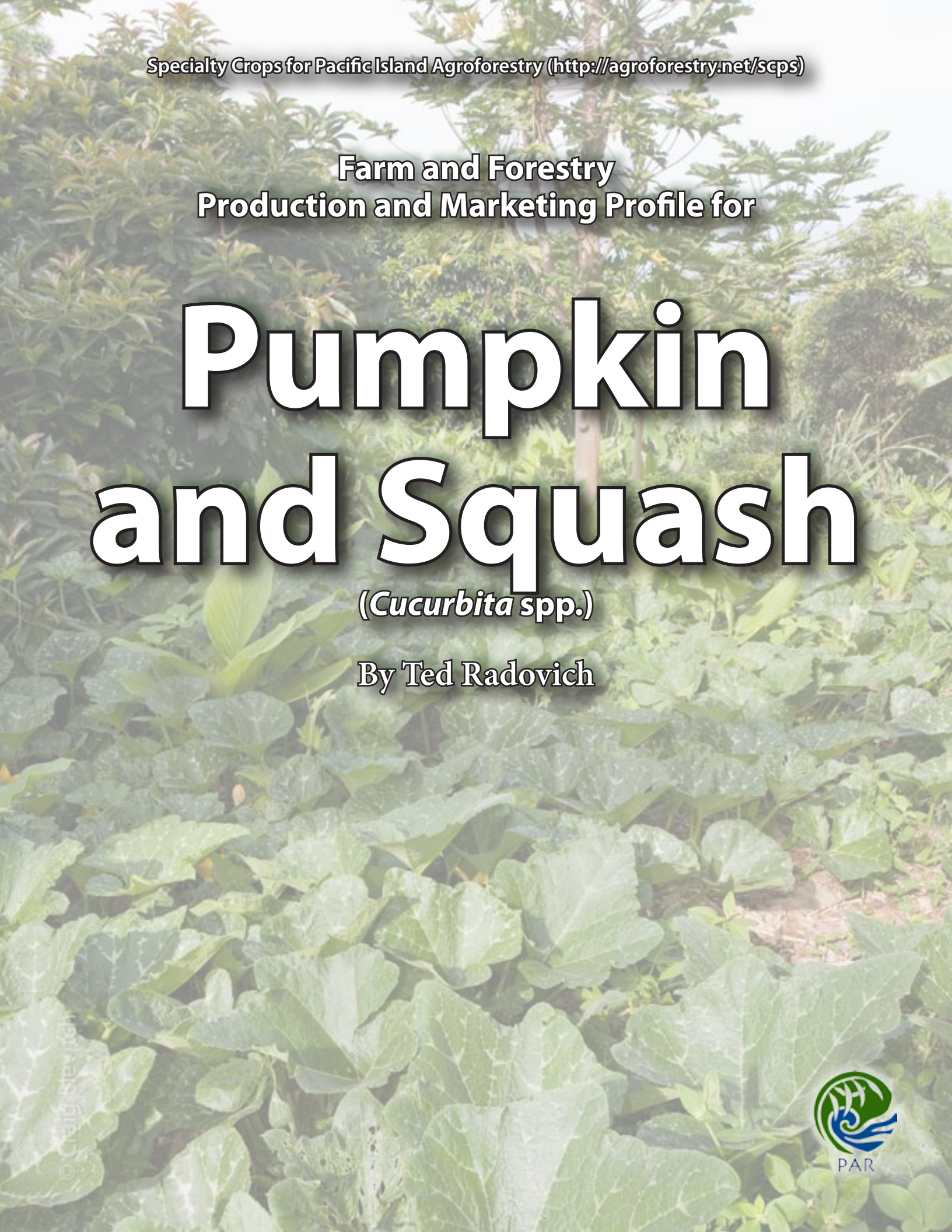
Specialty Crops for Pacific Island Agroforestry (http://agroforestry.net/scps)

Farm and Forestry
Production and Marketing Profile for

Pumpkin and Squash

(*Cucurbita* spp.)

By Ted Radovich



USES AND PRODUCTS

Whole fresh fruit is the primary product of commerce. Cooked squash may be canned or dried for storage. Seed can also be consumed. Flowers and tender vine tips of all edible types are sold and consumed as vegetables. Male flowers and vine tips provide a source of income for growers prior to fruit reaching marketable stage, although care should be taken to leave some male flowers as a pollen source for female flowers. Selective, judicial harvesting of young shoots should preserve and promote canopy development and is not expected to significantly reduce yields.

