



DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

SQUASH

PRODUCTION GUIDE



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The SQUASH Plant

Squash is commonly grown in the Philippines throughout the year. In 2009, Philippines ranked 16th in the world production of squash together with pumpkins and gourds with a production value of \$43,441 at a volume of 247,759 metric tons (BAS, 2009). It is usually grown in home gardens and commercial scale for its immature fruits, young shoots, flowers and seeds. In some places, intercropping squash with other crops like corn, sugarcane and coconut is practiced. It is commercially cultivated in Ilocos Region, Cagayan Valley, Southern Tagalog and Bicol Region. The provinces producing semi-commercial scale are Davao, Leyte, Nueva Ecija and Batangas. Like other cucurbits, squash is recognized as an important source of vitamins and minerals.

It is considered as one of the farmers' cash crops in the country. Acceptability to consumers is very high because of its nutritional value especially in Vitamin A. It is not perishable, commands high price in the market and a very good industrial potential. Squash can be used in the manufacture of catsup, baby foods, confectionaries, noodles and many others.

Squash or "kalabasa" (*Cucurbita moschata* Duch), belonging to family *Cucurbitaceae*, is viny, creeping and trailing crop producing fruits and considered to be one of the most delicious vegetables. It is the most commonly and regularly grown among the cucurbits due to its rich source of Vitamins A and C, phosphorus, calcium and iron. It can reach a length of 4 meters or more and flowers throughout the year. Adventitious roots are also commonly formed at its nodes. The leaves are broadly rounded and heart shaped. Flowers are erect, yellow to deep orange in color, about 12 cm long.

Most squash and cucumber plants produce separate male and female flowers, pollen transfer from the male to the female flower is essential to the production of good yields of high quality fruit. Bees are the most common agent of pollination for cucurbit crops. Therefore, an ample supply of honeybees should be introduced into production fields to enhance and ensure pollination. Poorly pollinated fruits will have poor development which usually results in unmarketable fruits.

Amount of vitamin A content of squash is comparable to the degree of yellow color. The young shoots, flowers and fruits are used as vegetable; it is palatable when cooked alone or in combination with other vegetables, fish and meat. Mature fruits can be made into pies and other delicacies. In addition, seeds of mature fruits can be boiled in salted water, dried like watermelon seeds, roasted and used as snack food. It is now added in making noodles, vermicelli or canton.

Squash has very low calories. Phytochemicals is also present in squash. Coumarins and flavonoids are two of the phytochemicals present in squash. It is also rich in beta-carotene. Summer squash turns out to be the primary food source of alpha-carotene and beta-carotene. For lutein, zeaxanthin and beta-cryptoxanthin (three other health-supportive carotenoids) summer squash also comes out among the top three food sources in several studies. These antioxidants are especially helpful in protection of the eyes, including protection against age-related macular degeneration and cataracts. If possible, the skin should not be peeled off and the rind should not be removed when cooked. Many valuable antioxidant nutrients are found in skin and seeds of squash. Since the skin of this food is particularly antioxidant-rich, it's worth leaving the skin intact.

VARIETIES

Table 1. Recommended Varieties

OWNER	VARIETY	MATURITY (DAS)	FRUIT TYPE			SEASON	FEATURES
			Shape	Weight	Color		
Allied Botanical	Hybrid Jupiter 208	90-100	Flat	3-4kg	Solid green at young stage; yellow brown at color break. Flesh is yellow	Year round	Very vigorous and highly uniform in size. Excellent flesh texture and taste. Ideal for stacking and long distance shipping
Allied Botanical	Hybrid Venus 106	95-100	Flat	3-4kg	Solid green at young stage; yellow brown at color break. Flesh is yellow orange	Year round	Very uniform in terms of size and shape. Very adaptable. Good shipping quality and eating quality
East-West Seed	La Preciosa	90	Flat round	3kg	Yellow orange	Year round	Tolerant to virus and foliar diseases
Keystone	Matavia OP	60	Semi flat	1000-2000		All Season	Super glutinous, tolerant to squash mosaic
Allied Botanical	Rosalinda	95-100	Flat	3-4kg	Solid green at young stage; yellow brown at color break. Flesh is yellow	Year round	Excellent fruit and plant characteristics. Good shipper.
Allied Botanical	Saturn 108	95-100	Flat	3-4kg	Solid green at young stage; yellow brown at color break.	Year round	Vigorous and prolific. Very good eating quality and good shipping quality
Pilipinas Kaneko	Squash Royal Cup	80 (DAS)	High flat	3-4kg	Dark green	Year round	Early flowering; sticky flesh
	Rizalina	102(DS)-125(WS)	Deeply rigged and flat round	4.2-5.0kg	Yellow-orange fruits	Year round	Flowers 57 days during dry season, 80 days during wet season, vigorous open-pollinated, tolerant to squash virus complex
East West	Suprema	85	Flat round, regularly ridged	3-4kg	Attractive orange	Year round	Resistant to virus, strong against powdery and mildew, high yielding, has excellent eating quality, has good adaptation to wide range of different agro-climatic condition
		70-80	High round	1 -2kg	Yellow fruits	Year round	High yielding, has excellent eating quality

