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Bok Choy, an Asian Leafy Green Vegetable Emerging in Florida[1]

Hai Liu and Guodong Liu[2]

Asian vegetable crops are rapidly expanding in Florida since 2010 due to their health benefits combined with their high profitability. These crops can help increase vegetable growers' income and diversify Florida's crop production. They are new to most Floridians who are interested in growing and consuming them. This article provides a general overview of bok choy for vegetable growers, crop consultants, certified crop advisors, Extension agents, and graduate students.

Bok choy (*Brassica rapa* subsp. *chinensis* L.) is a biennial Chinese cabbage variety, a member of the cabbage family of Brassicaceae or Cruciferae. Bok choy grows best at 64°F–68°F (18°C–20°C), but it can tolerate temperatures as high as 95°F (35°C) and as low as 27°F (-3°C). It is widely grown in subtropical and temperate regions year-round and is increasingly expanding in Florida in recent years because of its great profitability (high yield and high popularity) and Florida's suitable climatic conditions. Bok choy is usually called Shanghai Qing or Shanghai Baicai, Qingjiang Cai, and Xiaoqing Cai in Chinese, and it is sometimes known as Piao'erbai due to its white gourd-shaped petiole. In North America and South Africa, this variety is widely known as bok choy (also spelled pak choi, bok choi, pak choy, pac choi), which originated from Cantonese. Sometimes, Chinese people also call bok choy "spoon cabbage" or "Chinese chard."

Florida's climate is suitable for bok choy production. Bok choy is much more profitable than some conventional crops grown in the state, based on personal communication with growers in the potato-growing region.

Bok choy's petiole is larger than its leaf blade in its late growth stage, similar to celery. Seeds are small (Figure 1). Newly harvested bok choy can stay fresh for 1 to 2 days at room temperature, and 5 or more days with refrigeration (at 39°F; 4°C).

Figure 1. Seeds of a bok choy cultivar (1–1.5 mm in diameter). Credits: Jieli Qiao, Guiyang, Guizhou, China

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2. Hai Liu, visiting PhD student, and Guodong Liu, associate professor, Horticultural Sciences Department; UF/IFAS Extension, Gainesville, FL 32611.

Bok choy is rich in mineral nutrients and vitamins (Table 1). Regular consumption may benefit human cardiovascular health (Manchalia et al. 2012) because of its abundant crude fiber and riboflavin (Vitamin B_2). Due to the rich content of retinol (Vitamin A_1), bok choy may also have a beneficial effect in the remediation of vision problems such as cataracts, amaurosis, and macular degeneration (Thomason et al. 2010). Bok choy contains 1.4% dietary fiber and can minimize constipation as well (Manchalia et al. 2012).

How to Grow Bok Choy

With a wide temperature range of adaptation, bok choy can be grown in most areas of south Florida year-round. In north Florida, it can have two or three growing seasons per year. This crop prefers slightly acidic (pH 5.5 to 7.0) sandy soil rich in nutrients. Soil should be prepared according to EDIS publication HS503, *Soil Preparation and Liming for Vegetable Gardens*, at https://edis.ifas.ufl.edu/vh024 (Stephens and Liu 2016). The prepared land should be kept moist. At planting, seeds should be planted in rows 12 inches (30 cm) apart with 8-inch (20 cm) plant spacing (Figure 2–3). There is no UF/IFAS fertilizer recommendation available, but growers may use recommendations for other crucifers, such as broccoli or cabbage for the time being: 175 lb/acre (196 kg/ha) nitrogen; 120–150 and 100 lb/acre (134–168 and 112 kg/ha) phosphate pentoxide and potassium oxide for low and medium soil test index using the Mehlich 3 soil extractant method (Chapter 2 of the *Vegetable Production Handbook of Florida*, "Fertilizer Management for Vegetable Production in Florida," http://edis.ifas.ufl.edu/cv296, Liu et al. 2018). Usually, bok choy is harvested at the 10–15 leaf stage for regular leafy green production, while sometimes growers would keep them growing until mature stage (bolting stage) for seed production.

