Franklin County Master Gardener Volunteers Vegetable Trials Annual Report 2016

Prepared by

Lorraine Normore

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THE OHIO STATE UNIVERSITY
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Executive Summary

The Vegetable Trials project is a research activity of the Ohio State University Extension Service's Franklin County Master Gardener Volunteer Program. The aim of the project is to evaluate vegetables that extend the diversity of backyard and local foods usually grown in Central Ohio. This report documents the results of the 2016 growing season, comparing seventeen types of vegetables, including one to five varieties of each type. It reports on two types of productivity data (total weight harvested and time available for harvest) and includes evaluative ratings made throughout the growing season.

In 2016, we took remedial actions designed to overcome productivity problems noted in last year's report. We are pleased to report that these were effective and that our harvest reached previous high levels. It was a very good year for peppers, tomatoes, sweet potatoes, and most greens. As always, there were sometimes substantial differences between different cultivars of the type of vegetable, noted in this report. This fact alone demonstrates the utility of collecting comparable data within the Central Ohio growing environment.

Introduction

Vegetable Trials are a research activity of the Ohio State University Extension Service's Franklin County Master Gardener Volunteer Program. The aim of the project is to plant vegetable varieties that could extend the diversity of commonly grown backyard and local foods and evaluate their success in Central Ohio. We use good cultural practices that are within the reach of the home gardener. The project gives Master Gardeners the added benefits of developing their own skills and knowledge through working with other Master Gardeners. Most of the produce is contributed to food banks in the Central Ohio community. This report documents the results of the 2016 growing season.

Method

The plot used in the 2016 Vegetable Trials is found within the Waterman Farm, a part of the OSU Agricultural Research and Development Center, located at the northwest corner of Kenny Road and Lane Avenue in Columbus, Ohio. The plot is 97' by 87' in size. A diagram of the 2016 plot appears in Appendix A.

The plot is organized into the following four areas:

(1) A raised bed that is 4' by 50' divided into 10 subplots. The vegetables grown in the raised bed in 2016 are shown in Table 1.

(2) Eleven cultivated field rows, 3' in width and divided by 6' paths. Ten of the rows were divided into three 20' segments and one into two 20' segments. The easternmost row was fashioned into a hill. The types of vegetables grown in the field area are shown in Table 1. Most vegetable varieties occupied one row segment. The only exception is that all four squash varieties occupy two row segments adjacent to each other.

In the 2016 harvest year, one row segment was donated for use in an OSU study of factors affecting zucchini production. The produce of that segment was also included in the harvest although not discussed in this report.

(3) Four square foot gardens in a 9' by 9' area. The square foot garden included a number of vegetables and herbs that were not included in the data gathered from the raised bed and the major field section of the plot. Some were included in the harvest donated to the food banks or taken home by the Master Gardeners.

(4) At the front of the garden, a three sisters' bed was planted. This included pole beans, butternut squash, and corn, arranged in the traditional teepee form.

The same number of plants was included in each row segment for each of the tomato and pepper varieties. For other varieties, within each type of vegetable (e.g., beets, squash), different varieties occupied the same amount of space in the plot or raised bed which enables us to make a rough comparison of the productivity of the different varieties.

Vegetable cultivars were chosen by subcommittees of Master Gardeners during the winter season and acquired from a variety of sources including Johnny's Select Seeds, Territorial, Seed Savers Exchange and Steele. White potatoes were started from seed potatoes, and sweet potatoes as slips. The varieties in the raised beds and other greens (chard, kale, collards) grown in the field this year were direct seeded. The warm weather varieties (cucumbers, eggplant, peppers, squash, and tomatoes) were started in the Chadwick greenhouse and were hardened off by Master Gardener volunteers in the three weeks prior to being transferred to the field. Varieties in the greenhouse were sown as seeds in FAF Surefire Germination Mix and begun in the OSU greenhouses before being transplanted into the plot. A brief description of the varieties and their source appears in Appendix B.

Various methods were used to encourage growth and aid maintenance. The plot is usually tilled after the previous season has been completed. Early in the spring, well in advance of planting, composted manure was tilled into the plot. Worm compost was applied as a top layer in the raised bed and added as a top dressing for field crops. A transplant conditioner supplied by the Farm Manager was applied to the warm season crops when they were planted in the plot. For a few weeks after transplanting, row covers were used to protect the eggplant, squash and cucumber plants from insect pests. The paths between the rows were covered with cardboard that needed to be secured with bricks and rocks. Drip lines were placed in the center of each row in the main plot with two drip lines placed in the sweet potato area. The raised bed, three sisters, and square foot gardens were watered by hand. Volunteer sunflowers from last year's plot were moved to the north border of the plot. Zinnias were planted at the end of each row segment. The sunflowers and zinnias attracted a wide variety of both birds and pollinator insects.

Table 1 lists the vegetables grown and monitored in the Vegetable Trials plot in the 2016 harvest year. The table gives the common names and species epithet, the location grown in the plot, and indicates the data collected for each cultivar.

Table 1: Cultivars grown in 2016

Type	Variety	Location	Type of Data (#=productivity, *=quality)
Beets	Chioggia	Raised bed	#
Beets	Merlin	Raised bed	#
Carrot	Baltimore	Raised bed	#
Carrot	Chantenay	Raised bed	#
Collards	Top bunch	Field	#
Cucumber	Amiga	Field	#,*
Cucumber	Saber	Field	#,*
Eggplant	Diamond	Field	#,*
Eggplant	Millionaire	Field	#,*
Kale	Red Russian	Field	#
Kale	Toscano	Field	#
Lettuce	Crisp Mint	Raised bed	#
Lettuce	Mascara	Raised bed	#
Mustard greens	Tah Tsai	Raised bed	#
Onions	Red Baron	Raised bed	#
Peppers	Beaver Dam	Field	#,*
Peppers	Lipstick	Field	#,*
Peppers	Sweet Chocolate	Field	#,*
Peppers	Wonder Bell	Field	#,*
Potatoes, White	Mountain Rose	Field	#,*
Potatoes, White	Purple Viking	Field	#,*
Potatoes, White	Yukon Nugget	Field	#,*
Radish	Dragon	Raised bed	#
Radish	Plum purple	Raised bed	#
Squash, Summer	Gold star	Field	#,*
Squash, Summer	Safari	Field	#,*
Squash, Winter	Butterpie	Field	#,*
Squash, Winter	Sweet Fall	Field	#,*
Sweet Potato	Beauregard	Field	#,*
Sweet Potato	Bonita	Field	#,*
Sweet Potato	Covington	Field	#,*
Swiss Chard	Rhubarb Red	Field	#,*
Tomatoes	Black Sea Man	Field	#,*
Tomatoes	Mountain fresh plus	Field	#,*
Tomatoes	Pineapple	Field	#,*
Tomatoes	San Marzano	Field	#,*
Tomatoes	Valencia	Field	#,*

Results

This section will focus on first productivity and then evaluative data.