BOTANICAL DESCRIPTION

Preferred scientific names

Cucurbita moschata, C. pepo, C. maxima, C. argyrosperma, C. ficifolia.

Family

Cucurbitaceae

Subfamily

Cucurbitoideae

Non-preferred scientific names

C. mixta (syn. for *C. argyrosperma*)

Common names

English common names include squash, zucchini, pumpkin, gourd, cushaw, and marrow. The use of English common names is somewhat confusing and is dependent on a combination of species, culinary use, and regional preference. "Summer squash," "zucchini," or "vegetable marrow" refer to *Cucurbita* fruit consumed when immature (primarily *C. pepo*). "Winter squash" (U.S.) or "pumpkin" (outside the U.S.) refers to all *Cucurbita* consumed mature. In the U.S. "pumpkin" is generally reserved for fruit used for pies, Jack ʻO lantern, or stock feed. The term "gourd" refers to mature fruit with hard rind and the term "cushaw" is used for winter squash with a curved neck.

Names in other Pacific languages:

Chomorro: *kalamasa*, *kondót*
Fijian: *qaqi-a*
Filipino: *calabasa* (Tagalog), *carabasa* (Ilocano), *kulubasa* (Kapangpangan)
French: *citrouille*
Hawaiian: *palaʻai*, *ipu pū*
Hindi: *kaddū*, *skavaisa*
Indonesian/Malay: *labu*
Japanese: *kabocha*
Maori: *paukena*
Marshallese: *baanke*
Palauan: *kalabasáng*, *tongáng*
Pohnpei: *pwenkin*
Samoan: *mauteni*
Spanish: *calabaza*, *zapallo*
Tahitian: *mautini*, *mautene*, *mauteni*
Tokelau: *mauteni*, *paumukini*
Tongan: *hina*
Yap: *galbaas*, *pʻaaw*

Brief botanical description

Almost all cultivars produce vining plants with the exception of the mostly bush-type cultivars of *C. pepo* grown for consumption of the immature fruit (e.g., zucchini). Flowers are generally large with separate male and female flowers borne on the same plant (monoecious). Male flowers form first. Fruit varies in shape (flattened, elongated, smooth, ribbed) and size (0.25–6 kg or more). Seed is large (up to

Left: Varied fruit shape of multiple cultivars grown in Waimānalo, Oʻahu. Right: The tender growing tips are eaten as a nutritious vegetable.

Top left: Male flower. Top middle: Female flower with unpollinated ovary of pear shaped variety. Top right: Female flower being pollinated by carpenter bee. Bottom left: Developing fruit of oblate type. Wilting flower indicates pollination has occurred recently. Bottom right: Developing fruit of pear shaped variety.

3 cm long). Rooting commonly occurs at the stem nodes, which may improve plant vigor. Some varieties produce tendrils that help secure vines, limit wind damage, and improve vine growth across weedy and uneven ground.

After pollination, fruit develops from the pre-formed ovary at the base of female flowers. The shape of the ovary prior to pollination is indicative of the mature fruit shape. Fruit shapes vary widely, including flat, obvate, round, and cylindrical. Fruits may be deeply lobed to smooth. The leaf occurring at the node where a fruit is developing is called the "feeder" leaf because photosynthates from the leaf are preferentially translocated to the adjacent fruit. If present, tendrils indicate ripeness in mature pumpkins when they begin to brown.

DISTRIBUTION

Native range

Cucurbita were originally domesticated in Mexico, South America, and the eastern U.S. *C. maxima* and especially *C.*

ficifolia are more cold tolerant than the other species and are thought to have been domesticated in the tropical highlands of North and South America.

Current distribution worldwide

Squash is currently grown worldwide, with China, India, Russia, and the U.S. being the biggest producers. In the Pacific islands, New Zealand, Tonga, Fiji, Hawai'i, French Polynesia, and Papua New Guinea were the region's biggest producers in 2007.

