CARIBBEAN FOOD CROPS SOCIETY

49

Forty-ninth Annual Meeting 2013

Port of Spain, Trinidad and Tobago
Vol. XLIX

PROCEEDINGS

OF THE

49TH ANNUAL MEETING

Caribbean Food Crops Society
49TH Annual Meeting
June 30 – July 6, 2013

Hyatt Regency Hotel
Port of Spain, Trinidad and Tobago

"Agribusiness Essential for Food Security: Empowering Youth and Enhancing Quality Products"

Edited
by
Wanda I. Lugo, Héctor L. Santiago, Rohanie Maharaj, and Wilfredo Colón

Published by the Caribbean Food Crops Society

ISSN 95-07-0410

Copies of this publication may be obtained from:

Secretariat CFCS
P.O. Box 40108
San Juan, Puerto Rico, 00940

or from:

CFCS Treasurer
Agricultural Experiment Station
Jardín Botánico Sur
1193 Calle Guayacán
San Juan, Puerto Rico 00936-1118

Proceedings of the Caribbean Food Crops Society. 49:134-137. 2013

CUCUMBER PRODUCTION (*CUCUMIS SATIVUS*) IN THE UVI AQUAPONIC SYSTEM

D. Bailey and D. Nandwani. Agricultural Experiment Station, University of the Virgin Islands, USVI

ABSTRACT: The UVI Aquaponics System is an integrated production system of fish culture and vegetable hydroponics which conserves land and water resources by concentrating production, reusing and recycling water, uses fish waste (both metabolic and digestive) as nutrient sources for plant growth, reduces waste discharged into the environment. Two trials were conducted to evaluate production of 10 varieties of cucumber (*Cucumis sativus*) in the aquaponic system from June – December, 2011. Cucumber seedlings were transplanted at a density of 8/m^2, which is the density recommended for field production by the seed company. In the first trial, five varieties were transplanted in complete randomized block design in one-third of the system. Transplanted seedlings were two-weeks old and harvests began on day 21 and continued for an additional 21 days when the crops were removed. These five varieties were transplanted again at week 2 and 4. Fruits harvested three times a week for total seven harvests for each crop. The same transplanting and harvest procedure was repeated for a second trial with five additional varieties in season and year. Cucumber var. "Speedway", "Fanfare" and "Sweeter Yet" yielded 24 fruits per m^2 per planting. "Palace King" produced the greatest mass (6.2 kg/m^2/crop). Varietal differences will influence the mass produced for each crop. Market preference in the USVI for smaller varieties must be met by a farmer choosing the cucumber type to produce.

Materials and Methods

System Description

The UVI Aquaponic Systems consists of fish rearing tanks, solids removal filters and hydroponic grow beds (Figure 1) (Rakocy 2007, Rakocy 2004a, Rakocy 2004b). Fish (Nile Tilapia, *Oreochromis niloticus*) are stocked in the rearing tanks at 6-week intervals and cultured for 24 weeks. Tilapia fingerlings are stocked at a density of 77/m^3 and an average weight of 50 grams and adults are harvested at 900 grams. The initial biomass is therefore 30 kg and the final harvested live weight is 540 kg. During the production period each tank is fed individually *ad libitum* for 30 minutes, three times each day. Input of feed ranges from 18 to 23 kg daily.

Water is continuously pumped into the rearing tank from the sump and exits through a central bottom drain. This drain flushes out fish waste, both the solid feces and the dissolved metabolic waste. The effluent flows first into cone bottom clarifiers and then into filter tanks. Passive filtration removes 50% of solid waste in the clarifier with a 20 minute retention time. These solids are concentrated in the cone bottom and removed through a drain at each feeding event. The remainder of the solid waste is trapped by netting in the filter tanks. The solids are retained on the net for a week and can

decompose and mineralize during that time, releasing nutrients into the water. From the filter tanks, water flows to a degassing tank where diffused aeration can displace gasses produced by metabolism (CO_2) and decomposition of solid waste (CH_4, H_2S, N_2). The water is also oxygenated as it flows to the hydroponic tanks. The hydroponic tanks are lined troughs, 30.5 m x 1.2 m x 0.4 m, arranged in pairs. Water enters at one end of a tank, flows its length, and returns in the second tank of the pair. The water leaves the hydroponic tank, flowing to the sump which is the lowest tank in the system. Water is pumped from the sump to the fish rearing tanks.