Productivity Data

Two types of productivity data could be of interest to the home gardener. The first describes the overall quantity (weight) harvested for each cultivar. The second aspect of productivity of interest to a home gardener concerns the length of time between planting/transplanting and harvest and the amount of time available for harvest. For a home gardener, having early access to a vegetable and having harvest spread over a longer time can be advantageous since both expand the time available for use in the home kitchen and do not burden the gardener with the need to preserve as well as to use a given vegetable at a given, short period of time.

Total Harvest

Records of the total weight were kept each time vegetables were harvested during the growing season. The total weights are reported in Table 2.

Table 2: Total harvest weight by cultivar in pounds

2016 Vegetables	Cultivar	Total harvest (lbs.)
Beets	Chioggia	34.81
	Merlin	35.97
Carrot	Baltimore	19.31
	Chantenay	24.88
Collards	Top Bunch	72.75
Cucumber	Amiga	17.81
	Saber	45.72
Eggplant	Diamond	1.75
	Millionaire	11.47
Kale	Red Russian	9.31
	Toscano	21.72
Lettuce	Crisp Mint	25.06
	Mascara	13.63
Mustard greens	Tah Tsai	5.63
Onions	Red Baron	6.84
Peppers	Beaver Dam	56.81
	Lipstick	36.88
	Sweet Chocolate	75.75
	Wonder Bell	88.03
Potatoes, White	Mountain Rose	9.44
	Purple Viking	19.28

Potatoes, White	Yukon Nugget	12.28
Radish	Dragon	13.00
	Plum Purple	6.34
Squash, Summer	Gold Star	171.16
	Safari	60.25
Squash, Winter	Butterpie	158.75
	Sweet Fall	94.69
Sweet Potato	Beauregard	203.53
	Bonita	123.38
	Covington	83.25
Swiss Chard	Rhubarb Red	42.27
Tomatoes	Black Sea Man	50.47
	Mountain Fresh Plus	159.31
	Pineapple	84.53
	San Marzano	111.03
	Valencia	138.75

While some features of these data are to be expected: for example, the total weight of greens is lower than that of larger and more dense vegetables like squash or potatoes, differences within a given type of vegetable will be described in the section that follows. Since the number of plants for cultivars of each of the larger vegetable variety were the same and each subplot for the different varieties of tomatoes, squash, peppers, and potatoes are roughly similar in size and subject to roughly comparable cultural forces (water, weeding, etc.) as is the area in the raised beds devoted to different cultivars of greens, carrots, beets and radishes, differences between members of a group are potentially of importance.

Let us look at some vegetables that show differences among cultivars, based on the data in Table 2 above.

Beets

The data show that the two beet cultivars (Chiogga and Merlin) , though different in that one cultivar was a standard red beet while the other was a variety with variegated red and white flesh, were virtually indistinguishable in the weight harvested.

Carrots

The Chantenay cultivar was somewhat more productive than the Baltimore. An inspection of carrot productivity from 2013 to the present, however, shows that 2016 was a good harvest year overall.

Radish

The Dragon cultivar was more than twice as productive as Plum Purple in terms of weight harvested (13 vs. 6.3 pounds).

Cucumbers

The Saber cultivar was almost three times as productive as Amiga in terms of weight harvested (45 vs. 17 pounds).

Eggplant

The eggplant cultivars were greatly affected by flea beetles this year. Diamond succumbed early with a resulting small harvest (1.75 pounds). Millionaire also suffered early damage but showed a surprising resurgence in mid-July that lasted through August and resulted in a harvest of over 11 pounds. We think of it as our summer miracle.

Peppers

All four types of peppers grown in the plot in 2016 were very successful. The best producer was the 2015 high producer, Wonder Bell. Sweet Chocolate, the next in terms of productivity, was a dark fleshed, sweet bell pepper while the next in line, Beaver Dam, was the most highly spiced of the varieties grown this year. The smallest producer, Lipstick, was also the smallest pepper whose harvest was proportionate to its size, rather than truly smaller than the others.

Squash

While there were substantial differences both within the summer and winter squash cultivars as well as between the two types of squash, all four types performed well when compared with poor performers in previous years. The Gold Star summer squash produced the highest yield overall, with a total harvest of over 170 pounds. Next was the Butterpie, a classic rounded butternut winter squash, which weighed in at almost 160 pounds. The remaining winter squash, Sweet Fall and summer squash Safari, produced harvests of 95 and 60 pounds respectively, a respectable showing if much less than the high producers in each category.

Potatoes

The potato crop was relatively small with harvests of approximately 10 pounds (Mountain Rose), 12 pounds (Yukon Nugget) and 20 pounds (Purple Viking). Two features provide useful perspective. The lesser harvest from the first two varieties was related to the fact that these were naturally small potatoes. Second, each variety was grown from two pounds of seed potatoes, which shows in a five to ten-fold increase.

Sweet Potatoes

The Beauregard cultivar was the most successful of the three sweet potato varieties in this year's crop as it was last year. This year, however, it produced over 200 pounds in contrast to last year's harvest of 76 pounds. Both the Bonita and Covington varieties did better than that 76 pound harvest, producing 123 and 83 pounds, respectively. The performance of Bonita was especially notable since it received an unprecedented amount of rodent predation.

Tomatoes

Each of the five tomato cultivars in the 2016 plot produced a harvest that exceeded the largest varietal harvest (38 pounds) in 2015. Mountain Fresh Plus, a variety that was described as that which was grown most in the East and Midwest by the authors of the seed catalog, was the high producer at almost 160

pounds. Valencia and San Marzano did well for a second year at 140 and 112 pounds respectively. The two remaining varieties, Pineapple and Black Sea Man substantially underperformed the other varieties. Both are heirloom varieties and had both the benefits and some problems associated with heirlooms. They were very tasty. However, they were also prone to both cracking and insect damage, resulting in a great loss in productivity. Our situation differs from that of the home gardener. We visit the plot only twice a week and can expend less care on individual plants and fruit. It may be that the home gardener could more carefully monitor the progress of the heirloom varieties and so not experience the poor performance we observed.

