From the Andes to the Pacific Northwest: Cultivating Edible Mashua Tubers

Oregon State University, Department of Horticulture
Taylor Kamsler, Dr. James Myers

Fig. 5 Mashua plants in the greenhouse one month after planting.

INTRODUCTION:

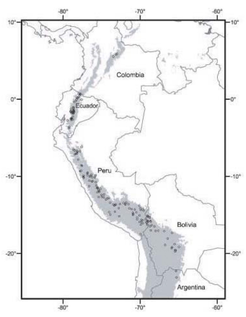
Agriculture in the U.S. focuses on a relatively small number of crops compared to the enormous array of edible plants in the world. In a world with a changing climate, growing a diversity of food crops provides more security, stability and flexibility in growing food for a swelling population.

Mashua is currently underutilized and understudied as a food crop. It could be a great candidate for organic agriculture due to low fertilizer requirements, pest and disease tolerance, high productivity, and its medicinal effects[1]. As cultivation of mashua declines in its traditional region, expanding its scope is also an opportunity to preserve its biodiversity. The coastal Pacific Northwest has similar temperatures and rainfall to mashua's native region, making the area a promising location for its cultivation.

BACKGROUND:

Mashua (*Tropaeolum tuberosum*), a close relative of nasturtium, produces edible tubers consumed by people in the Andean highlands from Colombia to northwest Argentina *(Fig. 1)*. Archaeological evidence dates mashua's cultivation to 650 AD[1]. As a subsistence crop, mashua tubers mainly fill the staple starch role, similar to potato. However, it has a peppery or cabbage-like flavor, especially when raw, that is ripe for culinary exploration. Mashua has the potential to be a unique addition to raw dishes, pickles, or ferments. The leaves *(Fig. 2)* and flowers *(Fig. 3)* also have a completely unique flavor.

Fig. 1 Traditional cultivation region for Mashua in the South American Andes[1]



REFERENCES:

[1]Grau Alfredo, Ramiro Ortega Dueñas, Carlos Nieto Cabrera and Michael Hermann. 2003. Mashua (Tropaeolum tuberosum Ruiz & Pav.). Promoting the conservation and use of underutilized and neglected crops. 25. International Potato Center, Lima, Peru/International Plant Genetic Resources Institute, Rome, Italy.

[2]Anonymous. (n.d.). Cultivariable. Retrieved March 18, 2021, from https://www.cultivariable.com/

[3]USDA. (2008, October 13). FoodData Central [Dataset]. USDA. https://fdc.usda.gov/

[4]Dressendörfer, W. (2012). Album Vilmorin: The Vegetable Garden (Multilingual ed.). TASCHEN.

OBJECTIVE:

To evaluate the performance of seven clonal cultivars of mashua in grown in the Willamette Valley. Specifically, we are looking at the adaptations and productivity of various mashua cultivars in this growing environment. Secondly, we will investigate the culinary quality and potential of the tubers.

MATERIALS & METHODS:

Mashua is cultivated from tubers rather than seeds. Seven clonal varieties of mashua were chosen to represent a range of characteristics including flavor (from sweet to cabbage-like), color (white with purple stripes, yellow, and orange-red), tuber yield, and origin (known heirlooms from the Andes to recent cultivars in the U.S.) Figure 4 shows a range of tuber phenotypes.

On April 20th, I cut the tubers into sections with two "eyes" each, let them suberize, then planted them in 4-inch pots 2-3 inches deep in OMRI certified organic potting soil mixed with compost (Fig. 5). Once the plants were established, we transplanted them to an organically managed field at the Lewis Brown Farm for the variety trial using a randomized block design with two plants per plot and three reps (Fig. 6). Plants are spaced 30 inches apart within rows and watered with drip irrigation. Throughout the growing season, data will be taken on high and low temperatures, day-length and rainfall. I am currently evaluating plant characteristics including date of flowering, date of tuber production, and presences of any pests and diseases.

CULTIVARS & SOURCES:

Cultivariable
(Moclips, WA)

- Copalis
- Hoh
- Lima
- Dabop

Peace Seedlings
(Corvallis, OR)

- Chilean Red
- Pilifera
- Puca Añu

Fig. 4 Variation in color, size, and shape in mashua cultivars from grower William Whitson of Cultivariable[2]

Fig. 7 Color lithograph of mashua from an 1869 French seed catalog, Album Vilmorin[4]

ONGOING WORK:

This project will continue through Spring 2022 through the Continuing Undergraduate Researchers Program. At harvest, I will find the total tuber weight and number per plant and record characteristics of tuber color and shape. I will test the tubers for soluble solids content (brix) and total solids (dry weight). We will characterize tubers for total glucosinolates using the spectrophotometric method developed by Mawlong et al. (2017). We will evaluate tubers for raw taste and flavor, using rating scales for pungency and sweetness.

Fig. 6 Mashua after transplanting into organic field at Lewis Brown Farm.

POTENTIAL NUTRITIONAL BENEFITS:

- High vitamin C content
- High anthocyanin (purple tubers)
- High Beta-carotene (yellow tubers)
- Low sodium

Component	Units per 100 g of edible portion	Range or Average			
		Mashua[1] (cooked)	Potato[3] (baked w/ skin)	Broccoli[3] (raw)	Lemon[3] (raw)
Water	%	79.2-93.8	71.2	90.7	89
Calories	kcal	35-50	109	28	29
Protein	g	1.1-2.7	2.3	2.98	1.1
Lipids	g	0.7	0.1	0.35	0.3
Carb.	g	13.3	25.23	5.24	9.32
Fiber	g	0.5-1.5	2.4	2.9	2.8
Vitamin C	g	77.5	12.9	74.6	53

Table 1. Comparison of nutritional content[1,3]

MEDICINAL USES:

In the Andes, it is used as treatment for tonsillitis, dengue and malaria fever, skin ailments, to induce menstruation and as an anaphrodisiac. Compounds found in mashua have been shown to prevent cardiovascular illness, cancer, and other neurodegenerative illnesses as well as benign prostatic hyperplasia[4].

Mashua contains glucosinolates—compounds that form mustard oils. These are also found in cruciferous vegetables like broccoli, horseradish, and brussels sprouts (Brassicaceae family). Glucosinolates are the precursors to isothiocyanates which have "…antibiotic, insecticidal, nematocidal and diuretic properties, which substantiates mashua's extensive use in Andean folk medicine"[1]. Glucoraphanin is one type that is converted to sulforophane when the tissue is macerated. This compound is a strong anticarcinogen and acts by upregulating the phase II enzyme system in the liver, which is responsible for removing toxins and carcinogens.

Fig. 3 Mashua flowers[2]

Fig. 2 Mashua leaves[2]

Fig. 8 Trellised mashua[2]

ACKNOWLEDGEMENTS:

Thank you to Dr. James Myers for initiating and overseeing this project, Dr. Shinji Kawai for guidance over my greenhouse and field work, and Dr. Christina Walsh for support. Thank you to E.R. Jackman Alumni & Friends, the College of Agricultural Sciences, and the Beginning Undergraduate Researchers Support Program for funding this project.