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Experimenting with Growing Ulluco as a Niche Crop for Fun and Profit

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Abstract

Ulluco (*Ullucus tuberosus*) has the potential to be farmed as a niche crop in temperate climates outside of the crop's native high elevation South American range. The brightly colored and delicious tubers have considerable consumer appeal for those who become aware of them and offer an alternative to potato growers. Challenges include photoperiod restrictions, along with sensitivity to summer heat and early fall frosts. Cultivars are only available from limited sources in the United States at this time, and evaluation for specific climatic suitability would be desirable. The sharply-sweet, crispy tubers of oca (*Oxalis tuberosa*) and the spicy elongated tubers of mashua (*Tropaelum tuberosum*) have a history of being intercropped with ulluco. All may be grown in United States maritime regions either as separate crops or together if photoperiod restrictions can be selected with future breeding programs.

Keywords: Ulluco; *Ullucus tuberosus*; Andean tubers; Potato; Oca; Mashua; Yacon

Introduction

Potatoes are but one of many cultivated tuber crops that originated in the South American Andes. The strikingly colored tubers of ulluco (*Ullucus tuberosus*-family Basellaceae) are potentially adaptable to temperate maritime regions given specific microclimates. Even better-tasting than another nutritious Andean crop known variously as oca or New Zealand yam (*Oxalis tuberosa*-Oxalidae), ulluco tubers are similarly waxy-skinned and brightly colored. Also entering worldwide consciousness as a 'new' crop, yacon (*Polymnia sonchifolia*-Asteraceae) is a sweet, low-calorie tuber with a high inulin content. However, oca and ulluco provide both flavor and sustenance as nutritional staples. Ulluco in particular stands out memorably by all who have the opportunity to sample this vegetable. Peru exports canned ulluco worldwide, which retains much of the texture and taste of fresh ulluco. With attention to selective breeding for hardiness, shortening the cropping season and removing photoperiod restrictions, these tubers may follow the now-universal potato in popularity [1].

Attributes

Variously yellow, pink, red, purple and even candy-striped, ulluco (pronounced oo-yoo-koh) resemble shiny jewels in appearance. Related to the subtropical vegetable Malabar spinach, ulluco produces buttery, crisp tubers, described variously as tasting like nutty-sweet corn, earthy beets or boiled peanuts. Ulluco does not mash like potatoes, but instead remains crunchy when cooked due to its high water content. Ulluco has a wide range of culinary uses. When blended in soup, cooks often prefer it as tubers impart a silky texture, rather than the familiar mealy texture of potatoes. The skin is about as thick as that on new potatoes, and if desired is easily removed. The flesh is either white or yellow, and slightly gummy unless cooked. They are frequently boiled and served cold as a salad, and also pickled with hot sauces. Most often ulluco tubers are used to thicken soups or stews. Dried ulluco has a much stronger flavor than fresh, and can be ground into flour and used in cooked foods.

Ulluco is a good source of carbohydrate. Fresh tubers are about 85 percent moisture, 14 percent starches and sugars, and 1–2 percent protein. They are high in vitamin C, containing 23 mg per 100 g fresh weight. They contain a gum, but no fat and almost no fiber. There is considerable nutritional variation among varieties, especially in protein content, which has been reported as high as 15 percent dry weight. Ulluco differs from potatoes in providing edible greens. Like Malabar spinach, greens from ulluco are mildly spinach-flavored and besides being eaten raw, they can be used to thicken soups and stews, since like okra they have a mucilaginous quality. Ulluco greens are extremely nutritious, particularly in Vitamin A and iron, containing 12 protein by dry weight [1].

Challenges

Ulluco has a well-deserved reputation as one of the most difficult of the Andean root crops to grow in temperate climates. It is unfortunate that it is so fussy, because it is a delicious crop [2]. Ulluco is sensitive to heat, drought, frost, and pest (particularly slug and snail) damage. It prefers mild temperatures, but also needs to grow in full sun to yield well. Andean crops are frequently day-length sensitive in regards to tuber production, as they have evolved with nearly equal periods of day and night hours. Ulluco does not form tubers of edible size until at least three weeks after September 22nd, so it must be protected from frost. It can be grown in containers, but a half-barrel container is required in order to grow unconstrained. It is a good crop for areas with summer fog, right along the coasts or other large bodies of water.

The crop is normally propagated by planting small tubers, stem cuttings, or chopped up pieces of tubers containing nodes. Most available sources of ulluco appear to be tainted with viruses that reduce production. In the past, it was thought that the plant never produced viable seed. However, Finnish researchers have obtained fertile seed under controlled conditions. This should increase the

potential for breeding and hybridizing. In particular, true seed may be used to remove viruses and locate day length-neutral types [1].