CULTURE AND MANAGEMENT

A. Climatic and Soil Requirement. Squash can be grown in both wet and dry season. It has been reported that environment can have a marked effect on development and quality of the fruit. The optimum monthly average temperature for good growth is from about 18 to 27°C. Likewise, warm temperature and low relative humidity favor good fruit-setting development and quality of the fruit.

It thrives on many types of soil but it grows well on organic-rich medium often found on compost or refuse heaps. A soil pH range of 5.6 to 6.5 is recommended.

B. Land Preparation. Choose a 1000 m² well-drained area previously planted to rice and accessible to water source. Squash grows in all types of well-drained soil, but the best soil type for the crop is sandy loam or clay loam with pH of 6.0 to 6.7. Squash can be grown with minimum tillage. Clear area and dig

holes at appropriate distances. In open field, a distance of 2-3 meters between hills. Field preparation for squash should be done by twice plowing and harrowing then furrow the field at 2 meters apart. Furrows are made with a native plow or machine tractor to a depth of 15 cm. For lowland rice-based areas, plow and harrow the field 2-3 times alternately. Furrow the field at a row spacing of 2 m. Prepare hills at 1 m apart. Incorporate complete fertilizer thoroughly with the soil at planting. For hilly areas, make holes 2 m x 1 m and placed complete fertilizer in each hole. Basal application of processed chicken manure or vermicompost of about 2 ton/ha must be done two weeks before planting.

- C. Planting and Spacing.** To plant a hectare, it needs about 2-4 kilos of good seeds. Squash are directly planted at the rate of 2-5 seeds per hill, spaced of 2-3 m between rows and 1 m between hills. One week after emergence, weak seedlings are thinned out and allow only 2 healthy seedlings to grow.

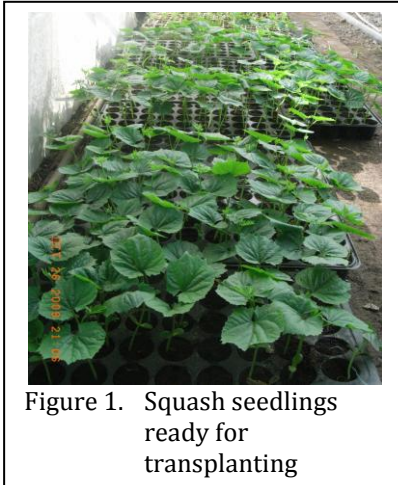


Figure 1. Squash seedlings ready for transplanting

Transplanting is also recommended especially for F1 varieties to save seeds and insure seedling establishment. Sow seeds in the seedbed and prick individually in the potlets. Transplanting is done 3 weeks after sowing.

D. Nutrient supplement. Foliar application of Fermented Plant Juice (FPJ) must be done once a week from emergence until fruiting stage.

E. Growing Season. For optimum yield and profit, plant in rice-based lowland areas from October to December, and May to July for hilly areas. Planting squash on these months will avoid the peak population of insect pests and the high incidence of plant diseases.

F. Crop Establishment. Plant 2-3 seeds per hill. Thin the weak seedlings when the first true leaves have developed and leave two vigorous plants per hill. Train the vines to crawl in a direction going

inside the plot so that these will be evenly distributed over the area. Properly trained vines help prevent growth of weeds in the plot because the thick leaves will shade the ground.

