FINAL REPORT

TITLE: *Herbs and Spices Production as Niche Crops for Urban Gardeners*

AGREEMENT NUMBER: 12-25-G-0542

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Project Summary

In implementing the *Herbs and Spices Production as Niche Crops for Urban Gardeners* we were able to initiate viable specialty crops research featuring herbs and spices in the District of Columbia. In initiating this project our goal was to develop cultural practices growing the herbs and spices commonly produced in the urban gardens and used for the culinary needs of the ethnic community of the District of Columbia. In establishing this project we developed cultural practices for the varieties Amaranth, Basil, Chives, Cilantro, Coriander, Hot peppers (Scotch Bonnet and Hybernaria) Oregano, Sage, Tarragon and Thyme.

These varieties of herbs and spices were grown in both the greenhouse and field to screen them for their growing requirements and possible adaptability to the climatic conditions of the District of Columbia. First, greenhouse grown plants were grown in a medium made up of cow manure, silt loam and sand in ratios of 4.5-4.5-1.0. Plants grown in the field were planted in plots amended with composted cow manure at a rate of 30 tons/acre. Plants in pots were grown on a year round basis either in the greenhouse or of outdoors on benches. Generally, the pot size used was 18 cm diameter. Pot size varied (larger or smaller) depending on the usage and number of plants involved. Plants grown in the field were planted from 30 to 45 days old seedlings during the period April 15th to May 30. During the growing season temperature and rainfall were monitored and the growth of the plants correlated to these environmental conditions to determine if the herbs and spices varieties grow well under the climatic conditions of the District of Columbia. In the fertility trials, in addition to plots being given 30 tons per acre of cow manure, we looked at plants growing in those plots amended with fertilizer (10-10-10) at rates of 350 to 450 pounds per acre at a PH level of 6.5 to 7.0. In the greenhouse, we grew the plants at PH levels 5.5, 6.0, 6.5, and 7.0. For recommendations for these plants to be grown in the District of Columbia, we also screened all of the varieties to determine if they are annuals, biennials or perennials.

Based on the evaluation of field and greenhouse trials, we are able to recommend the following varieties of herbs and spices for the District of Columbia: Basil, Coriander, Hot Peppers (Scotch Bonnet), Coriander, Oregano, Sage, Tarragon and Thyme. Amaranth is also recommended as both a vegetable and an ornamental with the green Amaranth as a vegetable and the red Amaranth as an ornamental. The overall goal of the Specialty Crop Program is to establish direction, specificity, and team work between extension and research in solely enhancing the production of specialty crops in the District of Columbia. At first, we had seven sub-goals under this main goal but we have now merged them into three which are: (a) screening the varieties for adaptability to the growing conditions of the District of Columbia (b) working out the soil fertility conditions under which the crops grow and (c) developing ways to deliver targeted and informed practical communications on specialty crops to the gardening community.

Project Approach

The first aspect of the program as stated in goal (a) is to screen the herbs and spices normally grown in the gardens, and possible new ones, to be introduced for production;

Crop Variety	Classification (annual or perennial)	Average yield/plant (gms 3 harvests)
Amaranth (green)*	Annual	835
Amaranth (red)**	Annual	-
Basil (sweet)	Annual	154
Chives***	Annual (re-vegetative)	409
Cilantro	Annual	60
Coriander	Annual	85
Oregano	Perennial	175
Rosemary	Perennial	-
Sage	Perennial	1610
Scotch Bonnet Pepper	Annual	4086
Tarragon	Annual	91
Thyme	Perennial	248

* Recommended as a fresh vegetable
**Recommended as an ornamental
***Recommended as a reseeding annual

to determine the soil fertility; and climatic needs so that we can recommend varieties that are best adapted to the growing conditions of the District of Columbia. As of now, we are growing most of the varieties in 18 cm pots. Similarly, due to the lack of land space, gardeners also find growing their plants in pots in their backyards more viable. We did, however, evaluate Basil, Sage, Thyme and Oregano in the field; but considered that although they grew very well, detailed field data is not yet available. As indicated before in the summary, plants which were grown in pots were placed both in the greenhouse and outdoors.

