PR-410

# Fruit and Vegetable Crop Research Report 1998

UNIVERSITY OF KENTUCKY

Kentucky Agricultural Experiment Station • University of Kentucky • College of Agriculture
Department of Horticulture/Landscape Architecture • Lexington, Kentucky 40546

# 1998 Fruit and Vegetable Crops Research Report

*edited by Brent Rowell*

## *Faculty, Staff, Student, Grower, and Industry Cooperators*

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*This is a progress report and may not reflect exactly the final outcome of ongoing projects.*

# Contents



*A listing of companies providing vegetable seeds for the varieties listed in this report can be found in the Appendix on page 44.*

# 1998 UK Fruit and Vegetable Program Overview

*Dewayne Ingram, Chair*
Department of Horticulture and Landscape Architecture

We are pleased to offer this 1998 Fruit and Vegetable Research Report as a means of sharing information generated from the UK faculty, staff, and students working in these commodity areas. This represents contributions from several departments in the College of Agriculture. The emphases in our research program reflect industry-defined needs, expertise available at UK, and the nature of research projects around the world generating information applicable to Kentucky. Please refer to the following article by Dr. Brent Rowell, editor of this research report and coordinator of the UK Vegetable Crops Team, for a general report and prospectus on Kentucky's emerging fresh produce industry.

Although the purpose of this publication is to report research results, the report also highlights our Extension program and Undergraduate and Graduate degree programs that address the needs of the horticultural industries.

## Extension Highlights

In addition to the more visible activities such as the state and area educational programs, the Extension program addresses the needs of the commercial industry and consumers of our products and services in more subtle ways. We provide training for county Extension agents so they can more effectively serve our clientele. Publications, videos, slide sets, newsletters, articles in state and national industry magazines, newspaper articles, radio spots, and television programs are important elements of our Extension program. Services such as the Plant Disease Diagnostic Clinic, soil testing and interpretative services, and problem-solving services are other important activities. Although there are many facets to the Extension program conducted by the team of subject-matter specialists and county agents, there is a critical need for applied research related to components of production and marketing systems. This need and the "hands-on" approach required for many first-time commercial vegetable growers have outstripped our human and financial resources.

## Undergraduate Program Highlights

We offer areas of emphasis in Horticultural Enterprise Management and Horticultural Science within a Plant and Soil Science Bachelor of Science degree. Here are a few highlights of our undergraduate program in 1998:

- The Plant and Soil Science degree program has more than 100 students in the Fall Semester of 1998, of which almost one-half are Horticulture students.
- We believe that a significant portion of an undergraduate education in horticulture must come outside the classroom. In addition to the local activities of the Horticulture Club and field trips during course laboratories, students have excellent off-campus learning experiences. Here are the highlights of such opportunities in 1998:
- A two-week study tour of the northeastern U.S. and southeastern Canada.
- Students visited horticultural enterprises and gardens in northern Kentucky.
- Students accompanied faculty to the following regional/national/international meetings, including: American Society for Horticultural Science Annual Conference, Kentucky Landscape Industries Conference and Trade Show, and the Southern Nurserymen Association Trade Show.

## Graduate Program Highlights

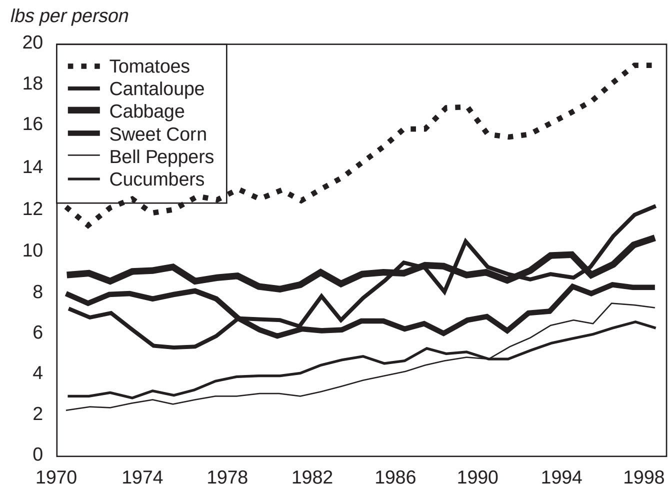
The demand for graduates with an M.S. or Ph.D. in Horticulture, Entomology, Plant Pathology, Agricultural Economics, and Agricultural Engineering is high. Our M.S. graduates are being employed in industry, Cooperative Extension, secondary and post-secondary education, and governmental agencies. There were nine graduate students in these degree programs conducting research related to Kentucky's fruit and vegetable industry in 1998. Graduate students also participate in outreach programs and are involved in such educational activities as the annual fruit and vegetable conference and trade show co-sponsored by the Kentucky Horticultural Society and the Kentucky Vegetable Growers Association.

