

Andean Tubers and the Reawakened 25

IN THE MOUNTAINOUS ANDEAN REGION, ABOUT 20 SPECIES OF ROOTS AND TUBER CROPS WERE DOMESTICATED.

Nine of these Andean root and tuber crops (ARTCs) (not including potato species) are still widely known and consumed in the Andes, and could have a huge impact in today's fight against malnutrition throughout the world.

Three of them are particularly gifted: Oca, Ulluco and Yacon.

Oca is a long cylindrical tuber, white to deep grayish purple in color. Oca is frost resistant and high in protein, with a good balance of amino acids and high amounts of fiber and antioxidants.

Ulluco is the second most widely cultivated tuber in Peru after the potato. It ranges from orange to yellow in color with red, pink and purple freckles. It is appreciated for the texture of its roots and its edible leaves, which are treated similarly to spinach. Ulluco is easy to grow, frost resistant, and moderately drought resistant.

Yacón is a distant cousin of sunflowers. The large edible roots have white or yellowish transparent flesh. Its name comes from the Quechua word yaku, alluding to its high water content. Yacón is beneficial for diabetics, as the roots contain oligofructose, a sugar that the human body does not metabolise. Yacón's leaves are commonly used to make infusions and pills for lowering cholesterol.



OCA

Oxalis Tuberosa

Origin: Andes Mountain Region (esp. Peru and Bolivia) - highlands
Grown in: Andes Mountain Region, Central America, New Zealand, Japan, Brazil, etc.

Root and tuber crops adapted to harsh environments and resilient to climate change, providing diet diversity.

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YACÓN

Smallanthus Sonchifolius

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ULLUCO

Ullucus Tuberosus

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BOTANY

Oca is a perennial herb cultivated in sandy soils in the highlands. The plant's top green growth is bushy and about one foot high, with leaves resembling clover and yellow flowers. After the plant's top dies back, the tubers continue to grow in the following season. The tubers are club-shaped and brightly colored in white, pinks, oranges, yellows and purples.

Ulluco is a compact succulent herb grown in the highlands that prefers soils rich in organic matter. Ulluco's pinkish green stems are thick and ridged, their leaves are dark green and oval heart shaped. The tubers come in a diversity of shapes, from spherical to long and curved like a crescent moon, and colors, purple to red to orange to white and sometimes a variegated mixture.

Yacón is a tall perennial herb that can grow up to 3m in height. The stems are covered with soft hairs and opposite triangular, dark-green leaves. The storage roots are clustered and cylindrical, similar in shape to a sweet potato. The yacón is related to the sunflower and Jerusalem artichoke.

CULINARY USE

Oca is most often consumed baked or boiled, although it is occasionally eaten raw with salt. Oca is separated and processed depending on its oxalate levels, a naturally occurring organic compound that is concentrated in the skin. Andean farmers use sour oca, high in oxalic acid, to prepare a storage product called khaya. To make khaya, oca tubers are soaked in water for a month then left outside to naturally dehydrate through the high elevation Andean climate cycle, with hot and dry days and freezing nights. Sweet oca, those low in oxalic acid, are exposed to sunlight to sweeten the tubers. Both dehydration and simple exposure to sunlight reduces the oxalate levels of oca before cooking. The young leaves and shoots of oca are eaten as a green vegetable, and the mature stems can be used similarly to rhubarb.

The ulluco tuber is loved for crispness that remains through cooking. Ulluco is generally cut into thin strips and added to stews, soups, and more recently, salads. Ulluco tubers with a high mucilage content are used in soups to serve as a thickener. Ulluco has a high water content that keeps it firm and crunchy when cooking, but prevents it from taking well to frying or baking methods. Ulluco leaves are also eaten, prepared similarly to spinach.

Yacón is a sweet and crunchy tuber, similar to jicama with a floral and fruity taste. Yacon contains the fructan inulin, a sweet soluble fiber that the human body can't break down and metabolize. Yacón is popular as a low calorie sweetener because of inulin, and is made into juice or syrup, popular for diabetics. Yacón tubers can be fried into chips, pickled, boiled, baked, or eaten raw.

NUTRITION AND MEDICINAL USE

Fresh oca provides a significant amount of vitamin C, vitamin A, and potassium along with carbohydrates and fiber, while dried oca concentrates nutrients and provides a good amount of iron and protein. Oca is a good source of the antioxidants anthocyanin and flavonoids.

Ulluco is a good source of iron, vitamin C and carbohydrates. Proteins from ulluco tubers contain all essential amino acids, making ulluco a complete protein. The leaves of ulluco are rich in protein, calcium and carotene.

Yacón's tubers contain sweet tasting fructooligosaccharides such as inulin which the human body does not metabolize, passing through digestion with little caloric value; this has made products such as yacón syrup and tea popular for diabetics. The beneficial bacteria in the body feed on these fructooligosaccharides, creating a prebiotic effect that enhances digestion and colon health.

