

# Growing Chinese Greens in the Caribbean

## Bok choy production in plant towers vs. other cultures

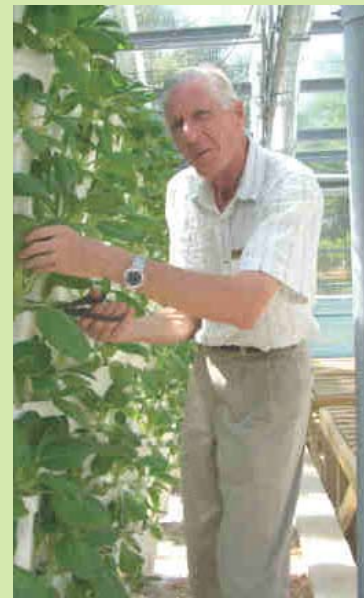
**Howard M. Resh, Ph.D.**

Under high temperatures at Cuisinart Resort & Spa in Anguilla, British West Indies, those of us who work at the resort's hydroponic farm have found a miniature bok choy called Green Fortune, a low-profile, slow-bolting variety, to be tolerant of warm growing conditions. It is a cultivar from Takii Seeds.

To better utilize the greenhouse floor area we use a plant tower system from Verti-Gro of Summerland, Fla. They originally designed these towers for strawberries. However, they have proven to produce herbs and bok choy efficiently on a per-square-foot basis. They are spaced at one plant tower per 12 square feet, which is 3,630 plant towers per acre.

The plant towers are formed by stacking 10 Styrofoam pots one on top of the other. They are square pots with special grooves on the top of each side so that they may be set one on top of the other by rotating the pot 45 degrees. The pots are about 3 quarts in volume. Three irrigation drip lines are placed in a tower, two in the top pot and one in the middle pot half way down the tower. Each pot has drainage holes for the solution to pass from one to the next below. The solution may be collected by a drain pipe below and recycled to a cistern. Details on the set up of the plant towers are given in my book "Hydroponic Food Production." (To order Howard Resh's book and other year-round gardening books, go online at [www.growingedge.com/store/books\\_multimedia.php](http://www.growingedge.com/store/books_multimedia.php).)

We use perlite as a substrate for growing herbs and bok choy. Each tower receives irrigation for 5 minutes three times a day. The bok choy is seeded directly into the perlite in each corner of the pots. After sowing we water the tower once with a hose to moisten the perlite, and then the subsequent watering is by the irrigation system. It is difficult to place one seed per corner of each pot, so often multiple plants will germinate. The extra seedlings can be thinned out to keep one only at 10 days. In the top pot 8 plants may be permitted to grow to maturity, but in the lower pots only 4 per pot or they get crowded and form small plants. As a result, 44 plants may be grown per plant tower. They mature within 45 to 50 days from sowing.



Above, left to right: In the Cuisinart Resort hydroponic greenhouse, bok choy grows in plant towers of 10 pots each. Takuchoy type bok choy at 44 days soon will be ready for the resort's restaurant. Another type of Chinese cabbage grown in the greenhouse is this dwarf pak choi sum, here at 36 days. Greenhouse manager Howard Resh harvests bok choy.



## Cropping and Production

If it takes 45 to 50 days from seed to maturity. For continuous daily production sow one plant tower a day. To do this 45 to 50 plant towers are needed, depending upon how long it takes to get the plants to maturity. In this way, daily production is 44 head of bok choy per square meter.

The best way to harvest the plants is to cut them at the crown above the perlite to prevent perlite from falling inside the plant. Start at the bottom of the plant tower and work up. In that way, perlite will not fall onto the foliage of plants below. It is important not to get perlite into the harvested head as that could cause problems in cleaning the plants.