In this phase of the approach, we concentrated on identifying a growing medium that would be suitable for pot culture. Based on our evaluation so far, we found that a medium consisting of a 1:1 ration mixture of compost (cow manure or yard waste) and washed sand is adequate enough to grow these specialty crops. In this project we were able to get enough good data (Table 1) to make recommendations for production in the District of Columbia.

For field grown plants, we were also able to make recommendations based on field soil fertility (goal b). Under goal (b) emphasis was made in determining how each of the herbs and spices varieties will grow under the climatic conditions of the District of Columbia. To accomplish this aim we maintained the greenhouse at a temperature of 75-80 degree F and a relative humidity of 50-60%. For the field grown plants, we monitored the Field (outdoors) temperature from April 15, 2010 to the first killing frost in the fall which occurred on October 30, 2010.

During the growing season, plants that were growing outdoors in pots tolerated temperatures up to a high of 90 degrees F but had to be watered to saturation twice daily. On the first killing frost at the end of October, Basil, Cilantro, Coriander, Scotch Bonnet, Amaranth and Tarragon plants were all killed. However, Oregano, Rosemary and Thyme continued to grow well outdoors. In September just before the cool frost period all outdoor potted and field growing plants were placed in the greenhouse and they grew well in the greenhouse during winter. As an exception, we found that chives plants that were left outdoors lost all the vegetative growth (killed) above pot surface but the root area within the pots remained alive and thus the plants regrew as soon as temperatures warmed up during spring. Additionally, we found that we were able to produce seedlings from cuttings of rosemary seedlings from plants growing both in the greenhouse and in the field thus eliminating the need to start from seeds each year.

For goal (c) the emphasis was made on communicating technical information through the writing of fact sheets, info docs and varied other outreach activities such as field days. We have just recently begun to develop and publish publications:

(i) completed and in circulation: "*Amaranth as a Specialty Crop for Urban Gardeners*" by James R. Allen and Iveracottis Short

(ii) "*Growing Rosemary Plants from Cuttings*" (in progress) by James Allen.

Other outreach activities include:

(i) Presenting the program at the District of Columbia Rosedale Community Quality of Life Day which was held on Saturday June 27, 2009. At this program, we established a booth where we met citizens either in groups or individually to discuss the production program of the specialty crops. This discussion program included a display of herbs or spices growing in pots.

(ii) On Friday, July 10, 2009, we held a field day at our Muirkirk Farm in Beltsville, MD where stakeholder- gardeners from the District of Columbia were shown exhibits (specialty crops plants in the greenhouse and field and allowed toss and explain what were being done (cultural practices) for the plants to grow well.

(iii) On September 24, 2009, James Allen, the project director participated in a workshop on the farm where he made a presentation to students and gardeners entitled "Specialty Crop Production in the District of Columbia."

(iv) On February 20, 2010, UDC/Agricultural Experiment Station (AES) researchers and others participated in a District of Columbia gardener-stakeholder initiated conference named "Rooting DC." At that conference the AES project director, James Allen gave a detailed presentation on how to enhance the growing of herbs and spices as specialty crops in the District of Columbia.

Goals and Outcomes Achieved

We achieved the following goals and outcomes:

(1) A viable pot culture for growing herbs and spices have been developed and as a result, we are able to grow these crops on a year round basis and have them on display for District of Columbia gardeners who want to start production.

(2) On the basis of field and greenhouse trials, we have been able to recommend 10 herbs and spices and one vegetable crop as specialty crops for production in the District of Columbia

(3) We have gathered enough data to start publishing fact sheets to our local gardening community. One has been completed and is in circulation and another is being prepared {see goal (c)}. We will continue these publications as more data is generated.

(4) In an effort to strengthen our collaborative efforts with our gardening community, we presented one field day and participated in three District wide community programs where we made presentations on the production of specialty crops. From registration records we were able to estimate that we reached about 1000 members of the gardening community.

(5) To increase the availability of herbs and spices, we were able to establish a farmers market on the campus of the University of the District of Columbia. This farmers market is activated in May and operates until the middle of November. Based on informal monitoring of sales records, we have been able to estimate that 225-300 customers purchase fresh herbs and spices (Rosemary, Thyme, Sweet Basil and Chives) each Saturday. As of now, their main purchases are basil, chive and rosemary. Additionally, On November 6, 2010, we were able to sponsor a "Latin Fest" at the market where we were able to attract many stakeholders including members of the Latino community.