ENVIRONMENTAL PREFERENCES AND TOLERANCES

Climate

C. moschata is best adapted to the lowland tropics, and includes calabaza and butternut squash. *C. pepo* (zucchini, acorn squash, and Halloween pumpkin) and *C. maxima* (kabocha, Halloween pumpkin) fruits are also important, and cultivars have been selected for good agronomic performance in the lowland tropics. Sugar content in *C. maxima* fruit can be adversely affected by low night temperatures. *C. maxima* and *C. argyosperma* are most tolerant of cool temperatures and are particularly well adapted for production in the highland tropics.

Soils

Cucurbita are widely adapted to various soils, but prefer good drainage and will not tolerate "wet feet." Plants may be grown on raised beds or mounds in heavier soil to improve drainage.

GROWTH AND DEVELOPMENT

Cucurbita grows rapidly in warm weather and adequate soil moisture. Plants grow vegetatively for the first 4–8 weeks before flowering. The first flowers are typically male. Female flowers generally occur at internodes 20–30. Stressful conditions encourage early development of female flowers. Some farmers use ethylene to induce female flowering.

Table 1. Elevation, rainfall, and temperature

Elevation range	**lower:** sea level **upper:** 1,000 m
Mean annual rainfall	**lower:** 500 mm **upper:** 3,000 mm
Dry season duration (consecutive months with <40 mm [1.6 in] rainfall)	*Cucurbita* are tolerate of dry periods during the vegetative stage, but should not dry out once fruit has set.
Mean annual temperature	**lower:** 10°C **upper:** 32°C
Minimum temperature tolerated	7°C

The first fruiting cycle is usually the strongest and yields tend to decline over time as plants age and disease builds up in the field. Commercial plantings typically do not extend beyond 6–7 months. Plants in home gardens have been observed to live 2 years or more, but this is not considered typical.

Flowering and fruiting

When the fruit is harvested for consumption at an immature stage, the highest quality is achieved just after the blossom drops off the fruit. Mature fruits are harvested when their skin becomes dull and the tendril nearest the fruit dies. The time from flowering to harvest varies with cultivar and environment. For immature fruit, this is generally 1–2 months after planting or as little as a week after pollination of the female flower. Fruit generally reaches maturity 30–60 days after pollination.

Scale of commercial production

Statistics on Hawai'i *Cucurbita* production are divided into two classes: "pumpkin" (kabocha, Halloween, and other mature fruited types) and "Italian squash" (zucchini). A third category, "oriental squash," includes genera other than *Cucurbita*, the fruit of which are generally consumed immature (e.g., hyotan, *Benincasa hispida*). 2008 production, farm value, and market share data for these crops in Hawai'i are shown in Table 2.

An effort was initiated in Tonga during the 1980s to promote kabocha type pumpkin (C. *maxima* and C. *maxima* × *moschata* hybrids) production for export to Asia. It has since become Tonga's biggest export. In 2006 Tonga produced 20,000 metric tons (MT) of pumpkin and exported 10,600 MT with a total export value of US$2,748,000. Exports were primarily to Korea and Japan. In comparison, New Zealand exported 80,000 MT of pumpkin in 2006 for a total value of almost US$38 million. Export values for other locations in the Pacific are not readily available.

AGROFORESTRY AND ENVIRONMENTAL SERVICES

Cucurbita species can grow well in full or partial sunlight, but generally do not grow well under heavy shade. They can be planted successfully under young fruit trees before cano-

Table 2. *Cucurbita* and related crop production, value and market share data for Hawai'i in 2008 (USDA NASS).

Crop	Production (lb)	Farm gate value	Hawai'i market share
Pumpkin	90,000	$59,000	9%
Italian squash	1,480,000	$888,000	46%
Oriental squash	350,000	$217,000	35%

Top left: C. *moschata* growing under young papaya plants in Kula, Maui (elevation 600 m). Top right: Squash used as a vigorous cover to aid in establishment of banana by suppressing kikuyu grass in a pasture, Hāwī, Hawai'i. Bottom left: Squash planted as a ground cover around young bamboo plants. Bottom right: Squash growing on a farm in an open area that is not being used for other crops.

py closure or under papaya and similar sparse-canopy crops. It is often grown as a rapidly growing, weed suppressive, soil protective cover that provides some economic/food return while longer-term crops have time to become established.

Rapid vine growth and large leaves makes squash a relatively weed-tolerant crop that is rotated with less weed tolerant crops such as onions to reduce weed pressure. Vigorously vining cultivars of *Cucurbita* may be used to cover marginal soils and steep slopes by preparing small planting holes and allowing vines to spread over unimproved or non-arable areas.

