POLICY BRIEF
AKI RESEARCH GRANTS ON FOOD STUDIES
Volume VIII, No. 3, 2014
ISSN # 2094-3342

De La Salle University
AKI
Angelo King Institute
for Economic and Business Studies

Urban Hydroponics for Diversified Agriculture: Part II

INTRODUCTION

Achieving food security in urban communities proves to be a challenging task. The inability of cities to produce its food requirement means that food has to be imported from faraway places. Traffic congestion, rising fuel prices, and poor road infrastructure have caused problems in transporting food from farms to markets. The increase in rates of spoilage of perishable vegetables and in transportation costs is a food security issue that needs to be addressed.

Our proposed solution is urban agriculture – specifically through hydroponics and organic farming. Giving urban farming enthusiasts alternative farming methods can help popularize the concept of urban agriculture. Our past surveys indicate that organic farming is more popular to farming enthusiasts than hydroponics. Furthermore products of organic farming are perceived to be more nutritious than those grown using chemical fertilizers and pesticides. To showcase the merits of hydroponics over other methods, we have compared the yield, growth parameters, nutritional value, and even the chemical contaminants found in lettuce grown using both methods.

The present project sought to establish that lettuce grown using urban hydroponics is as healthy and as marketable as those grown using organic methods. The hydroponics method also registered positive environmental footprints. The following metrics were used in the project: nutrient source applied per growth output; nutrient content of the yield; and level of chemical contamination in lettuce grown via urban hydroponics measured against chemical contamination in organically grown lettuce. This project hoped to derive evidence that will prove that the nutrient content of hydroponically grown lettuce is comparable if not better than those that are organically grown. To illustrate food safety levels, contaminants in the lettuce harvested from both methods were also investigated.

For this project, Romaine lettuce was raised using a hydroponics set-up at the De La Salle University Manila campus, and using organic farming methods at the De La Salle University - Dasmariñas campus. Organic methods include the sowing of seedlings in plots of pure garden soil, in various containers of garden soil and vermicasts. The plants were harvested at maturation.

Written by
Jose Santos R. Carandang, VI[a]

Robert W. Taylor[a]

Josemari S. Calleja[a]

Edito A. Busayong[b]

Eric Camilo R. Punzalan[a]

[a]De La Salle University- Manila
[b]De La Salle University- Dasmariñas

Comparing Hydroponics & Organic Farming

A. Germination, Maturation, and Yield

The percentage germination in both set ups (hydroponics and organic methods) was around 85%, which is close to what has been advertised by the source of the seeds (Condor quality Seeds from Allied Botanical Corporation). However, the plants grown using the hydroponics method grew faster and were ready for harvest at 21 days after sowing. The plants grown organically using vermicasts as nutrient source and garden soil as medium were harvested 52 days after sowing. Nevertheless, even if hydroponically grown lettuce were smaller at harvest time, as indicated by the student t-test, maturation takes less than half the time as those grown in soil. In the organic set up, the soil-grown lettuce plants in containers do not vary much in harvest weight. Analysis by student t-test also indicated that there was no difference in the mean harvest weights of lettuce grown in garden plots and those grown in containers, although plant density (or crowding) apparently affected the harvest weight inversely, that is, the more densely planted the lettuce plants were, the lower the yield.

These results indicate that the overall harvest yield of hydroponically grown lettuce can be higher (even if yield in terms of biomass is lower) since maturation period is shorter, and therefore, more harvesting can be done in the same period as in the organic method. In general, results indicate that both methods produce high yields.

B. Vitamins and Minerals

To determine the Vitamin A, D3 and E in the harvested lettuce leaves, HPLC analysis was performed on an Agilent Technologies 1200 Series High-performance Liquid Chromatography (HPLC) with a UV detector. A reversed phase C18 column was used as stationary phase. Copper was also monitored because at low quantities, it served as an essential mineral for biochemical reactions. Results of this study indicate that the Vit A, Vit D3 and Vit E or α-tocopherol content of lettuce from both agricultural methods are high. Comparatively, both treatment groups have high levels of copper in relation to the recommended daily value for this essential nutrient. But the copper levels of lettuce cultured using the organic method is higher than those of the hydroponically grown group. Results indicate that the nutrient value of lettuce harvested using the two methods are both high.