The greens

As in 2015, the Master Gardener seed selectors were interested in trying to expand the variety of greens grown in part in response to the expressed interest from the food banks to which we ordinarily give the major part of our produce. This year, we continued this trend and grew greens in both the raised beds and in the field. Because the space allotted for raised bed and for field are roughly equivalent only within each category, our comparisons will be made within those groupings.

The greens grown in the raised bed were primarily cool season crops. They included Crisp Mint and Mascara lettuces and Tah Tsai mustard greens. Although the Tah Tsai produced only five pounds, this was greater than our 2015 mustard green selection. Even Mascara yielded a weightier harvest than any lettuce within the last three years at 13 pounds and Crisp Mint was the clear winner at 25 pounds.

The field greens included Swiss chard, collards, and two varieties of kale. We extended the harvest throughout the season by picking the mature leaves and leaving the central parts of the plants to produce throughout the season. The Top Bunch collards did best, adding over 70 pounds to our harvest. The Rhubarb Red chard was next with a total of over 40 pounds. Both of the kale varieties suffered a large amount of insect predation and so were not as productive as either the chard or collards. However, the two varieties did differ, with Toscano being well over twice as productive as Red Russian (21.72 vs. 9.31 pounds).

Time to Maturity and Duration of Harvest

It is useful to be able to predict how long it will be before vegetables will be available for use. A side issue that has come up is whether there is a difference between the time to harvest according to seed catalogs vs. the time to harvest experienced in our gardens. Table 3 gives an overview of three pieces of data for each of the cultivars grown in the plot.

Table 3: Time to first harvest (actual and predicted)

		Time to First Harvest (days)		
2016 Cultivars	**Varietal Name**	**From seed/ slip**	**From transplant**	**According to seed source**
Beets	Chioggia	59		65
Beets	Merlin	59		55
Carrot	Baltimore	73		75

Carrot	Chantenay	77		70
Collards	Top Bunch	54		50
Cucumber	Amiga	76	51	55
Cucumber	Saber	76	51	50-55
Eggplant	Diamond	119	63	70
Eggplant	Millionaire	101	45	54
Kale	Red Russian	72		50-60
Kale	Toscano	72		30-65
Lettuce	Crisp Mint	25		45-55
Lettuce	Mascara	25		48
Mustard greens	Tah Tsai	45		40-50
Onions	Red Baron	84		N/A
Peppers	Beaver Dam	122	56	80
Peppers	Lipstick	129	63	55-75
Peppers	Sweet Chocolate	140	74	60-85
Peppers	Wonder Bell	122	56	70
Potatoes, White	Mountain Rose	113		70-90
Potatoes, White	Purple Viking	99		70-90
Potatoes, White	Yukon Nugget	89		N/A
Radish	Dragon	49		40
Radish	Plum Purple	49		25-30
Squash, Summer	Gold star	67	42	50
Squash, Summer	Safari	67	42	50
Squash, Winter	Butterpie	109	84	85
Squash, Winter	Sweet Fall	123	98	100
Sweet Potato	Beauregard	123		90-100
Sweet Potato	Bonita	133		95
Sweet Potato	Covington	133		100
Swiss Chard	Rhubarb Red	39		50-60
Tomatoes	Black Sea Man	136	77	75
Tomatoes	Mountain Fresh Plus	136	77	75
Tomatoes	Pineapple	147	88	90
Tomatoes	San Marzano	133	74	78
Tomatoes	Valencia	126	67	76

An inspection of the data shows a few things of interest. First, the data show that the seed catalog date to first harvest corresponded most closely to the date to first harvest from the transplant date. While this is not surprising for people who carefully read catalog information, it is important to remember the often lengthy period needed to factor in the duration from seeding to transplant for warm weather crops when considering the time needed before vegetables are ready for the table. Second, while the dates suggested by the seed catalogs seem to be relatively good predictors of the time to first harvest,

there are some differences both in overestimates and underestimates of the time needed to first harvest that could reflect variability in the weather and other environmental conditions as well as differences between cultivars. A late last frost date (cf. Tables 9, 10) might account for the relatively longer time to first harvest for the kale. There are also differences among different varieties of the same type of vegetable (e.g., winter squash, tomatoes) that are in line with differences suggested by the seed source.

Table 4 displays the order with which vegetables came to be available for use in the 2016 plot, sorted by the first date at which produce was harvested.

Table 4: Cultivars sorted by first harvest date

2016 Cultivars		Seed plant date	First harvest date	Duration to 1st harvest from seed, slip
Lettuce	Crisp Mint	5/12/2016	6/6/2016	25
Lettuce	Mascara	5/12/2016	6/6/2016	25
Radish	Dragon	4/18/2016	6/6/2016	49
Radish	Plum Purple	4/18/2016	6/6/2016	49
Mustard greens	Tah Tsai	4/25/2016	6/9/2016	45
Beets	Chioggia	4/18/2016	6/16/2016	59
Beets	Merlin	4/18/2016	6/16/2016	59
Collards	Top bunch	4/27/2016	6/20/2016	54
Squash, Summer	Gold star	4/21/2016	6/27/2016	67
Squash, Summer	Safari	4/21/2016	6/27/2016	67
Eggplant	Millionaire	3/21/2016	6/30/2016	101
Cucumber	Amiga	4/21/2016	7/6/2016	76
Cucumber	Saber	4/21/2016	7/6/2016	76
Kale	Red Russian	4/25/2016	7/6/2016	72
Kale	Toscano	4/25/2016	7/6/2016	72
Carrot	Baltimore	4/25/2016	7/7/22016	73
Carrot	Chantenay	4/25/2016	7/11/2016	77
Onions	Red Baron	4/18/2016	7/11/2016	84
Swiss Chard	Rhubarb Red	6/2/2016	7/11/2016	39
Peppers	Beaver Dam	3/14/2016	7/14/2016	122
Peppers	Wonder Bell	3/14/2016	7/14/2016	122
Eggplant	Diamond	3/21/2016	7/18/2016	119
Peppers	Lipstick	3/14/2016	7/21/2016	129
Potatoes, White	Yukon Nugget	4/27/2016	7/25/2016	89
Tomatoes	Valencia	3/21/2016	7/25/2016	126
Peppers	Sweet Chocolate	3/14/2016	8/1/2016	140