PROPAGATION AND PLANTING

Cucurbita is easily and almost exclusively propagated by seed. However, plants can be reproduced vegetatively via cuttings. Vegetative reproduction is generally not difficult, but ease of propagation is dependent on rooting conditions and plant health. 1–3 node cuttings from healthy, vigorous plants with a small feeder leaf will root readily in moist, well drained media. Time to fruiting may be quicker from rooted cuttings than with plants generated from seed.

Pumpkins are frequently direct-seeded, but transplants may be used to improve establishment when there is significant weed or nematode pressure. Seedlings started in the nursery should be transplanted after 4–6 weeks before becoming too large for their containers or too cumbersome to transport to the field. Transplanting should be done in the evening or early morning, rather than in the heat of the day. Transplants should be kept well watered until established (about 2 weeks).

CULTIVATION

Variability of species and known varieties

There are many varieties within the three primary squash species (C. *moschata*, C. *maxima,* and *C. pepo*). There are also many landraces (farmer varieties) that have been selected for adaptability to local conditions, and this is particularly true of *C. moschata* in the Pacific. Open pollinated varieties often produce fruit of variable shape and sometimes color. For example, 'Waltham-29', an open-pollinated butternut squash, can produce fruit with large or small "bulbs" at the blossom end, and may have very curved to almost completely straight necks (straight necks are generally preferred because they are easier to process). When producing seed for replanting, female flowers may be hand pollinated with male flowers from another plant with the same fruit shape to increase fruit shape uniformity in a population. Alternatively, if relatively few plants have undesirable fruit shape, these plants may be rouged (pulled up).

Commercial hybrid seed produces uniform plants but can be expensive. Commercial growers of kabocha type pumpkins in the tropics usually prefer *C. maxima* × *C. moschata* commercial hybrids because of the vigor, uniformity and pest tolerance of the interspecific hybrids. Disadvantages of commercial hybrids include low availability and the high cost of seed. 'Sweet Mama' is a *C. maxima* × *C. moschata* kabocha-type hybrid grown in Hawai'i. 'Soler' and 'Taina Dorada' from the University of Puerto Rico and 'Lloyd Marsh' from ECHO (Ft. Myers, Florida) are C. *moschata* varieties that have performed well in limited trials in Hawai'i. 'Butternut' type cultivars (*C. moschata*), have dry, fine textured, sweet, deep orange flesh that is favored in many markets. However, 'Butternut'-derived cultivars are highly susceptible to many pests found in the tropics and are not generally recommended for commercial production (L. Wessel-Beaver, pers. comm.).

Basic crop management

Spacing is dependent on the species and variety.. Spacing of 0.9 m × 0.9 m (3 ft × 3 ft) has been used to good effect in Hawai'i for pumpkin/winter squash production, although spacing of 1.8 m × 1.8 m (6 ft × 6 ft) is considered more appropriate for commercial plantings, especially in cultivation of vining types of C. *moschata*. Closer spacing can aid in weed control through rapid canopy cover, and generally results in a greater number but smaller fruit per unit area. Wider spacing will generally result in larger but fewer fruit per unit area, and very wide spacings may increase the chance for sunburn on fruit due to lack of leaf cover. Recommended spacing of bush-type zucchini and summer squash (e.g., 0.6 m within rows and 1.8 m between rows) is much closer than for pumpkin/winter squash production.

Top: Examples of winter squash from the three primary *Cucurbita* species, *C. moschata, C. pepo,* and *C. maxima* (left to right). Bottom: Variability in *C. moschata*. 'Waltham' type butternut squash (far left) and three fruits from a local landrace in Hawai'i.

Established plants can tolerate some drought stress during the vegetative period, but irrigation is recommended and drought stress should be avoided during the reproductive phase.

Cucurbita can be particularly heavy feeders. Nitrogen is required for early vegetative growth, and P and especially K for fruit development. Quantities of 112–170 kg/ha of N is considered adequate under most conditions. P and K applications should be made based on soil analysis and recommendations range from 0–135 kg/ha P_20_5 and K_20 depending on nutrient availability. Fertilizer recommendations from Florida are the same for pumpkin, winter squash and Zuchini (Olsen et al. 2010).

