and Peru and has been eaten continuously for 5,000 years by people who live on the mountain plateaus and in the valleys of Peru, Bolivia, Ecuador, and Chile. Quinoa means "mother grain" in the Inca language. This crop is used as a staple food and remains an important food crop worldwide now days. In India, quinoa farming has bright future due to its high protein content and less carbohydrates compared to rice. The challenge for Indian farmers is to get the seeds. Quinoa is also grown for the purpose of fodder (green manuring). Quinoa extract is also used in soaps, shampoo and body milk. Bolivia, Peru and Ecuador are top production countries of quinoa in the world.

Quinoa is also in the same botanical family as sugarbeet, table beet, and spinach, and it is susceptible to many of the same insect and disease problems as these crops. Quinoa is sometimes referred to as a "pseudocereal" because it is a broadleaf non-legume that is grown for grain unlike most cereal grains which are grassy plants. It is similar in this respect to the pseudocereals buckwheat and amaranth.

USES

Quinoa is a highly nutritious food. The nutritional quality of this crop has been compared to that of dried whole milk by the Food and Agriculture Organization (FAO) of the United Nations. The protein quality and quantity in quinoa seed is often superior to those of more common cereal grains. Quinoa is higher in lysine than wheat, and the amino acid content of quinoa seed is considered well-balanced for human and animal nutrition, similar to that of casein.



Quinoa is used to make flour, soup, breakfast cereal, and alcohol. Most quinoa sold in the United States has been sold as whole grain that is cooked separately as rice or in combination dishes such as pilaf. Quinoa flour works well as a starch extender when combined with wheat flour or grain, or corn meal, in making biscuits, bread, and processed food.

Seed coats (pericarp) are usually covered with bitter saponin compounds that must be removed before human consumption. Saponins may also be toxic to fish. Deresination (removal of the pericarp and the saponins by mechanical or chemical means) does not affect the mineral content of the seed (Johnson and Croissant, 1990). The marketable seed is usually white in color. The leaves are frequently eaten as a leafy vegetable, like spinach. Seed imported from growers in South America is sold in the United States in health-food stores and gourmet food shops at high prices.

Quinoa grain has a lower sodium content and is higher in calcium, phosphorus, magnesium, potassium, iron, copper, manganese, and zinc than wheat, barley, or corn The determination of the mineral content from Colorado quinoa trials showed a similar relationship, but differences from other grains were less conspicuous.

GROWTH HABITS

Plants grow from 1 1/2 to 6 1/2 ft in height, and come in a range of colors that vary from white, yellow, and pink, to darker red, purple, and black. Quinoa has a thick, erect, woody stalk that may be branched or unbranched, and alternate, wide leaves that resemble the foot of a goose. Leaves on younger plants are usually green; but as the plant matures, they turn yellow, red, or purple. The root

system develops from a tap root to form a highly branched system that makes plants more resistant to drought. Varieties of quinoa mature in 90 to 125 days after planting in southern Colorado. Early-maturing

varieties are recommended because of the short growing season at these high elevations.

Quinoa is usually self pollinated, but cross pollination does occur at rates of up to 10 to 15% (Risi and Galwey, 1989). Seed is produced in large clusters on a panicle that resembles that of sorghum. The seed is similar in size to millet (0.8 to 0.11 in. in diameter) and has two flat surfaces and rounded sides, which resembles an aspirin tablet. Seeds can be black, red, pink, orange, yellow, or white in color. The seed color is due to a resinous coating that contains two to six percent saponin. The embryo comprises 60% of the volume within the pericarp, and this results in the higher protein content of the seed in comparison to cereal grains.

CLIMATE

Quinoa requires short day lengths and cool temperatures for good growth. Areas in South America where it is still produced tend to be marginal agricultural areas that are prone to drought and have soils with low fertility. Cultivated quinoa will flower and produce seed at high elevations between 7,000 and 10,000 ft also since it requires a cool temperature for good vegetative growth. Research reported that temperatures which exceeded 45°C tended to cause plant dormancy or pollen sterility. In several years of trials near the Twin Cities, Minnesota, quinoa plants have failed to set seed; probably due to high temperatures. Quinoa plants are usually tolerant to light frosts up to 5°C. Plants should not be exposed to temperatures below 5°C. However, plants are not affected by temperatures down to 3°C after the grain has reached the soft-dough stage. Quinoa will flower earlier when grown in areas with shorter daylengths.