# Revisiting the "A" Word—Horticultural Opportunities 1998-99

*Brent Rowell*
Extension Vegetable Specialist
Department of Horticulture and Landscape Architecture

Welcome to the premier issue of the 1998 Fruit and Vegetable Research Report. This marks our first attempt to combine reports of applied research on both fruit and vegetable crops. These projects were conducted by Extension specialists, researchers, graduate students, and technical staff from the Department of Horticulture and Landscape Architecture and from several other departments in the College of Agriculture. Our intention is to provide Kentucky growers (and prospective growers) with a "one-stop shopping" report of what we have been doing to answer your questions and to provide you with new information. It is our hope that this information will help you to better compete in the local and national marketplace. We also hope you will let us know the kinds of problems we need to address in future research. We anticipate that the demands for research-based information and for extension programs to deliver that information will continue to rise with changes occurring in the tobacco industry and as new horticultural marketing opportunities develop in the state.

*Figure 1. U.S. Fresh Vegetable Consumption.*




*Courtesy of Kentucky Department of Agriculture.*

## *Mark Twain on Tobacco*

The status of the tobacco industry in 1998 reminds us of that famous cablegram of 100 years ago in which Mark Twain said "the reports of my death are greatly exaggerated." Tobacco will likely remain important to Kentucky farmers for some years to come; however, no one denies that consolidation in the industry is taking its toll on smaller growers and that the long-range market outlook is unfavorable, to say the least.

In Kentucky, the words "alternative crops" have come to mean high-value, intensively grown crops having the potential to make up for declining or lost tobacco income. Although the term "alternative" may not be politically correct, it is still the word most commonly used by tobacco growers in describing vegetables and other high-value horticultural crops. These so-called alternative crops are nothing new. There have always been horticultural alternatives or supplements to tobacco for innovative individuals willing and able to make the investments in time, money, and energy. Kentucky has always had a small group of farmers who put their kids through school on "hort money" in addition to "tobacco money." What is new is that the opportunities and markets for most horticultural crops are increasing dramatically.

## *Bullish on Broccoli*

The short- and long-term market outlooks for fresh produce are extremely favorable; consumption continues to rise (Figure 1). Although many factors contribute to this trend, an important one has been the rising awareness of health benefits associated with increased consumption of fruits and vegetables. A growing body of medical research has established important linkages between increased consumption and favorable biochemical and pharmacological effects. These include such things as anti-allergy properties, anti-inflammation effects, and more importantly, reduced cancer risk. National and local markets have not been oblivious to these findings. Fresh produce now drives the business of the major chain supermarkets. Increasingly, these chains recognize the merchandising power of fresh, *local* produce to the advantage of Kentucky growers.

## *Infrastructure Building*

The opportunities in horticulture are just beginning to be recognized in the state. While still lagging behind some of its neighboring tobacco states, Kentucky has taken great strides over the past three years in recognizing the importance of establishing marketing infrastructure for fresh produce. The Burley Tobacco Growers' Association was one of the first Kentucky farm organizations to take a leading role in supporting horticultural crop marketing initiatives through its Commodity Growers Association. This organization, together with the Kentucky Department of Agriculture and UK, helped obtain federal funds in support of four small vegetable producers' cooperatives in 1997. In addition, the Kentucky Farm Bureau began its innovative Kentucky Certified Roadside Market program in 1996; this program has done much to advertise roadside markets and promote direct marketing in the state.

Perhaps the most radical changes have occurred within the Kentucky Department of Agriculture. Billy Ray Smith became Kentucky's first Commissioner of Agriculture to take the marketing and promotion role of the KDA seriously when, at the insistence of local vegetable producers and the Kentucky Horticulture Council, he established the first Marketing Development Advisory Board in 1996. The Board's task was to determine how hort marketing efforts might best be served by the

KDA. In 1997, the Commissioner began hiring hort marketing professionals. These specialists are already having a significant positive impact on the marketing of Kentucky produce both within the state and nationwide.