Tomatoes	San Marzano	3/21/2016	8/1/2016	133
Potatoes, White	Purple Viking	4/27/2016	8/4/2016	99
Tomatoes	Black Sea Man	3/21/2016	8/4/2016	136
Tomatoes	Mountain Fresh Plus	3/21/2016	8/4/2016	136
Squash, Winter	Butterpie	4/21/2016	8/8/2016	109
Tomatoes	Pineapple	3/21/2016	8/15/2016	147
Potatoes, White	Mountain Rose	4/27/2016	8/18/2016	113
Squash, Winter	Sweet Fall	4/21/2016	8/22/2016	123
Sweet Potato	Beauregard	6/2/2016	10/3/2016	123
Sweet Potato	Bonita	5/23/2016	10/3/2016	133
Sweet Potato	Covington	5/23/2016	10/3/2016	133

For the home gardener, we find a succession of vegetable varieties that become available over the course of the harvest season. As has been noted in previous years, the plants that were first available for harvest (radish, lettuce and mustard greens) are commonly designated as cool season crops. Most were direct seeded into our raised bed in mid-April and available for harvest early in June. The lettuce planted in mid-April failed to thrive and was re-planted early in May but even at that was ready to pick in early June. As might be expected our warm season varieties dominated the later part of the harvest season.

Harvest Duration

An additional feature of interest is the length of time that vegetables are available for use. When the harvest duration is limited and harvest generous, the home gardener may be overwhelmed by the amount of vegetables available and have to either preserve or give away a substantial proportion of the crop. However, when the harvest duration is lengthy, availability is stretched over a longer period and may be more effectively integrated into the home diet.

Sorting the data provides some additional insight into relationships among cultivars with common timelines. Table 5 gives the harvest duration for the cultivars in the 2016 plot and includes the previous data on the time to first harvest.

Table 5: Harvest duration in days

2016 Cultivars		Duration to 1st harvest from seed, slip	Harvest duration (days)
Collards	Top bunch	54	119
Squash, Summer	Gold star	67	112
Eggplant	Millionaire	101	105
Kale	Toscano	72	103
Squash, Summer	Safari	67	101

Peppers	Beaver Dam	122	95
Peppers	Wonder Bell	122	95
Swiss Chard	Rhubarb Red	39	94
Kale	Red Russian	72	89
Peppers	Lipstick	129	88
Tomatoes	Valencia	126	84
Peppers	Sweet Chocolate	140	77
Tomatoes	San Marzano	133	77
Tomatoes	Black Sea Man	136	74
Tomatoes	Mountain Fresh Plus	136	74
Carrot	Chantenay	77	73
Beets	Merlin	59	70
Squash, Winter	Butterpie	109	70
Cucumber	Amiga	76	64
Beets	Chioggia	59	63
Tomatoes	Pineapple	147	63
Carrot	Baltimore	73	49
Cucumber	Saber	76	43
Onions	Red Baron	84	42
Squash, Winter	Sweet Fall	123	38
Lettuce	Crisp Mint	25	35
Radish	Dragon	49	30
Radish	Plum Purple	49	30
Mustard greens	Tah Tsai	45	27
Lettuce	Mascara	25	24
Eggplant	Diamond	119	14
Potatoes, White	Purple Viking	99	7
Potatoes, White	Mountain Rose	113	4
Sweet Potato	Beauregard	123	3
Sweet Potato	Bonita	133	3
Sweet Potato	Covington	133	3
Potatoes, White	Yukon Nugget	89	0

The shading in Table 5 roughly categorizes the cultivars into groups whose harvest lasts twenty days (e.g., harvests from 100 to 120 days, etc.). Both of the summer squash and two of the field greens (collards and Toscano kale) fall into the longest harvest duration category. Most of the peppers and the remaining field greens fall into the next "long harvest" category, with the majority of the tomatoes following close on their heels. The short harvest duration for both sweet potatoes and white potatoes is at least in part an artifact of our harvest practice, since we dig each of those types of vegetables at a fixed time. A home gardener could easily extend their harvest over a longer time. The relatively short

harvest duration for the lettuces, radishes and mustard greens is more related to the nature of those cool season crops than our harvest practice.

As always a detailed view reveals considerable variation both for different cultivars of the same type of vegetable. In some cases, like the differences in harvest duration for the Baltimore and Chantenay carrots, this may indeed be a difference between the two cultivars although both were considerably longer in harvest duration than that recorded for the 2015 varieties. The Butterpie winter squash had clear advantages over the Sweet Fall variety, being both available earlier and remaining in production longer. Delaying the harvest for the Sweet Chocolate pepper until the fruit had turned the target "chocolate" color also differentiated it from the other peppers, although we did try to delay full harvest of the Wonder Bell and Lipstick varieties until some of the fruit had turned red, a characteristic that the seed catalogs suggest takes an extra 20 days. Other differences between cultivars of different varieties of vegetable were more likely attributable to their resistance to insect pests and bacterial disease. Both eggplant varieties were greatly predated by flea beetles but the Millionaire cultivar recovered and produced a good late season harvest. The large fruit of the Pineapple tomato took longer to mature and was affected by insect pests and subject to cracking and ensuing bacterial infection.

Evaluation of Plant Health

Our reports typically focus on plant health. An attempt to introduce some data on perceived taste was made in 2016 but no substantial data was gathered. We will try to develop a more systematic approach in 2017.

The cultivars listed below were evaluated by the participating Master Gardeners weekly from June 18, 2015 through September 24, 2015 using a Likert scale ranging from 1 ("perfect condition") through 5 ("dead"). Half were evaluated by the group that met on Mondays; the other half by the Thursday gardeners. Once a cultivar was categorized as "dead" (5), the data analysis was discontinued.

To arrive at an overall description, three measures appear in the table below. The first provides an estimate of the value which best describe the condition of the cultivar. The mode (most frequently occurring value) is used in place of the arithmetic mean ("average") because the categorical judgments that we make are qualitative data for which arithmetic means are not appropriate. To give a measure of dispersion, the second column uses the range of values given for each cultivar over the entire time period.