After harvesting the entire plant tower, remove the roots carefully to get as much of the root system as possible out of the perlite. Use a knife or fork to lodge under the root mass to assist in lifting the roots out. It is best to clean the upper parts of the pots with a cloth containing a 10% bleach solution. Wipe the pots with the wet cloth to remove algae and any fungal spores. Within 10 to 15 minutes the pots will dry, as you add a little more perlite to make up the loss from removing the plants. An important tip is to keep the level of the perlite in the pots about 1-inch below the bottom of the pots resting on top. This level will provide an air space between the pots of the plant tower that will assist in keeping the roots of the plants from growing from the bottom of the pot to the top

*Top left:* At the Cuisinart Resort on Anguilla, bok choy is harvested after 45-50 days. *Top center:* Bok choy seedlings are thinned to one plant in each corner. *Top right:* Bok choy grows in plant towers, 10 pots to each tower. *Below:* Green Fortune, a type of baby bok choy, is just about ready to be harvested after 42 days growing in nutrient film technique (NFT). These Chinese greens will be used in meals prepared by Cuisinart chefs for resort patrons.



of the immediately adjacent pot.

With a 45-50-day cropping cycle 7 to 8 crops are possible annually. Using 8 crops per year and 3630 plant towers per acre, the total production per acre is  $8 \times 3630 \times 44 = 1,277,760$ , or about 1.28 million head per acre per year. At a price of \$0.40 per head this would bring annual revenues

to about \$511,000. Production could be increased if the plants were sown into trays and later at 15 days transplanted to the plant towers. That would permit a cropping cycle within the plant towers themselves of from 30 to 35 days. The total crops per year could be increased to 10.5 to 12 crops. This would increase production to from 1.68

to 1.92 million head per year, with annual revenues between \$672,000 and \$768,000.

Of course, some assumptions are made with these projections. Firstly, it is assumed that there is sufficient market. To get the maximum production the plants must be harvested on time and not permitted to continue growing longer than the cropping period. If they are allowed to grow longer due to insufficient demand, the number of annual cropping cycles will be significantly reduced and so will the overall production. A stable average price of \$0.40 is possibly overly optimistic, and any yearly price average less than that will reduce revenues. We have not experienced any serious pest or disease problems with bok choy under our tropical conditions. However, any such infestation or infection would reduce annual yields.

### Other Related Crops

As mentioned initially there are a number of similar Chinese cabbages to bok choy that are also in demand. I have seen a number of miniature types in Chinese markets in Chinatown in Vancouver, B.C. Some of them are compact rosette in form. These include dwarf bok choy, which is harvested at from 4- to 6-inches in height within 45 to 50 days from sowing. Takuchoy is a relatively flat-growing, compact form that is used in mixed salads. Ching Chang is also a compact form that matures within 40 to 45 days.

We have tested four types here in Anguilla. We tried dwarf pak choi sum, Takuchoy, special green petiole Ching Chang and Ching Chang #5001. These varieties were purchased from Tai-nong Seeds, Vista, Calif. The special green petiole Ching Chang and Ching Chang #5001 did not tolerate the heat of late May to mid-July here. The plants grew tall, unlike their normal dwarf form. The Takuchoy and dwarf pak choi sum were much lower in profile. As a result, we will continue testing these varieties to determine whether any of them will grow in a compact form under our conditions.

Trials of the above four varieties tested during March-April 2005 proved the same results as the previous ones. Both Takuchoy and dwarf pak choi sum grew very compact while special green Ching Chang and Ching Chang #5001 bolted by 45 days from sowing.

### Comparison of NFT and Peatlite Systems

Bok choy may be grown in nutrient film technique (NFT) systems. (For details on NFT refer to my book "Hydroponic Food Production.") Several NFT systems that grow lettuce may also be used for bok choy—Agri-Systems NFT and the standard channel NFT. In either system 10 crops may be grown annually by sowing bok choy in cubes or plug trays with a substrate such as coarse vermiculite. By transplanting to the NFT channels after 15 to 20 days the production cycle in the NFT channels is 25 to 30 days, similar to that of lettuce.