Commissioner Smith recently divided the original Marketing Development Advisory Board into commodity-based committees, expanding its scope to include *all* Kentucky agricultural products. The Board will oversee the allocation of more than $5 million in state funds for marketing in 1999, $500,000 of which is dedicated to fruit and vegetable marketing efforts.

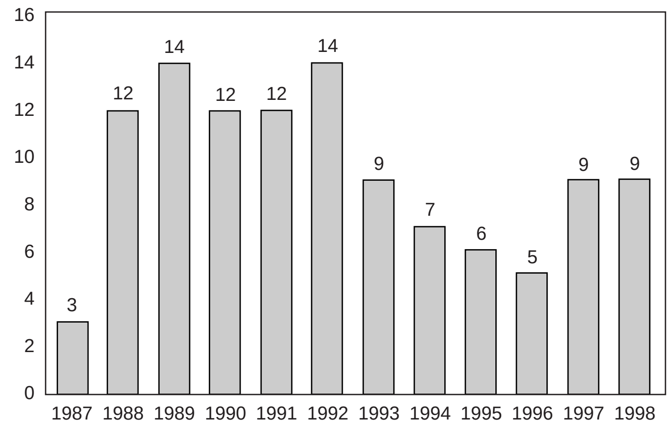
Significant market opportunities are in place, but two important questions remain: Will Kentuckians take advantage of these opportunities? Will the statewide agricultural extension and research system be prepared to meet the needs of a much larger clientele group interested in producing horticultural crops? No less than *five* new small farmer vegetable cooperatives or growers' associations have organized themselves within the past three years in Kentucky— more than in the previous three decades combined. Most members of these associations are tobacco growers without prior experience producing horticultural crops. What these groups require most is personal, "hands-on" help. The Department of Horticulture and Landscape Architecture has been in the forefront of researching and providing information on these crops since at least the turn of the century. But increasing requests from new growers have severely stretched our resources. Our challenge is how to best help these new groups develop the skills required in order to supply a quality fresh (and highly perishable) product in sufficient volumes to a growing market.

## *Variety Testing and Applied Research*

Growers usually put variety trials at the top of the list when rating projects at a public institution's research station. Kentucky growers are no exception. An ongoing testing program producing reliable and usable results is prerequisite to expanding and maintaining competitiveness in our commercial fruit and vegetable industries. Although variety testing has always been an important part of our work at the University of Kentucky, maintaining this program has become increasingly difficult given cuts in staffing and budgets at some of our research farms.

From 1988 to 1990, USDA funding through the "Hal Rogers Project" provided sufficient resources to conduct from 12 to 14 vegetable crop variety trials each year. Some of the trials in that period were conducted in cooperation with Small Farm Assistants at the county level, a program administered by Kentucky State University. For 1991-1993, TVA funds allowed for a continuation of some of these trials. Also in 1993, three variety trials were conducted as part of a special project with funding for that year only. The total number of trials has steadily declined since its peak in 1992 (Figure 2). The number has risen somewhat over the past two years due to the hiring of a support technician for eastern Kentucky based at the Robinson Experiment Station; however, it is not certain that funding will be available for that position beyond 1999. Due to lack of technical support and appropriate plot land, it is also no longer possible to conduct vegetable variety testing in the western part of the state at the Research and Education Center at Princeton.

*Figure 2. Vegetable Cultivar Trials, 1987-1998.*




Numbers are totals of all trials in counties and at Lexington, Princeton, and Quicksand. A Support Technician was employed to assist at Quicksand station in 1997 and 1998.

Where possible, variety evaluation has been combined with other priority research areas. In cooperation with the Department of Plant Pathology, for example, several trials have been conducted in recent years to identify disease-resistant varieties. Whenever possible, these varieties have been recommended in ongoing integrated pest management (IPM) extension programs for fruit and vegetable crops.

The following individual reports are primarily cultivar trials but also include a range of research projects on everything from organic fertilizers to the search for the elusive "Kentucky Tomato."