SOIL

This crop grows well on sandy-loam to loamy-sand soils it can also be grown in black soils and red Soils. Marginal agricultural soils are frequently used to grow quinoa. These soils have poor or excessive drainage, low natural fertility, or very acidic (pH of 4.8) to alkaline (8.5) conditions.

SEED PREPARATION AND GERMINATION

Quinoa prefers cool soil conditions (25° to 35°C). Germination occurs within 24 to 48 hours after planting when adequate moisture is present, and seedlings emerge in three to five days. Quinoa seeds, like those of spinach, may not germinate if conditions are warm and may need to be refrigerated for a week (vernalized) to obtain adequate germination.

CULTURAL PRACTICES

- **Land Preparation :**

Land should be given couple of ploughings to make weed free and bring the soil to fine tilth stage. Supplementing with organic manures and fertilizers like- Vermicompost- Which provide nutrition and earthworms to land, Neem Cake- It is organic insecticide, which is helpful to eradicate all soil borne insects, Gypsum- It acts as a conditioner to the soil which results in soil aeration and Trichoderma- This is fungicide which is very useful to destroy all soil borne harmful fungus. These all are beneficial in getting a good yield of the crop

- **Seedbed Preparation :**

Quinoa requires a level, well-drained seedbed in order to avoid waterlogging.

• Method and Rate of Seeding :

Seeds should be planted at a depth of 1/2 to 1 in. depending on soil type and available soil moisture. Ile small size of the seed makes it susceptible to both dehydration and waterlogging when planted too shallow, or deep, respectively. Row width can vary, but rows should be spaced by a minimum of 12 inches. Varieties have been grown in rows 20 to 30 in. apart. Stands of 130,000 plants/acre appear to be optimal for growing conditions in India. A stand of this density would require 5 kg of seeds per acre. Seeding rates are usually doubled when growing conditions are not optimal. Better stands are obtained when seed is planted in a moist soil, instead of irrigating after planting prior to emergence. Field trials in some parts of the world indicated that increasing plant density resulted in a slightly earlier maturity, greater seed yield, and less -branching of plants.

• Water Requirements :

This crop is somewhat drought tolerant with a water requirement of 10 to 15 in. per year (precipitation and irrigation combined on sandy-loam or loamy-sand soils). Studies on crop water use conducted during 1987 found that the application of lower amounts of water reduced plant height by 50% with only an 18% reduction in yield. Crops planted during late April to mid-May did not usually need irrigation until mid-June when the soil was near field capacity at planting time. Plants should not be irrigated until the two- or three-leaf stage. Rainfall in July has usually been sufficient during research trials to supply the crop until August. Excessive irrigation after stand establishment usually produces tall, lanky plants with no yield improvement. Damping off and severe stunting of plants will occur with excessive irrigation in the seedling stages.

• Fertility Requirements :

Quinoa responds well to nitrogen fertilizer. Organic Fertilizers and manures are recommended for quinoa cultivation as stated above.

• Weed control :

Weed control in quinoa fields is difficult since plants grow slowly during the first two weeks after emergence. There are no registered herbicides for quinoa at this time. Preemergence herbicide trials have been conducted in field and greenhouse locations. Several herbicides were used safely on quinoa, but were variable in weed control. Competition from weeds is greater when quinoa is planted later in the growing season. Kochia and lambs' quarters numbers can be reduced when field irrigation is followed by cultivation before seeding. Pigweed emerges too late in the growing season to depend on cultivation for weed control. Early planting may be the most effective means to control pigweed since the quinoa will have a good start in growth before the pigweed emerges.

• Diseases :

Disease and pest problems may arise after a

crop like quinoa is introduced to a new production area. Viruses found on spinach or beets have been observed in quinoa fields. Many of these viruses are transmitted by aphids or leafhoppers. Several of the viruses tested produce symptoms, yet research needs to be conducted to determine if any cause significant damage. Diseases such as damping off (Sclerotium rolfsii), downy mildew (Peronospora farinosa), stalk rot (Phoma exigua var. foveata), leaf spot (Ascochyta hyalospora), grey mold (Botrytis cinerea), and bacterial blight (Pseudomonas sp.) have also caused significant losses in South America, North America, and Great Britain.