AGRICULTURE

Oca is the second most popular tuber after potato in Peru and Bolivia, prized for its ability to grow on marginal land in harsh climates. Oca is cultivated from seed-tubers around 2800 to 4000m above sea level on mountainous plots of generally poor soil quality. In crop rotations, oca follows potatoes, the tubers planted directly after the potatoes are harvested in similar mounded layout. After planting, oca requires little maintenance outside of a few weeding and hilling. In the Andes, the tubers seeds are planted in August/September and harvested about 7 months later. In order to form tubers, the plant requires short autumn days.

Ulluco cultivation is very similar to that of oca; in fact, ulluco and oca are often planted together in intercropping systems with another tuber, machusa. Ulluco tubers must be harvested by hand to avoid scarring and scuffing the skin. The tubers can be stored until the next year's harvest, providing a year-round food source.

Yacón is an easy to grow, vigorous perennial that thrives in the valleys of the Northern Andes and Columbia. The plant is not very susceptible to diseases or pests, but it does require fertile soil or compost/manure addition. The plants require a long season to form tubers, planted in early spring and ready to harvest in the late fall. When frosts arrive and wither the plant's leaves, the tubers are ready to harvest. The large tubers can be forked up and snapped off, leaving the rhizomes in the ground to propagate the following spring. The harvested tubers are left in the sun for a few days to increase their sweetness, before storing them in a cool, dry place for storage.

HISTORY

Hundreds of years prior to European colonization, Andean farmers domesticated at least 20 species of roots and tubers through detailed selection and maintenance. It is thought that ulluco was cultivated over 4000 years ago. Representations of tubers such as ulluco and oca have been found on ceramic urns and sculptures dating back to 2250 BC. Yacón is depicted on Moche, a pre-Incan culture from present-day Peru, ceramics, and is thought to have been used in special occasions and ceremonies.

The species and genetic diversity of Andean roots and tubers ensured, and continues to aid, food security in the harsh growing climate of the Andes; different species were adapted to different elevations and microclimates, and had unique roles in crop rotations and cuisine.

RESEARCH

Andean root and tuber crops (ARTCs) are extremely important for their role in dietary diversity and their resilience to harsh growing conditions caused by climate change. The growth in popularity and spread out of rural agricultural communities of ARTCs is stifled by their reputation as a sign of "rural backwardness," and as a "poor man's food." Ignorance on their existence, proper preparation, and culinary uses has limited their usage and spread as well.

Additionally, the international distribution and sourcing of ARTCs is restricted, as protocols to certify the material is phytosanitary clean are lacking. Research programs are developing phytosanitary tools to allow ARTCs to be exported.

Organizations such as the International Potato Center (CIP) are working to increase the awareness and usage of ARTCs, as well as protect the diversity of species and prevent genetic erosion. CIP is doing this by supporting the creation of new markets, such as training smallholder producers to produce a colorful variety of oca marmalades. CIP is guarding the genetic diversity of ARTCs by conducting ex situ and in situ conservation projects. In order to spread the cultivation of ARTCs, scientists are working on breeding and selection to address issues such as day-length restrictions with oca and ulluco, presence of oxalates with oca, and viruses with ulluco.

ARTCs hold great importance -nutritionally, economically and culturally- for farmers in the Andes as they are suited to grow in the difficult conditions of high altitudes and a changing climate. Market expansion and the spread of cultivation would allow the benefits of ARTCs to spread and grow.

CUISINE

- [Traditional High Andean Cuisine](#) - FAO Report
- [Olluco Con Carne: Traditional Andean Tuber Recipe](#) - Eat Peru
- [Chupe con Ollucos Recipe](#) - Peru Delights
- [Ocas](#) - Peru Delights
- [How to Grow and Cook Yacon](#) - The Guardian

SOURCING

- [Andean Tubers](#) - One Green World Plant Nursery
- [Yacon Tubers and Crowns](#) - Moon Ridge Farm
- [Yacon Syrup- Buying Guide](#) - MSN

COMMUNITY RESOURCES

- [International Potato Center, CIP](#)

RESOURCES

- [Andean roots and tubers](#)- Report from Bioversity International
- [Indigenous Andean Root and Tuber Crops: New Foods for the New Millennium](#) - Horticultural Science Focus
- [Nutritional evaluation of three underexploited andean tubers: Oxalis tuberosa \(Oxalidaceae\), Ullucus tuberosus \(Basellaceae\), and Tropaeolum tuberosum \(Tropaeolaceae\)](#) - Steven R. King and Stanley N. Gershoff
- [Andean Root Vegetables for the Pacific Northwest and Beyond](#) - Northwest Edible Life
- [Oca Illustration](#) -NAP
- [Ulluco Illustration](#) - Wikipedia
- [Yacon Illustration](#)