# Rootstock and Interstem Effects on Pome and Stone Fruit Trees

*Gerald R. Brown and Dwight Wolfe*
Department of Horticulture and Landscape Architecture

## Introduction

Although apples are the principal tree fruit grown in Kentucky, the hot, humid summers and heavy clay soils make apple production a more difficult task for growers in this state than in many major apple-producing regions where soil and climate are more favorable. Poor tree survival, due to Kentucky's heavy clay soils, has also limited plum production. Peach production is also erratic as a consequence of the extreme temperature fluctuations that occur in the winter and spring. In spite of these challenges, productive orchards are one of the highest income-per-acre enterprises suitable for Kentucky's upland rolling soil, and they also have a low potential for soil erosion. Kentucky still imports more apples than it produces; however, the strong market for peaches continues to encourage peach production. Continued identification of improved rootstocks and cultivars is required for growth of the Kentucky fruit industry. For these reasons, Kentucky continues to be a cooperator along with 39 other states and 3 provinces of Canada in the Cooperative Regional NC-140 Project: Rootstocks and Interstem Effects on Pome and Stone Fruit.

## Materials and Methods

Scions of known cultivars on various rootstocks were produced by commercial nurseries and distributed to cooperators for each planting. The University of Kentucky Research and Education Center at Princeton (REC) has five NC-140 rootstock plantings:

1) 1990 apple cultivar/rootstock planting consisting of 5 cultivars on 6 different rootstocks and replicated 6 times per rootstock. Trees are spaced 8 ft apart within rows 16 ft apart.
2) 1993 apple rootstock planting consisting of 'Liberty' on 6 rootstocks and 8 replications per rootstock. Trees are spaced 16 ft apart within rows 23 ft apart.
3) 1994 apple rootstock planting consisting of 'Red Gala' on 6 rootstocks and 10 replications per rootstock. Trees are spaced 13 ft apart within rows 18 ft apart.
4) 1990 plum rootstock planting consisting of 'Stanley' plum on 10 different rootstocks and 7 replications per rootstock. Trees are spaced 16 ft apart within rows 20 ft apart.
5) 1994 peach rootstock planting consisting of 'Redhaven' peach on 12 different rootstocks, and 8 replications per rootstock. Trees are spaced 16 ft apart within rows 20 ft apart.

Except for the 1990 apple cultivar/rootstock planting, trees of each rootstock were randomly allocated to blocks (rows) in a randomized block design (i.e., each rootstock appears once and at random within each block). In the 1990 apple cultivar/rootstock planting, trees of each cultivar/rootstock combination were allocated to the blocks in a split-plot design (i.e, groups of 6 trees [each on a different rootstock] of each cultivar were randomly allocated to each block). Soil management is a 6.5 ft herbicide strip with mowed sod alleyways. Trees are fertilized and sprayed according to local recommendations (1,2). Yield, trunk circumference, and maturity indices such as soluble solids are measured annually for each planting.

## Results and Discussion

The winter of 1998 in Kentucky was mild, but late spring frosts reduced some of our apple and plum crop. This was followed by an extremely wet spring and a very dry late summer and fall. Fruit generally had excellent quality, as there was no extreme pest pressure.

### *1990 apple cultivar/rootstock planting*

The 1990 Apple Cultivar/Rootstock Planting continues the evaluation of some of the promising rootstocks identified from previous trials at UK, REC, while also evaluating cultivars/rootstock interactions. This planting is also our first trial to be trained to the Dutch slender spindle system and supported by electrical conduit fastened to a wire trellis. This is one of a number of orchard systems that have been developed in Europe in order to reduce labor requirements and to enhance early production. Eastern and midwestern growers are rapidly adopting this production technique, and it is appropriate that UK should provide our growers with information on this system's performance. The chief advantage of this system is early production with reduced labor inputs. Early production allows growers to quickly establish orchards with newer, more profitable cultivars.

One hundred sixty-one trees of a possible 180 are in our test because three cultivar-rootstock combinations (Golden Delicious/EMLA M.9, Jonagold/Bud.9, and Liberty/Ott.3) and one tree of Liberty/Bud.9 were not available for this planting. A trellis system was constructed in 1992. Based on foliar analysis and visual observation of vegetative growth, no nitrogen was applied in 1993-98. Vegetative growth is now in the high normal range. With this controlled vigor, the surviving trees are developing nicely. All pest-control decisions are based on IPM procedures, the same as used by our more progressive growers. Fire blight was very light in 1998. Nevertheless, 79 of the 161 planted trees (49.1%) have not survived, and significant differences in mortality by rootstock and cultivar were observed (Tables 1 and 2).