Table 6: Evaluation of plant health

2016 Cultivars		Mode evaluation	Evaluation range	Number of evaluations
Cucumber	Amiga	4	1-5	14
Cucumber	Saber	4	2-5	12
Eggplant	Diamond	4	3-4	13
Eggplant	Millionaire	4	2-4	18
Peppers	Beaver Dam	1	1-2	18

Peppers	Lipstick	1	1-2	18
Peppers	Sweet Chocolate	1	1-2	18
Peppers	Wonder Bell	1	1-2	18
Potatoes, White	Mountain Rose	3,4	2-5	10
Potatoes, White	Purple Viking	3,4	2-5	9
Potatoes, White	Yukon Nugget	3	2-5	7
Squash, Summer	Gold star	3	1-4	18
Squash, Summer	Safari	3,4	2-4	18
Squash, Winter	Butterpie	3	2-4	17
Squash, Winter	Sweet Fall	4	2-5	16
Sweet Potato	Beauregard	2	1-5	18
Sweet Potato	Bonita	1,2	1-5	18
Sweet Potato	Covington	1	1-5	18
Tomatoes	Black Sea Man	3	2-4.5	18
Tomatoes	Mountain Fresh Plus	1	1-4	18
Tomatoes	Pineapple	2	1-3.5	18
Tomatoes	San Marzano	1	1-4	18
Tomatoes	Valencia	1,2	1-4	18

The 2016 median evaluations show much better overall subjective assessments of the performance for the peppers, tomatoes and sweet potatoes. Cucumber, eggplant, and squash varieties suffered greater damage from insects, including squash vine borers and flea beetles. Among the tomatoes, the heirloom varieties, Black Sea Man and Pineapple, received the lowest evaluations for plant health, although informal comments suggested their superior flavor.

The final column gives the number of times the cultivar was evaluated, providing a re-statement of the length of harvest data. The smaller numbers of evaluations for the white potatoes reflect their earlier-than-average harvest. The smaller numbers for both cucumbers and the Diamond eggplant reflect early loss of productivity.

Contributions to the Food Banks

The majority of the produce from the garden were distributed to community food banks, including the Clintonville Community Resource Center, the Broad Street Food Bank, and the Westerville Area Resource Ministry. In addition to our own produce, it included donations from the OSU Zucchini study and some donations from our home gardens. In 2016, this totaled 1,752 pounds.

Summary and Discussion

While the 2015 harvest fell considerably below previous harvest totals, 2016 was much more successful. The broad outline is shown in Table 7.

Table 7. Overall productivity comparisons, 2013 to 2016.

Year	Total weight (lbs.)
2013	2115.31
2014	2022.25
2015	954.69
2016	2145.83

A more in depth view can be seen in Table 8 that shows detail underlying these high level effects.

Table 8. Productivity comparisons for 2014 through 2016, by type of vegetable.

Varieties	2016 Harvest		2015 Harvest		2014 Harvest	
	Total (oz.)	No. varieties	Total (oz.)	No. varieties	Total (oz.)	No. varieties
Beets	1132.5	2	242	2	1025.5	2
Carrots	707	2	169	1	291.9	1
Cucumber	1016.5	2	1579.5	2	568.6	2
Eggplant	211.5	2	62	2	357	2
Kale	496.5	2	426.5	3	163	1
Lettuce	619	2	158	3	378.7	3
Peppers	4119.5	4	792.5	4	1533.8	4
Potatoes, White	656	3	415.5	3	903	3
Squash, Summer	3702.5	2	3655.5	2	10475	2
Squash, Winter	4055	2	1178.5	2	2577.4	2
Sweet Potato	6562.5	3	2663.5	3	4407.8	3
Swiss Chard	676.3	1	221	1	288.4	1
Tomatoes	8705.5	5	2078.5	5	7917	5

This table includes only those types of vegetables which were grown and had a measurable harvest in all three years. Nine of the 13 types of vegetables were most productive in 2016, one (cucumber) most productive in 2015, and three most productive in 2015. The 2014 harvest was, by and large, closer to

the 2016 harvest, which is not surprising given the poor overall harvest in 2015. Some of the variability is, of necessity, a function of the varieties of vegetable planted in a given year. Some varieties were unusually productive. For example, the 2015 cucumber varieties (Pepinex and Summer Dance) were more productive than any of other years' varieties. The 2014 Tromboncino summer squash was notably more productive than any other grown in the three year span shown here.

While it is a major goal of the Vegetable Trials project to study the success of various cultivars in Central Ohio, it is appropriate to acknowledge the effect that environmental factors exert on that success. The first factor is related to plot fertility. The second is related to the most difficult to control variable, the weather.

Plot Fertility

The productivity problems experienced in 2015 were attributed in part to problems with plot fertility that were shown in a soil test at the end of that crop season. That test revealed that only one soil nutrient, potash, was in the optimum range. Soil pH, phosphate, magnesium, and calcium were above optimum. In response, with the help of Farm Manager Glenn Mills and FCMG volunteer Mark Arnold, four tons of cow manure were plowed into the plot in the late fall of 2015. It was believed that this large application of organic material would help with deficiencies--including neutralizing the high pH. A second soil test was carried out in October 2016 and appears in Appendix C. Soil pH, phosphate, and potash levels are now classified as Optimum, with magnesium and calcium classified as Above Optimum.

Weather

A second source of reduced productivity in 2015 was related to the weather. Steve Herminghausen created the following table that shows that the 2015 crop year was plagued by both colder than normal and wetter than normal weather at key points in the growing season.

Table 9. Temperature and precipitation during the 2015 crop year.[1]

	2015 Temp	2015 Precip	Norm Temp	Norm Precip	Temp dif from norm	Precip dif from norm
Mar-15	38.3	4.34	41.9	3.02	-3.6	1.32
Apr-15	53.2	4.7	53.1	3.4	0.1	1.3
May-15	67.1	3.87	62.5	4.17	4.6	-0.3
Jun-15	71.2	9.21	71.5	4.01	-0.3	5.2
Jul-15	72.3	4.98	75.2	4.79	-2.9	0.19
Aug-15	71.4	2.97	73.9	3.32	-2.5	-0.35
Sep-15	69.6	3.14	66.8	2.84	2.8	0.3
Oct-15	55.6	3.01	55	2.61	0.6	0.4

[1] Data from NOAA Monthly summaries maps: https://gis.ncdc.noaa.gov/maps/ncei/summaries/monthly. Norm data from NWS: http://w2.weather.gov/climate/index.php?wfo=iln Location for actual: WCMH TV station, Olentangy north of Ackerman. Location for normals: CMH airport - norms are based on 1981-2010. Temps in Fahrenheit. Precip in inches.

36.22		28.16	-0.15	8.06	difference March-October
27.18		21.74	0.38	5.44	difference May-October

As the table data show, there was a wetter than usual start to the growing season paired with lower than normal temperatures from mid-May through mid-August.

There were differences in the 2016 growing season, shown in Table 10.