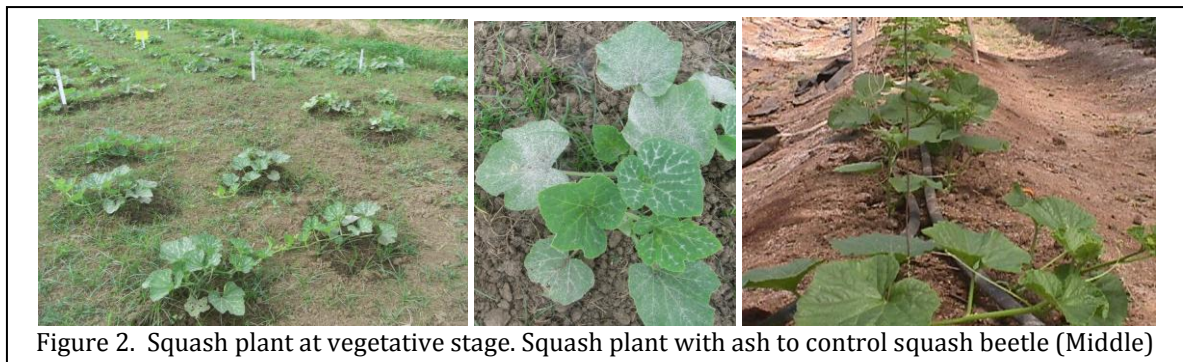


Figure 2. Squash plant at vegetative stage. Squash plant with ash to control squash beetle (Middle)

For optimum yield and profit, plant in rice-based lowland areas from October to December, and May to July for hilly areas. Planting squash on these months will avoid the peak population of insect pests and the high incidence of plant diseases.

- G. Hand Pollination.** To increase fruit setting when insect pollinators are few, hand pollinate by inserting the male flower of the same age to the female flower between 6:00 and 8:00 in the morning.
- H. Thinning of Vines and Fruits.** Thin some lateral vine near the fully developed fruits. Remove all deformed fruits while still small to avoid nutrient competition. Maintain bigger fruits by



Figure 3. Hand pollinating squash blossoms

allowing one fruit at each vine. Place 5-6 cm thick of rice straw beneath the good fruits or lay bedding materials made of knitted bamboo if there are available bamboo to prevent rotting of the fruits.

- I. **Water Management.** Irrigate once a week or hand water with 1 L/hill every other day. Irrigate also every after fertilizer application. Withhold watering or irrigation when the fruits reach matured green stage because this will result in lower quality.
- J. **Weeding.** Spot weeding around the plant is done two times a week. Repeat if weeds still grow in between plants.

Spreading of dry rice straw around the plant can minimize the emergence of weeds and also serves as good matting for the fruits.

- K. **Harvest Management.** Harvest immature fruits for vegetable at 30-40 days from anthesis or pollination.

Medium matured fruits (with light yellow stripe on the skin) are commonly harvested for market. The appearance of powdery, whitish substance on the surface of the fruit, and the hardening of the rind are indices of maturity if intended for seeds. The seeds of a squash are already matured and fully developed. Harvest the matured fruit when the fruits appear brownish orange. Harvest fruits of plants that have no symptoms of viral infection (mosaic, yellowing of leaves) if intended for seeds. This must be done to avoid virus-infected seeds for the next cropping.

- L. **Pest Management.** Squash beetles infest the crop especially at the seedling or vegetative stage. Aphids and leafhoppers are the most prevalent insect pests of squash throughout the year. For diseases, leaf curl or mosaic virus is the most damaging.

Insect Pests



Figure 4. Squash beetle infestation

1. Squash beetle (*Anasa tristis*) – Yellowish beetles damage the squash by scrapping the surface of the leaves producing a skeletonized appearance. Infestation at cotyledon stage may result in death of seedlings.

2. Aphids (*Aphis gossypii*) - The insect is as big as a coarse sand and lives in colonies under the

surface of the squash leaves. They produce sticky substances that favor the growth of soothy molds on the leaves of squash. The soot-like growth of the mold interferes with the photosynthetic activity of the plant. Aphids also secrete substance that is toxic to the plant causing leaf curling and dwarfing of shoots.

3. **Leaf hoppers (*Impoasca sp.*)** suck the leaves of squash and other crops causing hopper burn. In squash, they cause drying of leaves during severe infestation. The plants can tolerate the damage if irrigated twice a week during the whole growing period but with reduced yield.
4. **White fly (*Bemisia tabaci*)** - These are small white and dainty flies that live in the undersurface of the leaves. It transmits viral diseases to squash and other crops causing abnormal growth of leaves and shoots.

Diseases

1. **Leaf Mosaic virus** causes yellow green pattern of the leaves with slight curling. This is transferred by insect vector or through the seed.