Special horticultural techniques

Ground covers are often used for weed control and to keep fruit clean and disease free. Generally black plastic is

Top: Production field in Waianae, O'ahu. Middle: Newly planted field of pumpkin in Waianae. Bottom: Commercial production field in Kahuku, O'ahu.

used, but organic mulches and cover crops are also utilized. Cover crops (typically oats or similar grasses) are grown thickly and killed by rolling, cutting, or herbicide application. Pumpkins are sown or transplanted in holes or narrow strips plowed/cut in mulch. Under windy conditions growers use netting on the ground to help secure vines. Fruit may be covered or individually bagged to prevent sunburn and protect from pests, but this adds to labor costs.

Advantages and disadvantages of growing in polycultures

Cucurbita prefer full sun, but intercropping with erect companion crops such as papaya, banana, corn, trellised yam, and cassava is common in much of the tropics, which better exploits all three dimensions of cropping space. Although lower light levels and wider spacings common in intercropping may decrease yield of pumpkin per unit area, total productivity (land equivalency ratio [LER]) of pumpkin and companion crops together is expected to be higher than in a monocrop of *Cucurbita*.

Squash planted in a newly cleared secondary forest together with taro (*Colocasia esculenta),* yam (*Dioscorea* sp.), sweetpotato (*Ipomoea batatas*) and other food plants in Yap.

Left: Squash growing under a mature agroforest of papaya (*Carica papaya*), banana (*Musa* sp.), and coconut (*Cocos nucifera*) on ʻUpolu Island, Samoa. Top and bottom right: When planting an orchard in a newly cleared area, squash can rapidly cover the soil with a productive crop while the fruit trees become established such as here in Kealakekua, Hawaiʻi.

PESTS AND DISEASES

Powdery mildew is the most prevelant disease of *Cucurbita* in the tropics. Powdery mildew resistance has been incorporated into some cultivars from the wild species *C. okeechobeenensis* and *C. lundeliana* through traditional breeding. Several virus diseases are also problematic. Squash borer, pickleworm, and fruit flies can be problematic. Secondary rots from feeding wounds caused by these pests result in fruit loss. Silver-leaf, a physiological disorder caused by whitefly feeding, reduces productivity if severe.

Sustainable methods for pest and disease prevention

Pest resistant and well adapted varieties are the first line of defense against most pests. Fungal and bacterial disease of the fruit may be diminished by utilizing mulch that prevents fruit contact with the soil.

DISADVANTAGES

Squash generally has high fertility and water requirements and can be susceptible to many pests. Marketing can also be an issue due to seasonal gluts (typically August–November in the Northern Hemisphere). Market preferences are often also very specific with regard to fruit shape size and color (see discussion of butternut squash above).

Potential for invasiveness

All species are listed in Global Compendium of Weeds (HEAR 2007), but *Cucurbita* have not been assessed by the weed risk assessment program at the University of Hawaiʻi. Risk is expected to be negligible.

COMMERCIAL PRODUCTION

Leaving approximately 2.5 cm of stem on the fruit when harvesting mature fruit may help minimize incidence of stem end rot. However, if fruits are to be packed in bulk for

Top: Fruit rot on round-fruited type. Middle: Pickleworm and damage on susceptible *C. moschata* variety. Bottom: Spraying for pests.

transport, stems should be shortened or removed to avoid damage to other fruits.

Fruit may be cooked and preserved by canning. Orange skinned fruits are preferred for canning so that pieces of skin that get into the puree are less noticeable.

Seeds

Seeds are frequently dried and salted for snacks, and are used for cooking or oil extraction (Casico 2007). To prepare pumpkin seeds for drying and roasting, seeds are extracted with a spoon or other implement and carefully washed to remove the pulp. Pumpkin seeds can be dried in the sun for 6 hours or more, in a dehydrator at 46–49°C (115–120˚F) for 1–2 hours, or in a warm oven for 3–4 hours. If drying in the oven, seeds should be stirred frequently to avoid burning. Once dried, seeds may be coated with oil, sprinkled with salt and roasted in a preheated oven at 120°C (250°F) for 10–15 minutes. Dried or roasted seeds should be stored in an airtight container. Seeds may also be frozen for long-term storage.