Both rootstock and cultivar significantly influenced dropped fruit, average fruit weight, cumulative yield and one of the fruit maturity indices, fruit pressure, (Tables 1 & 2). Percent soluble solids, the other maturity indicator that was measured, was significantly affected by cultivar (Table 1), but not by rootstock. 1998 yield, picked fruit, and trunk circumference varied significantly by rootstock, but not by cultivar (Table 2). Significant cultivar-by-rootstock interactions were only observed for dropped fruit and average fruit weight (Table 3).

**Table 1. 1998 Cultivar Results — NC-140 1990 Apple Cultivar/rootstock Planting[1]**

| Cultivar[2] | Cumulative Yield per Live Tree (lb) | Picks (lb/tree) | Drops (lb/tree) | 1998 Yield (lb/tree) | Average Fruit Wt (oz) | Mean Pressure of Blush & Offsides (lbs) | Percent Soluble Solids | Number of Suckers | Trunk Circum. (in) | Percent of Trees Alive |
|---|---|---|---|---|---|---|---|---|---|---|
| Liberty | 326.3 | 35.3 | 4.4 | 37.5 | 4.2 | 23.3 | 12.9 | 0.7 | 10.2 | 69.0 |
| Golden Delicious | 321.9 | 30.9 | 19.8 | 50.7 | 5.6 | 17.0 | 14.8 | 0.5 | 11.3 | 40.0 |
| Jonagold | 257.9 | 19.8 | 15.4 | 37.5 | 7.1 | 17.6 | 14.6 | 0.4 | 12.0 | 30.0 |
| Rome | 251.3 | 17.6 | 11.0 | 26.5 | 8.7 | 21.4 | 13.5 | 0.0 | 11.1 | 41.7 |
| Empire | 194.0 | 17.6 | 4.4 | 22.0 | 5.0 | 21.0 | 12.1 | 1.8 | 8.9 | 72.2 |
| Mean | 262.4 | 24.3 | 8.8 | 33.1 | 5.7 | 20.7 | 13.2 | 0.9 | 10.3 | 50.9 |
| LSD (.05) | 79.4 | 15.4 | 6.6 | 19.8 | 0.7 | 1.4 | 1.3 | 0.7 | 1.3 | NA |

[1]University of Kentucky, Research and Education Center, Princeton, KY.
[2]Arranged by cumulative yield in descending order.

**Table 2. 1998 Rootstock Results — NC-140 1990 Apple Cultivar/Rootstock Planting.[1]**

| Rootstocks[2] | Cumulative Yield per Live Tree (lb) | Drops (lb/tree) | Picks (lb/tree) | 1998 Yield (lb/tree) | Average Fruit Wt. (oz) | Mean Pressure of Blush & Offsides (lbs) | Percent Soluble Solids | Trunk Circumference (inches) | Percent of Trees alive |
|---|---|---|---|---|---|---|---|---|---|
| M.26 EMLA | 390.2 | 13.2 | 28.7 | 41.9 | 6.8 | 19.7 | 12.6 | 14.8 | 56.7 |
| M.9 EMLA | 352.7 | 4.4 | 30.9 | 35.3 | 5.3 | 22.4 | 12.4 | 13.0 | 41.7 |
| Ottawa 3 | 330.7 | 15.4 | 22.0 | 37.5 | 5.4 | 19.6 | 14.5 | 12.8 | 25.0 |
| Bud.9 | 260.1 | 11.0 | 26.5 | 37.5 | 5.9 | 20.8 | 13.7 | 9.4 | 87.0 |
| MARK | 152.1 | 6.6 | 13.2 | 19.8 | 4.8 | 20.9 | 13.6 | 7.1 | 50.0 |
| P.22 | 138.9 | 6.6 | 17.6 | 24.3 | 5.3 | 21.1 | 12.9 | 6.5 | 46.7 |
| Mean | 262.4 | 8.8 | 24.3 | 33.1 | 5.7 | 20.7 | 13.2 | 10.3 | 50.9 |
| LSD (.05) | 79.4 | 4.4 | 11.0 | 13.2 | 0.5 | 0.9 | 1.0 | 1.78 | NA |

[1]University of Kentucky, Research and Education Center, Princeton, KY.
[2]Arranged by cumulative yield in descending order.

