Post-Harvest Processing

- Quinoa seeds have a bitter saponin coat
- Soak overnight, rinse, dry, package, or grind
- Sort seeds by size and color using sieves
- Can use machines (Quinoa Pearler) for saponin removal, grading, and cleaning
- Store in plastic or polypropylene bags, or metal silos

Uses of Quinoa

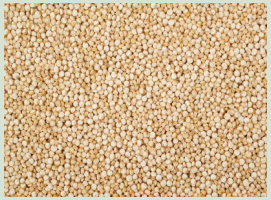
- **Seeds**: Flour, breakfast cereal, bread, couscous, soups, stews and sauces
- **Leaves**: Used in salads, as animal fodder
- **Residues**: Used for livestock or processed products or making compost
- **Saponin**: Used in cosmetics and pharmaceuticals

Quinoa Varieties

- Him Shakti (Released by AICRN on potential crops by NBPGR)

Quinoa based cropping systems

- Chickpea + Quinoa
- Soybean + Quinoa
- Greengram + Quinoa
- Blackgram + Quinoa



Cost of Cultivation (INR per ha)

Sl N.	Particulars	Activity	Amount (Rs.)
1	Filed Preparation	Ploughing, levelling, layout	5,000
2	Seeds	5 kg @100 per kg	500
3	Seed sowing and gap filling/thinning	Mixing of seeds with soil and sowing; gap filling/ thinning	2000
4	Manures/ fertilizers	Compost, vermi compost, urea, SSP, MOP	8000
5	Intercultural operations	Hoeing and weeding	5000
6	Harvesting	Cutting of plants	3000
7	Threshing & cleaning	Beating and winnowing of panicles	5000
8	Seed Pearling	Removal of seed coat	5000
	Total cost		**33,500**
1	Quinoa seeds (without processing)	1500 kg@ Rs 80 per kg	1,20,000 **(B:C ratio = 3.5: 1)**
2	Quinoa seeds (with processing)	1200 kg@ Rs 200 per kg	2,40,000 **(B: C ratio = 7.2: 1)**

Technical Folder No. 83

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Package of Practices for Quinoa cultivation in Shallow Basaltic Soils

ICAR - National Institute of Abiotic Stress Management

Malegaon, Baramati, Pune, Maharashtra 413 115

Web: niam.res.in

Introduction

Common name: Quinoa, Keenwah, Quinua

Scientific name: *Chenopodium quinoa* Willd.

Family: Chenopodiaceae

Group: Pseudocereal

Quinoa, traditionally cultivated in the Andes mountains, has gained global recognition mainly for its gluten-free, protein-rich seeds. It is often referred as "Mother of grains" due to its superior nutritional profile especially for its excellent balance of essential amino acids. Besides, the crop is highly adaptable to different environments and can thrive well in marginal soils with minimal rainfall. Although the crop began its journey in Bolivia, Peru, and Chile, it is now grown in more than 100 countries worldwide. Its remarkable adaptability, coupled with impressive nutritional profile, low input requirements, and high market price (exceeding $ 3000 per ton), makes quinoa a valuable climate resilient crop for enhancing livelihoods and alleviating poverty.

Nutritional Importance

- Quinoa provides high energy similar to beans, rice, maize, and wheat.
- It's a rich source of protein (14%), fiber, essential amino acids, and minerals, while being gluten-free.
- It is renowned for being a complete protein, meaning it contains all nine essential amino acids in adequate proportions for human nutrition—a rarity among plant based foods.

Botanical Description

- **Height**: 50–200 cm (depends on variety and conditions)
- **Roots**: Deep, fibrous, and strong-helps with drought resistance
- **Stem**: Cylindrical at the base, angled at the branches
- **Leaves**: Broad and goosefoot-shaped
- **Seeds**: Resemble millet; colors vary—white, red, black, etc.
- Early varieties mature in **100–120 days**, while late ones take **150–180 days**.

Soil and Climate

- Optimal temperature: ~20-25°C
- Sensitive to:
  - **Cold**: below 0°C during germination
  - **Heat**: over 35°C during flowering
- Tolerates high salinity (up to seawater levels ~40 dS/m)

Field Preparation

- Plow 2-3 times; need a rough seed bed
- Add 30-40 tonnes of FYM per ha
- Install drip irrigation system (50 cm between lines ; 25 cm between emitters)
- Early sowing: Second week of October

Sowing Time

- Optimum sowing: First week of November
- Late sowing: First week of December

Seed Rate and Spacing

- Hand sowing: 4-6 kg ha^{-1}
- Mechanical: 2-3 kg ha^{-1}
- Seed: sand: 1: 3
- Method of sowing: Flat bed/Ridge and furrow
- Spacing: 45-50 cm x 10-20 cm;
- Sowing depth: 1-2 cm; 2-3 seeds per hole

Nutrient Management

- N:P_2O_5: K_2O: 100-120; 50-60; 50-60 kg per ha (marginal shallow lands under rainfed condition)
- N:P_2O_5: K_2O: 150-200: 80-100: 60-80 kg per ha (deep, fertile land under irrigated conditions)
- Apply 1/3rd N as basal, 1/3rd at flowering and 1/3rd at grain filling
- All P and K as basal

Water Management

- Mostly rainfed; Total water requirement: 200-300 mm
- Drought tolerant
- Critical stage of irrigation: flowering and seed filling
- Water should be withdrawn 30 days before harvest

Intercultural Operation

- Thinning: keep 1-2 plants per emitter
- Initial crop growth is slow; two manual weeding at 15 and 30 DAS
- No herbicides yet as the crop belongs to weed family

Disease Pest Management

- Minor occurrence of disease pest
- Pests: larvae, aphids
- Diseases: Downy mildew (*Mildew*), Leaf spot (*Ascochyta hyalospora*)

Harvesting and Yield

- Maturity indicated by leaf yellowing and drying
- Manual harvest: cut, dry, thresh, winnow, sun-dry
- Mechanical: use wheat harvesters with adjusted sieves
- Seed yield: 500–1500 kg ha^{-1} (up to 4000 kg ha^{-1} with good inputs)
- Straw yield : up to 10 t ha^{-1} (used as animal feed)