Beneficiaries

The beneficiaries of this special crop project are:

(a) The urban gardeners of the District of Columbia who are being able to increase productivity in their gardens through the addition of the specialty crops, herbs and spices as crops in their urban gardens.

(b) The culinary industry which is now being able to obtain these fresh herbs and spices to enhance their various menus

(c) Our ethnic community who are accustomed to diets of spicy foods and therefore need these herbs and spices to add to the flavor of their meals

(d) The Agricultural Experiment Station or the University of the District of Columbia which is the responsible land grant unit for developing and enhancing crop production for the benefit of the citizens of the District of Columbia.

Lessons Learned

Lessons learned from the initiation of this project include the following:

(a) Due to the fact that most of the community gardens in the District of Columbia are located on Federal or District owned land, it is difficult to stabilize a gardening program since the land on which the gardening is being done can be claimed by the government for needed construction at any time.

(b) A crop growing program in a backyard or community garden which requires a greenhouse or related structure is difficult to establish since there is usually not enough funds to acquire the structure or land space to locate it.

(c) Most of the gardeners are transient professionals who work for the Federal or District government or associated agencies until they retire and move to another state. Because of this lack of stability, it is very difficult to establish a strong viable gardening program in the District of Columbia.

(d) Unstable weather conditions in the District of Columbia in the past three years can cause devasting delays in implementing a crop production program such as this one.

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UNIVERSITY OF THE DISTRICT OF COLUMBIA

August 2009

Amaranth as a Specialty Crop for Urban Gardens

James R. Allen and Iveracottis Short

Introduction

Although amaranth is a very nutritious vegetable crop, it is not well known in various parts of the United States. In fact, in the corn-soybean growing areas of the northeastern United States, amaranth is a fast growing dreaded plant known as "pigweed." Unlike the situation in the northeastern United States, in the Andes mountain area and Mexico, amaranth varies from a serious weed to a grain crop (Shands and White, 1990). In these areas, it is used as both a vegetable and grain crop with the seed (grain) producing a high quality of the amino acid lysine. This crop is also known to produce a large amount of biomass in a short period of time in China. Thus, in China, amaranth has been grown exclusively as forage for cattle (Kauffman and Weber, 1990).

Amaranth is also widely consumed as a nutritious vegetable in developing countries. For example, in Africa, the Caribbean, India, Nepal and the South Pacific Islands, leaves of the amaranth are used as a source of dietary fiber, protein, vitamins and minerals (Singh and Whitehead, 1996).

Environmental conditions necessary for the optimum growth of Amaranth

Amaranth is strictly a warm season crop and, therefore, cannot be grown in the cool spring months (March to mid-May) or the fall-winter months (November to mid-March). Preliminary studies at the University of the District of Columbia's Muirkirk Farm support this fact since potted plants of the vegetable amaranth did not survive the first "killing" frost in December, 2008. Studies by Singh and Whitehead, 1996, support these findings as they showed that the amaranth seeds planted in mid-April failed to germinate while germination was satisfactory when planted from mid-May onward. Their studies also indicated that plants of this crop grew best when planted in mid-June with a soil temperature at 25°C.

In general, preliminary studies at the DC Agricultural Experiment Station show that the amaranth will grow well in moderately fertile soil with limited amount of moisture (data not shown). However, other studies have shown that this crop does not respond well to potassium and phosphorous (Kauffman and Weber, 1990) but does show considerable increase in yield under high nitrogen fertility. Shands and White, 1990, and Singh and Whitehead, 1996, found that vegetable production was best at a nitrogen fertilization rate

(Continued from page 1)

ranging between 80-120 pounds per acre. At the Agricultural Experiment Station we found that our gardeners could produce amaranth well at a soil nitrogen level of 3.0 pounds per 100 square feet.