Table 10. Temperature and precipitation during the 2016 crop year

2016	Growing Degree Days at end of month	Growing Degree Days in month	2016 Temp	2016 Precip	Norm Temp	Norm Precip	Temp dif from norm	Precip dif from norm	
March	164	131	48.5	4.27	41.9	3.02	6.6	1.25	
April	345	181	51.4	2.31	53.1	3.4	-1.7	-1.09	
May	715	370	60.3	2.74	62.5	4.17	-2.2	-1.43	
June	1393	678	73.2	5.22	71.5	4.01	1.7	1.21	
July	2177	784	76.6	2.49	75.2	4.79	1.4	-2.3	
August	2989	812	77.6	5.82	73.9	3.32	3.7	2.5	
September	3575	586	70.4	4.68	66.8	2.84	3.6	1.84	
October	3882	307	59.2	1.73	55	2.61	4.2	-0.88	
				29.26		28.16	2.16	1.10	difference March-October
				22.68		21.74	2.07	0.94	difference May-October

Precipitation differences were much less extreme in 2016. Temperature variability also differed. Although 2016 had a cold start to the growing season (April and May), with a late frost recorded at the frost-free date, the rest of the growing season showed temperatures above the norm and more consistently so than the 2015 season. This provided a much better growing environment and allowed us to continue harvest into mid-October, two weeks later than in 2015.

Future Directions

While we were quite pleased that the measures taken to improve the nutritive conditions in the soil in addition to the more temperate climate were effective in bringing plot productivity into line with past success, three concerns emerged in 2016.

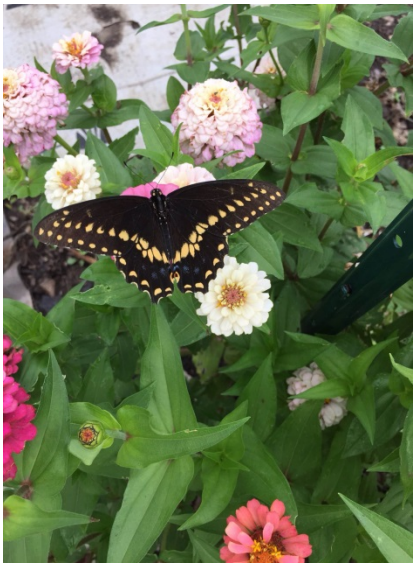
1. Using mulch for weed control. As an alternative to the wood chips used in 2014 and 2015 as mulch, we used cardboard, augmented by bricks and rocks to keep the cardboard pieces in place to discourage weeds in the field. This was suggested by consultants in Horticulture and Crop Science. The cardboard was effective in decreasing the thistle that infested the plot in the previous two years. The need for bricks/rocks to keep the cardboard in place was itself problematic, causing difficulties as we moved about the plot. The double layer of cardboard used also created additional problems in incorporating the residual cardboard into the soil. It is recommended that we remove leftover cardboard at the end of the growing season. My plan for the 2017 season is to compare a single cardboard layer with newspaper as mulch, covering both with straw. It will be interesting to see how the two main weed preventive measures compare.

2. Improving our disposal of herbaceous detritus. In 2016, our weed pile included both weed and vegetables not suitable for consumption. The pile was not systematically removed during the growing season. When removal was completed at season's end, a number of rodents were discovered in the pile. To be better stewards of the plot, a committee has been established to identify ways to better deal with our litter through and in the long term to develop a more active compost program for the plot.

3. Dealing with insect pests. This year, we suffered both our normal problems with squash vine borer and an infestation of flea beetles, especially on our eggplant and kale. Dr. Celeste Welty was invited to visit during both Monday and Thursday sessions and to provide insight into our insect pests. Her advice on insect pests was deeply appreciated. She also made us aware of the many beneficial insects that also inhabit the plot. As leader of the project, I declared a virtual moratorium on chemical controls during the harvest season and have set up a group of volunteers who are preparing documentation that help us to identify both harmful and beneficial insects in the future. The goal is to identify mechanical, biological and chemical approaches to pest control, in line with both the principles of Integrated Pest Management and with the continued plot philosophy of minimizing the use of chemical pesticides whenever possible.

A final note is more cheery: in 2016, we established a line of sunflowers on the northern boundary of the plot and continued previous practice of using zinnias to mark the end of row sections. This had a marked effect of bringing a variety of birds, bees, and butterflies to the plot. They are evident in the pictures at the end of this section. We hope to continue this practice in future years.

As always, the Vegetable Trials project will continue to experiment with interesting new varieties as we move forward as a research project. We want to explore ways to make the information we gather more broadly available, adding exposure to these new and unusual vegetables to the Central Ohio community. We want to continue to contribute to our local food banks, including providing vegetable varieties that may expand the experience of their consumers. We also hope to collect more useful data about our harvest. Where practical, we plan to grow the best cultivar in the preceding year among the varieties in the year following to get some comparison data about differences in cultural and climatic conditions across years. There is also an interest in finding ways to include data on taste and use into our process for assessing the cultivars we grow.



Many thanks to our volunteer photographers including Mary Anne Ewing, Temple George, Mike Heys, Jennifer Kuehn, and Tisa Watts.

Acknowledgements

We'd also like to acknowledge the input of many people and institutions to the success of the 2016 Vegetable Trials. Our biggest thank you goes to Marcia Armstrong, her team, Maggie Harriman and Ken Zack, and their large and enthusiastic group of volunteers. Growing the vegetables and manning the

booth at the Chadwick Spring Plant Sale provides the major funding that makes the Vegetable Trials project possible. Special thanks go to Glenn Mills the manager of the Waterman Farm for his support in so many ways, to Jim Vent and the OSU Howlett Hall Greenhouse staff, and to Mary Maloney, Director of the OSU Chadwick Arboretum and Learning Center and her staff. We are grateful to Steve Herminghausen, our fellow Mater Gardener and reference librarian, for research and preparation of the tables on weather conditions in the Central Ohio region. For the 2016 season, we need to acknowledge several members of the College of Food, Agricultural and Environmental Sciences, including Celeste Welty, Kent Harrison, and Elaine Grassbaugh, for their time and advice. We'd also like to thank Melissa Craft and Sandy Murray, and two local bicycle shops, Roll and Trek, that provided us with much of the free cardboard used as mulch.

Finally, we would like to acknowledge the hard work of the FCMG Volunteers listed below who "toiled in the fields," contributing 1,195 hours, according to the Volunteer Management System (VMS) hour tracking system.