Figure 5. Leaf mosaic virus infection

2. **Leaf curl virus**, like mosaic virus, is seed-borne. It is also characterized by curling of the leaves and shoots with shortened internodes exhibiting a dwarfed appearance. The plant can survive and produce numerous leaflets but not capable of producing normal shoots and fruits.



Figure 6. Leaf curl virus infection on squash

Table 2. Biological and remedial control of pests and diseases of squash

Insect pests	Recommended control
Squash beetle	Squash beetles are easy to catch. Use a net to catch more beetles. Dusting of ash with carbaryl is also the best remedy.
Aphids	Crush the colonies then spray infected and healthy plants with basil leaf extract at 200ml/16 L water. Dishwashing liquid detergent can be applied to minimize the aphids' colony, use of beneficial insects like parasitic wasps and lady beetles which prey on aphids.
Whitefly	Overhead irrigation twice a week can reduce the population of these pests. Use yellow sticky trap. Flooding once a week will replenish the plant sap sucked by the pest. Another alternative is the spraying of citronella extract (BPI-LBNCRDC)
Leafhopper	Overhead irrigation twice a week can reduce the population of these pests. Flooding once a week will replenish the plant sap sucked by the pest. <ul style="list-style-type: none"> • Maintain strict weed control in and around glasshouses and polythene tunnels • Dispose of infested plants carefully, keep stock plants in a separate structure from those used for propagation or production • Avoid taking cuttings from infested stock plants • Yellow sticky traps may be useful in doorways or under vents, to catch adult leafhoppers flying from infested plants to 'clean' plants. However, these will also catch flying beneficial insects, e.g. parasitic wasps, so they should be used and positioned with care. • Use biocontrol agents such as <i>Anagrus atomus</i> (tiny parasitic wasp), <i>Steinernema feltiae</i> (Insect-pathogenic nematodes), <i>Anthocorid bugs</i> and <i>Chrysoperla carnea</i>(lacewing) (http://herbs.hdc.org.uk/page.asp?id=3)
Disease	
Mosaic virus/ leaf curl virus	If symptoms appear on the plant at early stage, uproot the plants, then burn. If plants are infected at fruiting stage, irrigate the plant at weekly interval up to harvesting as it can tolerate the virus. If matured fruits are harvested, do not use the seeds as planting materials. Uproot and burn infected plants after harvesting.

Sources: Colting, L. M., et al., 2003; *Farmers'/Gardeners' Practices*

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Table 3. Cost and Return of Squash Production

Item	Unit Cost (PhP)	Total Cost (PhP)
I. Variable Costs		
A. Labor cost (PhP250/man-day(MD))		
Clearing (20MD)	250/MD	5,000
Plowing -mechanized(2X)	750/8hrs	1,500
Harrowing –mechanized(2X)	750/8hrs	1,500
Furrowing (4days)	250/man-animal-day	1,000
Dried manure/Fertilizer application (10MD)	250/MD	2,500
Planting (10MD)	250/MD	2,500
Side dressing/hilling up (10MD)	250/MD	2,000
Spraying (8MD)	250/MD	2,000
Weeding/hilling up (30MD)	250/MD	7,500
Irrigation (10MD)	250/MD	2,500
Harvesting (30MD)	250/MD	7,500
Subtotal		35,500
B. Supplies and Materials		
Seeds (2kg)	1,650/kg	3,300
Fertilizers		
Complete (2bags)	1,300/bag	2,600
40 bags of vermicompost/processed manure	250.00/bag	10,000
Urea (1bag)	1,300/bag	1,300
Muriate of Potash (1bag)	2,200/bag	2,200
2 Liters (FPJ**)	50/L	100
Jute sacks (50pcs)	15/piece	750
Subtotal		20,250
Total variable cost		55,750
Miscellaneous (15% of total variable costs)		8,363
II. Fixed Cost		
**Land Rental (10,000-12,000/ha province)	4,000	4,000
TOTAL COST		68,113
C. Average Yield per hectare		
* 12.0 tons to 21.8 tons (Php10.00/kg)		
Gross income		
@ 12,000kg		120,000
@ 21,800kg		218,000
Net income		
@ 12,000kg		51,887
@ 21,800kg		149,887
ROI (%)		
@ 12,000kg		76.18%
@ 21,800kg		220.06%

* Based on BPI Progress Report 1999- 2000. **Based on provincial rate (Laguna and Quezon)

**Fermented Plant Juice

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