C. Level of Contaminants

The analysis of metals in the samples was performed using Shimadzu Atomic Absorption Syphon (AA-6300), while the analysis of pesticide residue and other organic metabolites was done using a Perkin–Elmer gas chromatograph (Clarus 500 GC) with an Elite 5 MS GC column and characterized using MS. The method used for the pesticide analysis is patterned from an official method by AOAC International (2007). The levels of heavy metal contaminants in the floral foam and the vermicast for the two set-ups (hydroponics and organic farming) were the same. Regarding copper contamination, the level of this heavy metal content was analyzed in the harvested lettuce leaves. The analysis showed that levels of contaminants in the leaves were not yet at hazardous levels.

Four other chemical contaminants were identified in the GC–MS assay, namely oxirane, dithiane, dieldrin and endosulfan. These compounds were consistently present in all of the chromatograms and were selected for monitoring due to their potential adverse effects on human, vegetation and the environment. The four compounds are components of insecticides or pesticides.

Levels of oxirane content of both hydroponically and organically grown lettuce were the same. For the hydroponically grown lettuce, the heavy traffic at Taft Avenue and the floral foam used as medium were potential sources of oxyrane. This was apparently the same situation in the organic method set–up. The vermicast and heavy traffic in the vicinity contributed to the oxirane contamination of the harvested lettuce. For both set–ups, dithiane did not come from the medium but most likely from other plants in the vicinity. Apparently, lettuce does not take up dieldrin from the medium. The undetectable levels of dieldrin in the leaves of the analyzed lettuce may be related to the relative low solubility and stability of dieldrin (it is also slowly metabolized by organisms). Dieldrin was not detected in the plant samples but was detected in the floral foam and in the vermicast used as medium. However, the endosulfan levels in both set-ups were the same, but low compared to the lethal doses (LD50) prescribed for humans. The endosulfan contamination in the hydroponics may have been from the floral foam. The situation in the organic farming set-up is different. There was no endosulfan detected in the vermicast. The possible sources of endosulfan in this case were the surrounding farms and gardens in the vicinity.

Results of the study indicate that lettuce can be a good indicator of the quality of the air we breathe. The contaminants detected in lettuce in this study came from environments where the set-ups were placed and not from open areas where urban farming method was applied.

Policy Recommendation

Food security is achieved when safe and nutritious food is available to everybody on demand and at affordable prices. This is a tall order for all barangays, but most especially for those in highly populated urban centers. Urban agriculture methods such as hydroponics and organic farming in open areas havebeen proven by our studies to be not only feasible and safe, but also profitable. These methods also help lower the carbon footprint of food transfers, most especially those coming from faraway farms. In response to the need of achieving sustainable food supplies in urban areas, it is recommended that the practice of urban agriculture be encouraged not only to supplement the family food supply, but also to provide a means of secondary livelihood for the community. Growing vegetables in plastic bags in one's backyard may supply a family's needs and provide extra income, but if all family farms will be organized into a cooperative vegetable farm center, this venture may become profitable for the whole community.

CONTACT INFORMATION

DLSU - Angelo King Institute for Economic and Business Studies (DSLU-AKI)
Room 223, St. La Salle Hall
2401 Taft Avenue
1004 Manila

Angelo King International Center
Corner of Arellano Avenue and Estrada Street
1004 Manila

+63-2-524-4611 loc. 287,
+63-2-524-5333, +63-2-5245347 (Fax)
http://aki.dlsu.edu.ph

This publication is based on a study under the AKI Research Grants on Food Studies