### *1993 CG-Liberty apple rootstock planting*

This planting is located on a farm of a commercial apple producer in Somerset, which is about 200 miles east of the REC at Princeton. The planting provides us with a comparison of rootstock performance between western and south central Kentucky. To date, differences in mortality have not been statistically significant. Three out of eight trees on CG.202 and CG.210 have died. Four trees on CG.30, CG.222, and CG.13 and 2 on M.7 have also died. Statistical differences in the analysis of variance were not observed for trunk circumference, theoretical cumulative and 1998 yield, or number of rootsuckers (Table 4). The deer pressure contributes to the poor survival rate.

### *1994 apple semi-dwarf rootstock planting*

The 1994 semi-dwarf apple rootstock planting is the first trial at this station to be trained to the French vertical axe system. It also includes a number of new stocks, along with some that have performed well in previous plantings at UK, REC. This planting was established as planned, except for the substitution of B.9 for P.1. Trickle irrigation and a trellis system similar to the one in the 1990 apple planting were constructed in 1995. The mortality of trees on M.26 (10% survival) differed significantly from trees on the other 5 rootstocks (100% survival for trees on CG.11 and 90% for the others). There were no differences in the maturity indices (% soluble solids or pressures) or in the weight of dropped fruit, but trunk circumference, the number of rootsuckers, cumulative yield, 1998 yield, and picked fruit varied significantly by rootstock (Table 5). Trees on CG.13 have made the most growth. Crop load was adjusted so as to not exceed 10 fruits per $cm^2$ of trunk cross-sectional area as per NC-140 protocol.

### *1990 Stanley plum rootstock planting*

Poorly drained clay soils typically found in Kentucky have limited plum production. Rootstocks recently developed in France on soils similar to ours offer the potential for expanding the fruit industry in Kentucky to include this crop. To date, three trees on Julian A, five on Citation rootstock, and two on Myrobolan seedling have died, probably as a result of winter injury. All others (86%) are alive. Statistical differences in the analysis of variance were observed for cumulative yield, 1998 yield, number of root suckers, and trunk circumference, but not for fruit size (Table 6).

**Table 3. 1998 Results — NC-140 1990 Apple Cultivar/Rootstock Planting.[1]**

| Cultivar/Rootstock Combination[2] | Dropped Fruit per Live Tree (lb) | Average Fruit Wt. (oz) |
|---|---|---|
| Liberty/M.26 | 2.2 | 4.0 |
| Liberty/M.9 | 4.4 | 4.7 |
| Golden Delicious/Ottawa 3 | 35.3 | 5.4 |
| Golden Delicious/M.26 | 22.0 | 7.2 |
| Rome/M.26 | 11.0 | 9.0 |
| Jonagold/M.26 | 28.7 | 8.1 |
| Empire/M.26 | 6.6 | 5.6 |
| Liberty/Bud.9 | 2.2 | 4.3 |
| Golden Delicious/Bud.9 | 22.0 | 5.1 |
| Jonagold/Ottawa 3 | 13.2 | 5.8 |
| Rome/M.9 | 2.2 | 8.7 |
| Rome/Bud.9 | 13.2 | 9.1 |
| Empire/Ottawa 3 | 2.2 | 4.2 |
| Empire/M.9 | 6.6 | 5.0 |
| Empire/Bud.9 | 4.4 | 5.1 |
| Jonagold/P.22 | 13.2 | 8.5 |
| Golden Delicious/MARK | 8.8 | 5.1 |
| Liberty/MARK | 6.6 | 3.9 |
| Liberty/P.22 | 4.4 | 4.2 |
| Empire/MARK | 4.4 | 4.7 |
| Rome/MARK | 6.6 | • |
| Rome/P.22 | 15.4 | 7.1 |
| Jonagold/MARK | 6.6 | 6.7 |
| Empire/P.22 | 4.4 | 4.7 |
| LSD (0.5) | 11.0 | 1.3 |

[1]University of Kentucky, Research & Education Center, Princeton, KY.
[2]Arranged by cumulative yield in descending order.