Vegetable Trials Volunteers

Special thanks to those indicated by a star (*) in the list below who contributed more than 10 hours to the project in 2016 according to VMS records and other sources:

Our "old timers":

Marcia Armstrong-Burrows*, Karin Arnold*, Mark Arnold*, Deb Brower, Mary Butterfield*, Pat Claeys*, Mary Duchi*, Sally Francis*, Temple George*, Gail Gross-Brown*, Yen Hanes, Maggie Harriman*, Gretchen Heinke*, Barb House, Sharon Huber*, Jennifer Kuehn*, Theresa Merva-Sico*, Sandy Metzler, Kathy Nicholson*, Lorraine Normore*, Missy O'Malia, Susan Peck*, Agnes Poteet*, Debbie Roshto, Don Skaggs, Ardon Smith, Edie Smith*, Jan Stein*, Richard Stillman*, Mike Sullo, Evelyn Tolliver*, and Ken Zack*.

Members of the 2016 class:

Anisa Ahmad, Doncella Alexander, Terry Althouse, Christopher Appel, Christina Atzberger*, Lorna Biggert, Michael Biggert, Lindalee Brownstein, Sarah Bryant, Linda Call, Andrea Costin, Melissa Craft, Freda Daniely*, Alona Edwards, Karen English, Mary Anne Ewing*, Chris Fadley, Debbie Falter*, Cathy Ferrari, Denlle Fields, Laurie Fomby, Jane Gardner, Joan Garner*, Lisa Gatto, Henry Gosztyla, Linda Hennessy*, Mike Heys*, Kelley Hughes, Natalie Jennings, Hannah Jew, Bill Johnson, Taletha Jones, Suzanne Kull, Nancy Lahmers, Karen Lewis, Nancy Loy*, Beth Miglin, Susann Moeller, Julie Morrison, Matthew Morrison, Randy Morrison*, Peggy Mowry, Sandy Murray*, Jimmy Orr, Crystal Salt, Kate Sniderman, Tisa Watts, and Deb Wentz.