De-hulling seeds by hand is a tedious process. Hulls can be removed from the seeds after boiling, drying, or roasting. Hulls will slip off after seeds have been boiled or may be cracked and separated from the seed after drying or roasting. Cultivars of C. *pepo* with "hull-less" seeds (e.g., 'Triple Treat') that produce kernels with thin or partially formed hulls may be used to reduce hulling time. However, it should be noted there are no reports available regarding the performance of these cultivars in the tropics. De-hulling on a commercial scale is done with machines.

Low-tech oil extraction methods (e.g., grinding and boiling toasted seed) may be used but are relatively slow and inefficient. One low-tech method involves de-hulling and grinding the kernels, then boiling them for 5 minutes in water. After boiling, the mixture is strained and allowed to sit overnight, during which time the oil separates from the water.

Commercial production of pumpkin oil is largely limited to Austria and the surrounding regions, where it is considered a specialty. Commercial oil expellers are commonly used for extracting pumpkin seed oil. De-hulling may not be necessary for oil production if commercial pressing machines are used.

Product quality standards

USDA standards for summer and winter squash have been established. For summer squash, important characteristics are high sheen, tenderness, firmness, and freedom from rot and defects. For winter squash, rinds should be hard, of uniform color, waxy, and free from dry rot and cracks. Official standards for pumpkin seed oil extraction and quality have not been located.

Top left: Calabaza type *C. moschata*. Top right: Local landrace, Kealakekua, Hawai'i. Bottom left: Pumpkins boxed for sale. Bottom right: Cut surface of kabocha type, showing deep orange flesh.

Product storage requirements and shelf life

Immature *Cucurbita* (e.g., zucchini) can be forced-air cooled, but the skin should be kept dry to avoid rots. Fruit should be stored at 7–10°C and 95% relative humidity (RH). Shelf life of summer squash is 1–2 weeks.

Mature *Cucurbita* (e.g., kabocha, pumpkin) should be stored at 12–15°C and 50–70% RH. Mature *Cucurbita* fruit is susceptible to rots if stored ≤10°C; this is particularly true of *C. moschata*.

Shelf life for winter squash is typically 2–3 months. Mature fruit typically deepens in color and increase in sugar content during storage. The term "curing" is sometimes used to refer to storage under cool dark conditions to increase color and sugar content of *Cucurbita* fruit.

Recommended labeling

Food safety certification may be required by some wholesale and retail venues. Labels indicating where and how the product was grown (e.g., "local," "certified organic"), cultivar grown (e.g., "Tahitian"), nutritional content (e.g., "high lutein"), etc., may improve marketability.

SMALL SCALE PRODUCTION

Bush type cultivars may be used to maximize squash production in small spaces. Vine-types may be trellised to optimize use of small space and be trained into boundary margins or steep or rocky slopes.

Adding value on a small family farm

Extraction of seed kernels and seed oil may offer the best opportunity for adding value. However, little information

is available for seed production and processing on small family farms.

Household use in the Pacific

Winter squash is a relatively minor but important subsistence crop throughout the Pacific. Summer squash is generally less important.

Nutrition

Cucurbita fruit, seed, and greens are very nutritious. Greens can be a good source of Ca, P, Fe, and vitamins C and A. The most important non-caloric contribution of mature fruit to the diet is its carotenoid content, particularly pro-vitamin A carotenes (e.g., β-carotene). Mature squash and pumpkin contributes modestly (50 kcal per 100 g) to caloric intake due to its substantial dry matter and sugar content. However, the greatest potential caloric contribution to the diet comes from the seeds, with over 550 kcal per 100 g of fresh seed. *Cucurbita* seed oils are generally dominated by oleic (~50%), linoleic (~30%), and palmitic (~15%) acids.

Many types of squash are sold at the farmer's market in Apia, Samoa.

Import replacement

Locally produced pumpkin and squash can replace imported store-bought starches and vegetables. Seeds can also serve as a local source of vegetable oil.

YIELDS

Winter squash yields in the Pacific generally average about 11 MT/ha, although yields in New Zealand are twice that. Average summer squash (zucchini) yields in Hawai'i are reported at 9.6 MT/ha. In Austria, estimated seed oil yields are 200 liters/ha.

MARKETS

Local markets

The primary local markets are roadside or farmers' markets and local retailers. Other venues (e.g., Community Supported Agriculture farms or CSA's, restaurants) offer marketing opportunities.