Disease and Pest Control

The main pests and diseases occurring on bok choy include leaf blight, downy mildew, aphids, and cabbage caterpillars. Leaf blight and downy mildew usually occur in summer with high temperatures and rain. To control pests and diseases, firstly, strengthen field management; and secondly, apply chemical pesticides or fungicides, such as bordeaux mixture and carbendazim. Spraying trichlorfon or dimethoate 40% EC (dimethoate 40% emulsifiable concentrate, a systemic and contact insecticide and miticide) can control aphids and cabbage caterpillars, which exist at every growth stage.

Figure 2. A bok choy seedling.
Credits: Jieli Qiao, Guiyang, Guizhou, China

Figure 3. Bok choy grown to bolting stage (right) in Guangdong, China.
Credits: Fengchao Liu, Xiamen, Fujian, China

How to Harvest Bok Choy

Bok choy can normally be harvested 40–50 days after seeding. The plants can be harvested with 10 to 15 leaves by cutting from the soil surface and can then be cleaned and packed for sale. The harvesting date depends on the temperature, soil fertility, and moisture (Figure 4). If the vegetable is harvested too late (when it has more than 15 leaves), the taste will become a little bitter. Therefore, harvesting on time is critically important. Both one-time harvest for commercial production and multiple harvests by home gardeners may be practiced. For multiple harvests from the garden, plants that meet the 10-to-15-leaf stage should be selected, allowing smaller plants to continue growing.

Figure 4. Bok choy plants with green petioles.
Credits: Jieli Qiao, Guiyang, Guizhou, China

How to Cook Bok Choy

Bok choy's low calorie content makes it popular in Chinese communities. Before cooking, the leaves should be individually washed to remove any soil and chopped into pieces; then they are ready for cooking. Bok choy is often cooked by stir-frying alone or with some seasonings, such as pieces of fresh garlic or chili peppers (Figure 5). It can also be used in soup or as an instant-boiled vegetable in firepot or hotpot. Bok choy can be cooked with oyster sauce, mushroom, squid, or bacon as well to give different flavors.

Figure 5. Cooked bok choy dish.
Credits: Jieli Qiao, Guiyang, Guizhou, China

References and Further Reading

Ashen, M. D. 2013. "Vegetarian Diets in Cardiovascular Prevention." *Current Treatment Options in Cardiovascular Medicine* 15(6): 735–745.

Chen, S. G. 2010. "High Yield Cultivation Technology of Bok Choy." *Fujian Agricultural Science and Technology* 40(1): 45–46.

Liu, G., E. H. Simonne, K. T. Morgan, G. J. Hochmuth, S. Agehara and R. Mylavarapu. 2019. *Chapter 2. Fertilizer Management for Vegetable Production in Florida*. CV296. Gainesville: University of Florida Institute of Food and Agricultural Sciences. http://edis.ifas.ufl.edu/cv296.

Manchali, S., K. N. C. Murthy, and B. S. Patil. 2012. "Crucial Facts about Health Benefits of Popular Cruciferous Vegetables." *Journal of Functional Foods* 4(1): 94–106 https://www.sciencedirect.com/science/article/pii/S1756464611000843.

Nair, A., and B. Havlovic. 2015. "Bok Choy Cultivars for High Tunnel Production." *Iowa State Research Farm Progress Reports* 2141. Ames: Iowa State University. http://lib.dr.iastate.edu/farms_reports/2141.

Pan, X. L., and G. R. Liang. 2017. "High-Efficiency Cultivation Models of Cucumber, Shanghai Green and Tomato in Sunlight Greenhouse." *Henan Agriculture* (24): 46.

Shuler, K. D., S. J. Nie, and P. A. N. Shuler. 2001. "The Evolution of Production, Harvesting, and Marketing Techniques for Bok Choy." *Proceedings of the Florida State Horticultural Society* 114: 224–231.