Production of Amaranth in pot culture

A major objective of the DC Agricultural Experiment Station is to help our citizens grow food on limited land space which sometimes includes only a small back-yard. To achieve this aim, we are conducting variety trials of specialty crops which will grow well in urban areas and produce nutritious food. One such crop is the amaranth which has two main varieties: the green type which is a nutritious vegetable and the red type which can be grown as a beautiful ornamental plant. This crop is also popu-lar in the African, Latin American and Asian communities of the Washington Metro-politan area where these ethnic groups are used to growing it as a staple vegetable. Thus, the amaranth will be recommended as an ethnic crop for our urban gardeners.

"A major objective of the DC Agricultural Experiment Station is to help our citizens grow food on limited land space ..."

Currently, our research shows that amaranth thrives well in pots 8.0 inches in diameter with a growing mixture of 50% soil and 50% composted cow manure or composted yard waste (Leafgro) amended with 2.5 Pounds of 10-10-10 fertilizer per 100 pounds of the growing mixture (Fig. I). Plants of both the vegetable and the red amaranth were first germinated in a greenhouse and afterwards grown for three weeks or until they were 2.5 to 3.5 inches tall. Seedlings were then transferred to 8.0 inches diameter pots (Figs. I and II) and watered once daily.

Fig. I. Vegetable Amaranth growing in 8.0 inches diameter pots using a growing mixture of 50% soil and 50% Leafgro (produced by MD Environmental Service).

Amaranth as a Specialty Crop for Urban Gardens (cont'd)

Fig. II. Vegetable Amaranth (front) and Red Amaranth (back) growing in 8.0 inch pots.

The vegetable or green amaranth commonly known as "Calaloo" in the Caribbean was allowed to grow until plants were about 18 inches tall and then harvested as fresh greens (Fig. III). The red amaranths were allowed to grow until they were about 24 inches tall and at this point they began to produce seed heads (Fig. IV). Although the red amaranth is not normally used as a vegetable, it grows into a beautiful red plant which can be used as an ornamental in pots or planted in a flower garden. However, it should be noted that amaranth is a rapidly reproducing plant. Therefore, if the red amaranth is planted in a flower garden, efforts should be made to thin out excess plants to prevent them from crowding out other flowers or other ornamentals. Another caution that should be used when growing amaranth is that these plants sometime accumulate nitrates. Because of high concentrations of nitrates, the vegetable amaranth could cause diarrhea when excessive amounts are eaten. This problem can be avoided when the frequency and the amount eaten are reduced.

Fig. III. Vegetable Amaranth harvested to be eaten as fresh greens.

"Although the red amaranth is not normally used as a vegetable, it grows into a beautiful red plant which can be used as an ornamental in pots or planted in a flower garden."

Amaranth as a Specialty Crop for Urban Gardens (Cont'd)

Fig. IV. Red Amaranth plants which can be used as ornamentals are being grown in pots.

Fig. V. Dr. Allen (left) is seen telling a group of gardeners how to and why they should grow Amaranth in their gardens.

The vegetable or green amaranth is very easy to grow and is highly nutritious (Sealey et al, 1990). Thus, the DC Agricultural Experiment Station encourages gardeners of the District of Columbia to grow this crop in their urban gardens. Dr. Allen (Fig. V) is seen talking to a group of students and teachers discussing the advantages of growing amaranth in their gardens for use as a vegetable or an ornamental.

Glossary

Words	Meaning
Amino acid	The major units that form protein which is a primary nutrient in our diets provided by eating meat, fish grains and milk.
Beta carotene	A yellow colored nutrient found in the food we eat. It is a major unit of vitamin A, which gives the body energy.
Biomass	The weight of any living being. It can be expressed as weight per unit volume or area.
Forage	The plant materials eaten by animals such as cows, horses and sheep.
Germinate	The process by which a seed becomes a plant by taking up water through its seed-coat, swell and burst.
Nitrogen, Phosphorous and Potassium	These are essential chemical elements that plants must obtain from soil in order to grow.
Nitrate	This is a chemical that is found in soil water. It is formed by a combination, one nitrogen and two oxygen units. Nitrate is the main way plants eat nitrogen through its roots.
Lysine	An essential amino acid that is required for growth, tissue repair, enzyme production and for fighting viral infections.

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For further information or questions about the growth of the Amaranth plant, contact Dr. James R. Allen at (202) 274-7140.

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