- **Insects and Other Pests :**

A wide variety of insect pests can damage quinoa during seed germination up through harvest and seed storage in production areas. Tarnished plant bug, stem borer, flea beetles, aphids, leafhoppers, beet armyworm are common pests found in quinoa farming. Seed in the panicle is subject to feeding losses by birds. Quinoa, like some other grains, evolved a chemical defense against the feeding activity of insects and animals with the production of bitter saponins in the pericarp. However, saponins are easily washed out by rain and may not totally prevent feeding losses.

- **Harvesting :**

Usually quinoa crop will be ready for harvesting in 3 months to 4 months after sowing depending on the variety. Plants have a sorghum-like seed head at maturity. Harvest usually begins when the seed can barely be dented with a fingernail and plants have dried, turned a pale yellow or red color, and leaves have dropped. The seed should thresh easily by hand at this time. Field dry down is usually acceptable and plants are harvested easily with a combine. A sorghum header attachment is recommended for quinoa, although platform headers can usually be used as well, without a large crop loss. Cylinder speed and air flow of combines are usually greatly reduced. Smaller screens are used than with cereal grains due to the small size and lighter weight of quinoa seed. A fanning mill and gravity separator is usually necessary to remove trash from the seed after combining. Grain must be dry before storage. Quinoa stover contains little fiber and subsequently provides little crop residue. Rain during harvest will cause problems since mature seed will germinate within 24 hours after exposure to moisture.

- **Drying and Storage :**

The seed must remain dry during storage. Prior to using quinoa in food processing, the saponins in the pericarp are removed by soaking them in water or by mechanical methods, such as with a rice polisher or a machine similar to those used to remove wheat bran.

- **Yield :**

Generally on an average yield of 1200-1500 kg to 1700 kg of grains per acre can be expected. However, with proper farm management practices, fertilization and improved varieties, yield of up to 4 tonnes per hectare of quinoa grain can be achieved and green manure or fodder of 5 to 10 tonnes per hectare can be obtained.

DOCUMENTATION OF ACTIVITIES

The documentation of all the activities starting from cultivation to post-harvest processing should be in the continuation and maintained properly. Records should be kept for each activity of cultivation such as sowing, weeding, irrigation, harvesting, and of post-harvest processing after harvest to sorting, drying, grading, packing and storage, with details of time and type of activity that refers to a complete history and ensure traceability of the final product.

PER ACRE COST OF CULTIVATION

S.N.	PARTICULARS	ACTIVITY	AMOUNT
1	**Field Preparation**	Deep Ploughing, Leveling, Cultivating	2,000/-
2	**Planting Materials**	5 Kg @ Rs.1,000/Kg	5,000/-
3	**Manure/ Fertilizer**	Vermicompost, Trichoderma, Neem Cake, Gypsum	5,000/-
4	**Intercultural operation**	Seed Broadcasting, Irrigation Cutting, and Post Harvesting	5,000/-
Total Expenses			**17,000/-**

PER ACRE OUTPUT

S.N.	PRODUCTION DETAILS	YIELD PER ACRE	BUYBACK PRICE PER KG	TOTAL AMOUNT
1	Quinoa Seeds per Acre	**1500 Kg**	**Rs. 50/-**	**Rs. 75,000/-**
2	Total Expenses (Per acre)			
3	Total Income (100 Days)			**Rs. 58,000/-**

The all information given in this training manual are subject to provide only a basic idea and information of organic farming, medicinal plant cultivation and other related works. The information is sourced from various sources like- agriculture institutes, online platforms and other agri allied institutions, which may vary as per situation and place.

इस प्रशिक्षण मैनुअल में दी गई सभी जानकारी केवल जैविक खेती, औषधीय पौधों की खेती और अन्य संबंधित कार्यों का एक मूल विचार और जानकारी प्रदान करने के अधीन हैं। जानकारी विभिन्न स्रोतों ली गई होने के कारण स्थिति और स्थान के अनुसार बदल सकती है।

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