Stephens, J., and G. D. Liu. 2016. *Soil Preparation and Liming for Vegetable Gardens*. HS503. Gainesville: University of Florida Institute of Food and Agricultural Sciences. https://edis.ifas.ufl.edu/vh024.

Thomson C. A., S. Dickinson, and G. T. Bowden. 2010. "Cruciferous Vegetables, Isothiocyanates, Indoles, and Cancer Prevention." In: *Bioactive Compounds and Cancer. Nutrition and Health*, edited by J. A. Milner and D. F. Romagnolo. 535–566. Humana Press, Totowa, N.J. https://link.springer.com/chapter/10.1007/978-1-60761-627-6_23.

USDA-ARS. 2018. "National Nutrient Database for Standard Reference Legacy Release, Full Report (All Nutrients): 11116, Cabbage, chinese (pak-choi), raw." Accessed December 1, 2018. https://ndb.nal.usda.gov/ndb/foods/ show/2894?fgcd=&man=&lfacet=&count=&max=35&sort=&q lookup=chinese+cabbage&offset=&format=Full&new=&m easureby.

Zhang, X., X. O. Shu, Y. B. Xiang, G. Yang, H. Li, J. Gao, H. Cai, Y. T. Gao, and W. Zheng. 2011. "Cruciferous Vegetable Consumption Is Associated with a Reduced Risk of Total and Cardiovascular Disease Mortality." *The American Journal of Clinical Nutrition* 94(1): 240–246.

Table 1. Nutrient value per 100 g (3.5 oz) of raw bok choy (USDA-ARS).

Nutrient	Unit	Value			
		100 g	1 cup/70.0g	1 head/840.0g	1 leaf/14.0g
Proximates					
Water	g	95.32	66.72	800.69	13.34
Energy	kcal	13	9	109	2
Protein	g	1.5	1.05	12.6	0.21
Total lipid (fat)	g	0.2	0.14	1.68	0.03
Carbohydrate, by difference	g	2.18	1.53	18.31	0.31
Fiber, total dietary	g	1	0.7	8.4	0.1
Sugars, total	g	1.18	0.83	9.91	0.17
Minerals					
Calcium, Ca	mg	105	74	882	15
Iron, Fe	mg	0.8	0.56	6.72	0.11
Magnesium, Mg	mg	19	13	160	3
Phosphorus, P	mg	37	26	311	5
Potassium, K	mg	252	176	2117	35
Sodium, Na	mg	65	46	546	9
Zinc, Zn	mg	0.19	0.13	1.6	0.03
Vitamins					
Vitamin C, total ascorbic acid	mg	45	31.5	378	6.3
Thiamin	mg	0.04	0.028	0.336	0.006
Riboflavin	mg	0.07	0.049	0.588	0.01
Niacin	mg	0.5	0.35	4.2	0.07
Vitamin B_6	mg	0.194	0.136	1.63	0.027
Folate, DFE	µg	66	46	554	9
Vitamin B_{12}	µg	0	0	0	0
Vitamin A, RAE	µg	223	156	1873	31
Vitamin A, IU	IU	4468	3128	37531	626
Vitamin E (alpha-tocopherol)	mg	0.09	0.06	0.76	0.01
Vitamin D ($D_2 + D_3$)	µg	0	0	0	0
Vitamin D	IU	0	0	0	0
Vitamin K (phylloquinone)	µg	45.5	31.9	382.2	6.4
Lipids					
Total saturated fatty acids	g	0.027	0.019	0.227	0.004
Total monounsaturated fatty acids	g	0.015	0.011	0.126	0.002
Total polyunsaturated fatty acids	g	0.096	0.067	0.806	0.013

Source: USDA-ARS, National Nutrient Database available at https://ndb.nal.usda.gov/ndb/foods/show/2894?fgcd=&man=&lfacet=&count=&max=35&sort=&qlookup=chinese+cabbage&offset=&format =Full&new=&measureby