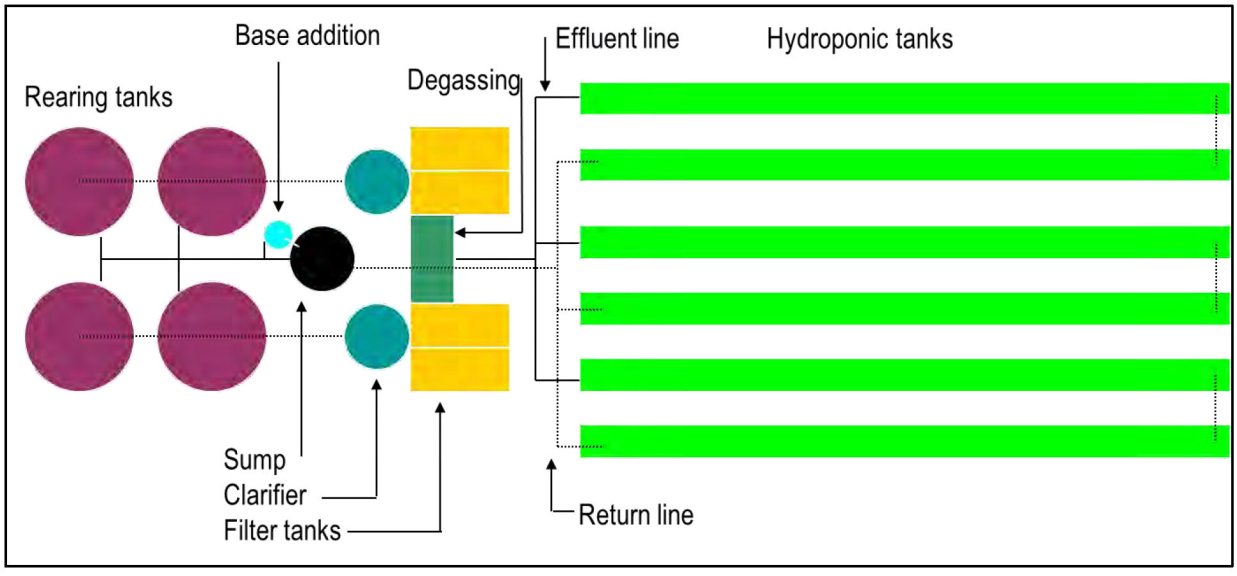

Figure 1. Schematic drawing of UVI Aquaponic System

Table 1a. System Components.

Tank	Number	Volume
Fish rearing	4	7.8 m^3
Cylindro-conical clarifiers	2	3.8 m^3
Filter tanks	4	0.7 m^3
Degassing tank	1	0.7 m^3
Hydroponic tanks	6	11.3 m^3
Sump	1	0.6 m^3
Base addition tank	1	0.2 m^3

Table 1b. System Summary Data.

System Characteristics	Volume & Area
Total water volume	110 m^3
Land area	0.05 ha
Total plant growing area	214 m^2

Experiment Design

Ten varieties of cucumber were evaluated for production performance. The varieties were grown in groups of 5 varieties, and 3 plantings at two week intervals for each group. The system is comprised of 72 polystyrene rafts, each 2.97 m^2. Seedlings of the 5 varieties were planted into 20 rafts, randomly selected around the system. Each raft was planted with 24 2-week old seedlings (8/m^2). Each variety occupied 2 adjoining rafts. The varieties in the first group were "Tasty Green", "Speedway", "Diva", "Calypso" and "Lemon". The varieties in the second group were "Eureka", "Fanfare", "Sweeter Yet", "Palace King" and "Arminian".