In its native environment, ulluco grows in high elevations, preferring a cool-weather climate with temperatures fluctuating between 40-70° F. For this reason, the crop has succeeded in insular climates such as New Zealand and the higher elevations of Hawaii, as well as montane zones near the equator [1]. For good-sized eating tubers to develop, a minimum of two months growing time after the equinox should be allowed. Ideally tubers are harvested in late December or January after a long, frost-free autumn, much later than potatoes.

Experimenting with blacking out ulluco two to three weeks before the equinox may lead to being able to harvest at an earlier date. Additionally extending the season with frost covers then harvesting 'fingerling' tubers early for a niche market may prove most appropriate in early frost areas such as the coastal United States or Europe. Unlike potatoes, ulluco is delicious raw and though the attractively colored tubers turn green when exposed to light, they remain edible and non-toxic.

Endemic Techniques

Ulluco was brought into cultivation from the wild in the central Andes of Peru and Bolivia around 5500 BC. Botanical material from several coastal Peruvian archaeological sites has been identified as containing starch grains, vessels and xylem of ulluco. Illustrations of ulluco have been found on wooden vessels, ceramic urns and sculptures from the same region, which are dated from about 2,250 – 2,050 BC [3]. There is a huge variety in molecular diversity between crops from different areas, indicating though ulluco was originally domesticated in southern Bolivia, after a first wave of being diffused north to Columbia, another wave of diversification occurred and Columbian varieties are significantly different from central South American varieties [4].

When grown in the Andes, ulluco has been frequently intercropped with oca, mashua (*Tropaelum tuberosum*-family Tropaeolaceae) and sometimes *papa mahuey* (bitter potato varieties) which are dehydrated for *chuño*, a long-keeping staple [5]. Ulluco is also freeze-dried as bitter potatoes are, but when processed it is called *llingli* [1] as is similarly oca, which is known as *caya* when dried. Bitter glycoalkaloids are water soluble and released from the tubers during dehydration. Less domesticated varieties of these three tubers required more processing to be palatable due to the higher glycoalkaloid content. Thus dehydration served two purposes…to provide food products that lasted beyond the harvest and fresh storage seasons and to increase the palatability of more bitter varieties.

One reason for this companion planting of Andean minor tubers is to ward off insect and mammal herbivores that would otherwise feed on ulluco. Mashua is a relative of the garden nasturtium and has a spicy taste unattractive to gophers and other rodents. When cooked, it loses its pungent quality. Mashua is the fourth most important tuber crop in the Andes, behind potatoes, oca and ulluco. It is hardy and the easiest of the lesser known tubers to grow, and gives the best yields. In the Andean region, minor tubers are harvested at the same time and separated out after harvest. Oca, ulluco and mashua are often planted in rotation on a three-year crop cycle with potatoes and barley as they do not share related viral disease issues [5].

Future

While the potato was widely accepted and exported world-wide with early European settlement, the other three crops remained associated with indigenous sustenance farming and poverty [5]. In the past 25 years, oca and ulluco have begun to gain footholds as desirable crops in highland New Zealand and Hawaii, and as more frost-resistant varieties become available, Andean crops are being grown as trial crops in temperate maritime regions. The hardier mashua could appeal to temperate growers experimenting with perennial vegetables in permaculture systems, along with other hardy roots of non-Andean origin such as mint root (*Stachys affinis*-Lamineae), Jerusalem artichoke (*Helianthus tuberosus*-Asteraceae) and skirret (*Sium sisarum*-Apiaceae).

When harvesting ulluco tubers, differences between this plant and potatoes emerge. Unlike potatoes, the tubers are found scattered though the soil around the whole root system rather than clustered around the plant's crown. They develop at nodes along underground rhizomes. This feature has discouraged the development of mechanical harvesting techniques, along with such high elevation crops being adapted to thrive on rocky soils [1]. Emerging ulluco greens have been reported as attractive to molluscs and detritivores such as slugs and sowbugs, and in wet growing seasons greens may sustain heavy initial feeding damage. Viruses have been reported in both ulluco and oca crops; however, given that the plants are unrelated to potatoes, diseases should not spread across species if planted in the same fields.

Summary

Ulluco is a tasty, desirable crop that has a reputation for being challenging to grow outside of the Andes. As a highly priced seasonal restaurant delicacy, growing ulluco may be worth investigating as a niche crop in protected maritime regions. Along with oca, mashua and yacon, these unique Andean tubers deserve attention from both agricultural researchers and experimental small-scale farmers looking for alternatives to potatoes.

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