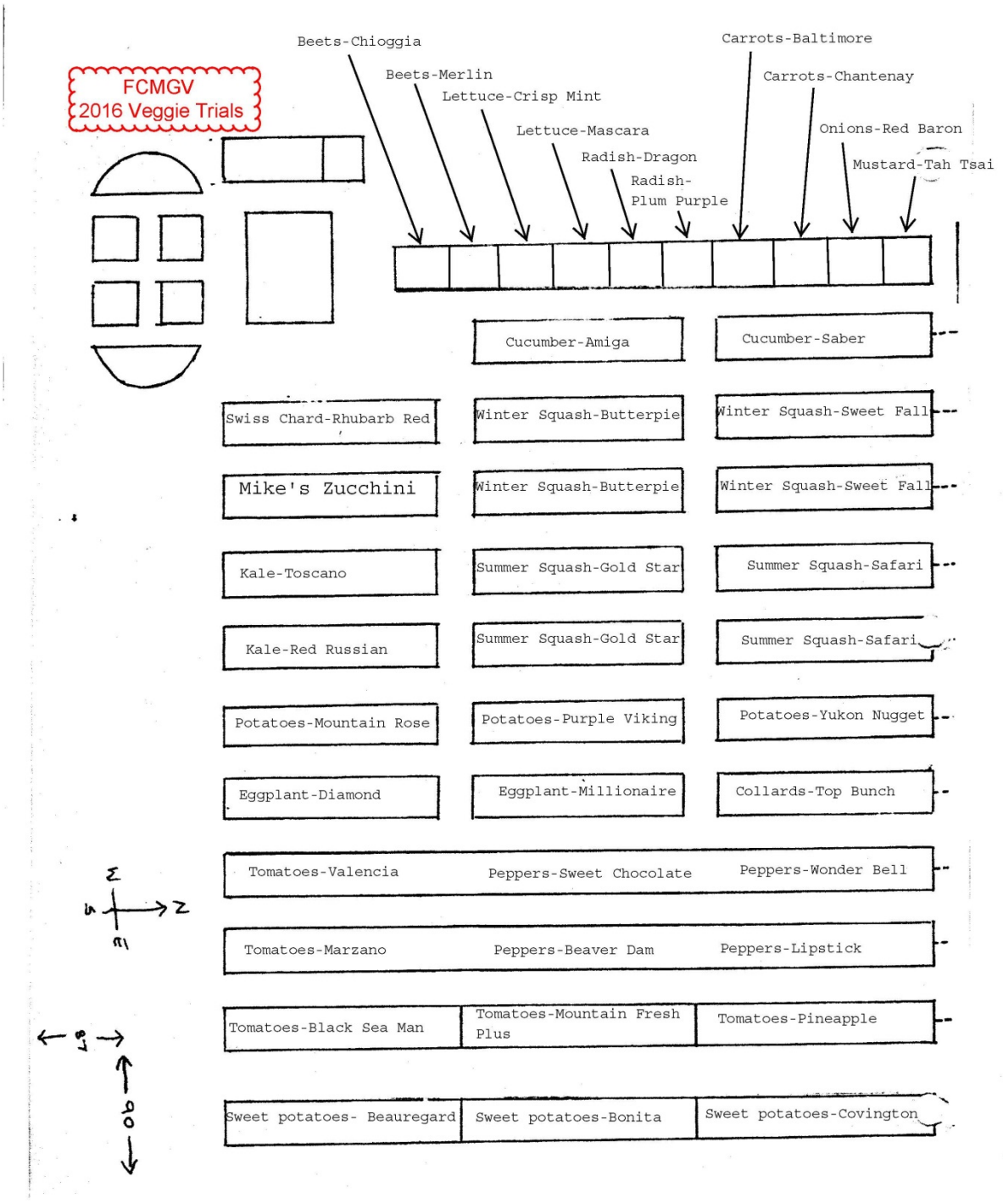
Appendices

A. Plot Layout

B. Brief description of the cultivars grown in 2016

C. Soil test results

Appendix A: Plot Layout



Appendix B. Brief descriptions of the cultivars grown in 2016

2016 cultivars		Description	Seller	Page
Beets	Chioggia	light red with interior rings of white and red	Territorial	17
Beets	Merlin	stand out flavor; red 3-4 inch	Territorial	17
Carrot	Baltimore	high yield, sweet, crispy crunch texture	Territorial	25
Carrot	Chantenay	heirloom, sweet orange, 6", 70 days	Seed Savers	22
Collards	Top Bunch	earliest to harvest, tall, savoyed leaf	Johnny's	32
Cucumber	Amiga	multiple disease resistant, 6" fruit, high yield, 55 days	Johnny's	39
Cucumber	Saber	Sweet, juice few/no seeds, 7", disease resistant	Territorial	32
Eggplant	Diamond	organic; in clusters, disease resistant	Seed Savers	31
Eggplant	Millionaire	8", early maturity, high yield	Territorial	36
Kale	Red Russian	organic; hardy/tender; purple-veined blue-green leaves; 18-36 " plants	Seed Savers	35
Kale	Toscano	heirloom, organic heat/cold tolerant; tender leaves; 'dinosaur' type; 30 days baby; 65 mature	Johnny's	63
Lettuce	Crisp Mint	Romaine, organic; compound heads to 10"	Seed Savers	37
Lettuce	Mascara	organic, dark red; keeps color, bold, disease resistant	Territorial	52
Mustard greens	Tah Tsai	dark green, spinach mustard; 6"; for salads, stir-fries, steamed	Territorial	61
Onions	Red Baron		Oakland Park	
Peppers	Beaver Dam	Medium-hot, horn shaped, 6" long, sweet to slow building heat	Territorial	78
Peppers	Lipstick	sweet, 4", heart shape, 55 days green, 75 red	Johnny's	96
Peppers	Sweet chocolate	short season, ripens green to brown, red inside, thick sweet flesh	Seed Savers	53

Peppers	Wonder Bell	2015 winner; green to red; large fruit 4 lobed; thick walls	Territorial	80
Potatoes, White	Mountain Rose	organic; early; rosy inside & out; disease resistant	Territorial	85
Potatoes, White	Purple Viking	purple/pink flecks, white flesh, good flavor, disease resistant	Territorial	84
Potatoes, White	Yukon Nugget		Oakland Park	
Radish	Dragon	extra crunchy; Chinese radish; cylindrical; harvest at 4-5"	Territorial	87
Radish	Plum purple	organic; sweet and mild, deep purple round roots	Seed Savers	54
Squash, Summer	Gold star	yellow crookneck, , broadly adaptable, 5-7 inches, high yield ,50 days	Johnny's	120
Squash, Summer	Safari	green , white stripe, high yield, F1 hybrid	Johnny's	118
Squash, Winter	Butterpie	classic butternut with best pie squash cross; 3-4 lb., good for soups, breads, pies, etc.	Territorial	93
Squash, Winter	Sweet fall	Hubbard, salmon/blue skin; 4 lb. fruit, very sweet; from Nebraska 1930s	Seed Savers	69
Sweet Potato	Beauregard	2015 winner	Steele	
Sweet Potato	Bonita	light skin, pink cast	Steele	
Sweet Potato	Covington	Excellent yield of uniformly shaped, rose colored skin. The flesh is sweet and slighter darker than a Beauregard.	Steele	
Swiss Chard	Rhubarb red	organic; crimson stalks, dark green heavily crumpled leaves; ornamental and delicious; good in soups and stews	Seed Savers	65
Tomatoes	Black Sea Man	heirloom, rich flavor; Russian heirloom; medium size, brown-pink fruit ; determinate	Seed Savers	75
Tomatoes	Mountain fresh plus	big red (8-17 oz.), most grown in East & Midwest; determinate; tolerates cool, wet	Johnny's	130

Tomatoes	Pineapple	yellow/red streaked heirloom, organic, meaty and full; 1 lb. fruits; indeterminate	Territorial	107
Tomatoes	San Marzano	classic, meaty, sauces, pastes, soups; 5" long fruit, organic, indeterminate	Territorial	108
Tomatoes	Valencia	2015 winner; midseason, orange fruit, full tomato flavor, 8-10 oz.; indeterminate	Johnny's	133

Appendix C: Soil Test Results

PENNSTATE

1855

(814) 863-0841 Fax: (814) 863-4540
Agricultural Analytical Services Laboratory
The Pennsylvania State University
University Park, PA 16802
www.aasl.psu.edu

SOIL TEST REPORT FOR:	ADDITIONAL COPY TO:
LORRAINE NORMORE MASTER GARDENER VEG TRAIL-FRANKLIN CTY 2105 S HAMILTON RD COLUMBUS OH 43232	OSU EXT- FRANKLIN COUNTY 2105 S HAMILTON RD; SUITE 100 COLUMBUS OH 43232

DATE	LAB #	SERIAL #	COUNTY	ACRES	FIELD ID	SOIL
10/10/2016	S16-42819	31661	OH-FRANKLIN		Vt	

SOIL NUTRIENT LEVELS		Below Optimum	Optimum	Above Optimum
Soil pH				
Phosphate	(P_2O_5)			
Potash	(K_2O)			
Magnesium	(MgO)			
Calcium	(CaO)			

RECOMMENDATIONS FOR: *Vegetable Garden*

Limestone, Calcium And Magnesium Recommendations

Apply the following quantities of limestone, epsom salts and/or gypsum to the soil to correct soil pH, calcium and magnesium levels.

Calcitic Limestone: NONE
(0-3 % Mg)

Magnesium: NONE

Gypsum ($CaSO_4$): NONE

Nitrogen, Phosphate And Potash Recommendations

Apply 0.5 lbs per 100 square feet of UREA and 0.5 lbs per 100 square feet of 0-46-0.

MESSAGES

The above lime and fertilizer recommendations are for this soil sample and this season only. Nitrogen, phosphate and potash recommendations are for fertilizers containing specific ratios of nitrogen (N), phosphate (P2O5) and potash (K2O). As an example 5-10-10 contains 5 % N, 10 % P2O5, and 10 % K2O. If fertilizers with the ratio(s) shown are not available, contact your local garden center or fertilizer supplier for the appropriate substitution.

The Cation Exchange Capacity (CEC) is the capacity of the soil to hold positively charged cations such as K+, Mg ++ and Ca++. If the CEC of your soil is less than 15.0 (see laboratory results below) add one inch of organic matter. If soil pH is greater than 7.0, use acid peat moss as the organic matter source.

pH is high. Use sulfur (see Table on back of report) to lower pH to optimum level of 6.5

LABORATORY RESULTS:

[1]pH	[2]P lb/A	Exchangeable Cations (meq/100g)					% Saturation of the CEC			Optional Tests:		
		[3]Acidity	[2]K	[2]Mg	[2]Ca	[4]CEC	K	Mg	Ca	Organic Matter %	Nitrate-N ppm	Soluble salts mmhos/cm
7.4	316	0.0	1.2	4.5	20.3	20.7	5.7	21.8	72.5			

Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations

The high calcium level in this sample indicates the probable presence of soluble calcium. Therefore the CEC and the percent saturations were calculated using a maximum exchangeable calcium level of 15 meq/100 g.

3260

Home Garden-1