Harvests began when the first fruit matured for each variety. Fruits were harvested on Monday, Wednesday and Friday of each week until production declined and plant became damaged by pests. Fruits were counted and weighed for each raft and variety. Caterpillars were controlled with Dipel *Bacillus thuringiensis* (Valent Bioscience, USA) twice each week.

Results and Discussion

Production results are listed in Table 2. Most varieties yielded between 17 to 24 fruits/m^2. Two varieties, "Armenian" and "Lemon" had very low yields of 1 fruit/m^2/planting and would not be recommended for production. Differences in type make direct comparisons of mass difficult as there are different expectations. "Palace Kings" was the best yielding Asian type and "Sweeter Yet" was the best burpless. The two pickling and two slicing varieties yielded equal number of fruit for each type. "Calypso" (3,578 g/m^2/planting) yielded a higher mass than "Eureka" (2,756 g/m^2/planting) and "Speedway" (5,180 g/m^2/planting) yielded a higher mass than "Fanfare" (4,764 g/m^2/planting).

Conclusion

Most cucumber varieties produce well in the UVI Aquaponic System. Nitrogen, as NH_3, is excreted as waste from fish metabolism through the gills. Through nitrification by bacteria the NH_3 is converted to nitrate, NO_3^-. This source of nitrate leads to vigorous and healthy plant growth. Pruning and training are not required and plants run on the rafts and on the ground. Fruits were harvested when mature, which varies by type.

The highest yields by count were from varieties "Speedway," "Fanfare" and "Sweeter Yet." The highest yield by mass was "Palace King." These should be tested in the marketplace for consumer acceptance and the best selected for production.

Two varieties performed poorly, "Lemon" and "Armenian". These are both specialty/novelty types and did not tolerate the conditions of aquaponic production.

Farmers using aquaponic technology look for the opportunity to provide a variety of crops to their customers, including leafy greens, herbs and fruiting crops. Cucumber is a productive and viable crop.

Table 2: Cucumber production in the aquaponic system.

Variety	Type	Count/m^2/planting	Mass g/m^2/planting
"Armenian"	Asian	1	157
"Palace King"	Asian	18	6,161
"Diva"	Burpless	9	1,739
"Sweeter Yet"	Burpless	24	6,013
"Tasty Green"	Burpless	17	5,148
"Calypso"	Pickling	19	3,578
"Eureka"	Pickling	19	2,756
"Fanfare"	Slicing	24	4,764
"Speedway"	Slicing	24	5,180
"Lemon"	Specialty	1	121

Acknowledgments

The research was conducted under the Hatch grant received from the National Institute of Food and Agriculture, United States Department of Agriculture. Thanks to Frankie and Donna Gonzales for the field assistance.

Literature Cited

Rakocy, J.E., D.S. Bailey, R.C. Shultz and J.J Danaher. 2007. Fish and vegetable production in a commercial aquaponic system: 25 Years of Research at the University of the Virgin Islands. Proc. 2007 National Canadian Aquaculture Conference.

Rakocy, J.E., D.S. Bailey, R.C. Shultz and E.S. Thoman. 2004a. Update on tilapia and vegetable production in the UVI aquaponic system. pp. 676-690. In: R. Bolivar, G. Mair and K. Fitzsimmons (eds.). New dimensions in farmed tilapia. Proc. 6th International Symposium on Tilapia in Aquaculture. Manila, Philippines.

Rakocy, J., R.C Shultz, D.S Bailey and E.S Thoman. 2004b. Aquaponic production of tilapia and basil: Comparing a batch and staggered cropping system. Acta Hort. (ISHS) 648:63-69.