Export markets

Most export markets for Pacific-grown squash are in Asia. In 2008, Tonga exported over 2,000 MT of squash to Japan and Korea. The primary challenge for growers who are considering export markets is meeting high quality standards.

Specialty markets

Given the increased awareness of the high nutritional value of deep orange and yellow vegetables, marketing locally grown pumpkin as a nutrient dense "functional food" may increase sales. Displaying cut sections of brightly colored pumpkin may support this strategy.

Organic certification may increase consumer appeal, although pest pressure can be high and organic methods may increase production costs significantly.

Branding possibilities

Labeling that increases awareness of the potential nutritional contribution to the diet and establishes the product as local or Hawaiian are suggested branding strategies (e.g., "Eat Your Colors! Pala'ai 'ulanui"). Other suggested strategies include highlighting excellent eating quality of well adapted varieties with unusual fruit shape (e.g., "Kabocha on the inside") and experimenting with locally produced pumpkin seed snacks (e.g., roasted "Hawaiian-grown" pumpkin seeds).

Potential for Internet sales

Processed products have some potential for Internet sales. Use of the Internet can also promote and support direct marketing efforts such as CSA farms.

EXAMPLE SUCCESSES

Domingo/Edra Farms, Waianae, O'ahu

Vicky Domingo has been growing *Cucurbita* (primarily *C. moschata* types with oblate fruit) for many years. She has been successful in selling *Cucurbita* products to wholesalers (mature fruit) and at traditional local markets (flowers and shoots). She has in recent years worked hard to increase awareness of *Cucurbita* as a crop with significant potential for improving the diet and food security of Hawai'i residents.

Ms. Vicky Domingo with pumpkin flowers and shoots (left) and fruits (right) ready for market.

You Farms, Kahuku, O'ahu.

Mr. You is a successful vegetable farmer who has integrated *Cucurbita* (primarily *C. moschata* types with elongated fruit) into his rotations to improve the stability of his overall vegetable sales. He sells fruit exclusively to wholesalers. He plants an area of 0.1–0.2 ha (0.25–0.5 ac) at a time and has introduced the innovative use of black plastic and netting to improve vine growth and fruit quality and reduce pests and diseases.

ECONOMIC ANALYSIS

Expenses of production

Variable cost of production for zucchini (summer squash) in Hawai'i has been estimated at $4,592 per acre (CTAHR, n.d.). A detailed list of general expenses of summer squash is available from the University of Hawai'i, College of Tropical Agriculture and Human Resources. Cost of production for mature fruit would be expected to be comparable, or slightly higher if specialized strategies such as ground netting are used.

Mr. You with young pumpkin plants.

Expected income

Expected income for unprocessed fruit sold at wholesale is approximately $US2–4 per plant, based on a planting density of 6,000 plants/ha, an average marketable yield of 11 MT/ha and an estimated wholesale price of US$1.20–2.20/kg (J. Sugano and V. Domingo, pers. comm.). Actual returns per plant will depend on market venue and the number of fruits per plant. Direct sales by growers can increase return per plant. At select farmers markets in Hawai'i, fruits may retail for $4–8 each (C. Elevitch, pers. comm.). Income per plant may also be increased from sale of shoot tips and flowers, which retail at $17.50/kg in select Hawai'i markets (Domingo, pers. comm.).

Given the high nutrition and palatability of *Cucurbita* fruit, seed and greens, the relatively low economic return of *Cucurbita* is offset by the significant potential for improvement of family and community nutrition and food security.

FURTHER RESEARCH

Potential for crop improvement

The potential for crop improvement in *Cucurbita* is substantial, given the broad genetic base of *C. moschata* landraces thorough the Pacific and the large number of commercial *Cucurbita* cultivars yet to be evaluated under Pacific conditions.

Improving potential for family or community farming

The potential nutritional and caloric contribution of *Cucurbita* to a farming community's diet combined with new marketing opportunities as a "functional food" makes this crop a valuable component of small, diversified cropping systems in the Pacific.

Genetic resources where collections exist

The Asian Vegetable Research and Development Center (AVRDC—The World Vegetable Center) maintains a collection of *Cucurbita* species. A collection of *Cucurbita* accessions is also maintained at the USDA Southern Regional Plant Introduction Station in Griffin, Georgia.

Left: Mixed vine and flower bundle that is typically sold at Asian markets. Right: Vine tips to be cut for sale.

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