In the Agri-Systems NFT plants are spaced 6 inches by 6 inches to get approximately 150,000 plants per acre. If we have 10 crops per year, that is 1.5 million head per acre per year. Other NFT systems space lettuce at 7.5 inches by 8 inches,



Above: Daniel Orr, Cuisinart Resort chef, created this dish with dwarf bok choy as a featured ingredient. The bok choy is sautéed with shallots, ginger, chilies, salt, pepper and olive oil. Live-caught Wahoo, beetroot vinaigrette and bronze fennel are added to complete the dish. Cuisinart patrons enjoy the fresh flavor of bok choy and its nutrition without any bitter taste or stringiness. Below: Bok choy is sown at different times in beds of Promix. This crop is between 30 and 42 days old.



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which is equivalent to 87,000 plants per acre. However, the space can be reduced to 6 inches by 6 inches for bok choy to reach 146,000 plants per acre. With 10 crops per year the annual production per acre reaches 1.46 million.

Trials we carried out at Cuisinart Resort & Spa hydroponic farm in NFT resulted in a faster growing rate than in the plant towers. Green Fortune bok choy was fully mature within 42 days from sowing. That was about three days sooner than in the plant towers. The only problem with the NFT system was that as the bok choy matured it started to lodge due to the top weight not being supported by the narrow channel of roots below. However, quality was not adversely affected. If the plants were carried beyond 46 to 47 days they started to get tipburn.

The plant tower culture, as mentioned above, with 10 crops per year will produce 1.6 million head a year per acre of greenhouse. This is a 7 percent increase over the NFT systems. The principal advantage of the plant towers over NFT would be lower capital cost; however, production costs may be higher due to the need to add perlite between crops and to replace the perlite at least once a year.

The NFT system is more efficient in harvesting and other cropping procedures, resulting in lower production costs than for plant towers. In addition, it is easy to sterilize NFT channels between crops, which helps prevent root diseases. Bok choy will tolerate high air temperatures if its roots are kept cooler by chilling the nutrient solution. That is not possible with the plant towers. Before deciding on the specific hydroponic culture to produce bok choy, you need to closely consider the advantages and disadvantages of each culture from both capital costs and operational costs.

We have grown bok choy at Cuisinart Resort in a peatlite mix successfully. The plants were spaced 6 inches by 6 inches within blocks 4 feet wide so that they could be harvested from either side of a narrow 18-inch aisle between the blocks. This spacing works out to 16 plants per lineal foot of the 4-foot wide block. That is

equivalent to 16 plants per 5.5 square feet, or 2.9 plants per square foot. For 1 acre of greenhouse we could have 126,700 plants per crop. For 10 crops that is 1.27 million head annually. This compares to 1.46 million with the NFT system and 1.5 million in the plant towers. The plant towers can produce 18% more than the peatlite system. However, the cost of the plant towers is significantly higher than beds of peatlite mix, so bok choy production may be more economically feasible in these beds.

While in most cases the plant tower method of growing bok choy should give higher yields per unit area of the greenhouse, one must consider the additional capital costs and labor involved in changing crops. Certainly, the plant towers have the advantage of keeping the product very clean and permits the workers to harvest without stooping, as would occur if the crop were growing in beds. However, we found under our hot conditions that the bok choy also grew well in the NFT system and could in fact be grown in a shorter period in the NFT system by growing seedlings to 15 to 20 days of age before transplanting.

In this way, time in the NFT system can be reduced to 25-30 days compared to 45-50 days required in the plant towers by direct seeding into tower pots. In addition, NFT gutters are easy to sterilize between crops.

There is a market for a number of miniature varieties of bok choy. These should be researched more as potential greenhouse crops. We were successful in growing several of these varieties in our trials. Besides our regular Green Fortune variety we found Takucho and dwarf pak choi sum to produce compact heads that are well accepted by guests here at Cuisinart Resort & Spa. 🌿

*Howard Resh is manager of the hydroponic greenhouse at the Cuisinart Resort and Spa.*

### Resources

Cuisinart Resort  
[www.cuisinartresort.com](http://www.cuisinartresort.com)  
 Verti-Gro  
[www.vertigro.com](http://www.vertigro.com)