**Table 4. 1998 Results 1993 — NC-140 CG-Liberty Apple Rootstock Planting.[1]**

| Rootstock[2] | Theoretical Cumulative Yields[3] (lb/tree) | 1998 Yield (lb/tree) | 1998 Trunk Circumference (inches) | Number of root suckers[4] |
|---|---|---|---|---|
| CG.030 | 127.9 | 79.4 | 11.2 | 1 |
| CG.202 | 101.4 | 55.1 | 8.4 | 1 |
| CG.222 | 101.4 | 59.5 | 10.9 | 0 |
| CG.210 | 94.8 | 63.9 | 12.7 | 2 |
| M.7 | 77.2 | 46.3 | 10.4 | 4 |
| CG.013 | 70.5 | 66.1 | 10.7 | 9 |
| Mean | 97.0 | 59.5 | 10.6 | 2 |
| LSD (.05) | 75.0 | 46.3 | 3.5 | 8 |

[1]University of Kentucky, Research & Education Center, Princeton, KY.
[2]Arranged by theoretical cumulative yield in descending order.
[3]Theoretical cumulative yield was calculated by summing the theoretical yield for 1996 and 1997, and the 1998 yield. Theoretical yield for 1996 and 1997 was calculated by multiplying the number of fruit on each live tree in this planting by the average weight per fruit from `Liberty' trees in the 1990 apple planting (125 grams and 121 grams for 1996 and 1997, respectively). For 1997, yield to the nearest 0.25 bushels was converted to kg by using a conversion factor of 19 kg (42 lbs)/bushel.
[4]Suckers are a disadvantage because they serve as a source of infestation and must be removed.

**Table 5. 1998 Results — NC-140 1994 Apple Semi-dwarf Rootstock Planting.[1]**

| Rootstock[2] | Cumulative Yield per Live Tree (lb) | 1998 Yield[3] (lb/tree) | Fruit Size (oz/fruit) | Truck Cirumference 10/98 (inches) | Number of Rootsuckers |
|---|---|---|---|---|---|
| M.26 EMLA | 138.9 | 48.5 | 4.8 | 7.0 | 0 |
| V.2 | 116.8 | 44.1 | 5.6 | 8.0 | 4 |
| CG.30 | 114.6 | 41.9 | 5.6 | 8.3 | 15 |
| B.9 | 68.3 | 28.7 | 5.4 | 5.4 | 0 |
| CG.11 | 26.5 | 4.4 | 4.7 | 11.9 | 9 |
| CG.13 | 22.0 | 4.4 | 5.4 | 12.2 | 15 |
| Mean | 68.3 | 24.3 | 5.4 | 9.2 | 9 |
| LSD (.05) | 37.5 | 15.4 | .7 | 1.2 | 13 |

[1]University of Kentucky, Research & Education Center, Princeton, KY.
[2]Arranged by cumulative yield in descending order. There is usually a direct correlation with trunk circumference and yield.
[3]Yield is the sum of picked and dropped fruit. Dropped fruit averaged less than 0.2 kg/tree for all rootstocks (LSD = 0.3).

*1994 peach rootstock planting*

Peaches are one of the most popular fruits in Kentucky. The strong market for this crop continues to entice growers to plant trees in spite of the fact that one can expect erratic production due to the extreme temperature fluctuations that occur in the winter and spring in this state. A rootstock that is more suitable to Kentucky's climate than ones traditionally used would be of great value to the fruit industry in the state. A rootstock that could significantly delay bloom would change the future of the Kentucky peach industry. To date, 75 of the 94 trees planted are alive (80% survival). Statistical differences in the analysis of variance were observed for bloom date, cumulative yield, 1998 yield, and average fruit weight (Table 7), but not for the number of rootsuckers, trunk circumference, or fruit pressure and soluble solids.

The NC-140 plantings are of utmost importance to Kentucky for gaining access to and testing new rootstocks from around the world. The detailed and objective evaluation of these rootstocks will provide growers with the information needed to select the most appropriate rootstocks for their needs when they become commercially available in the future. The 1990 Apple Cultivar/Rootstock Planting and the 1994 Apple Rootstock Planting will provide us with needed information on the adaptability of the slender spindle and vertical axe systems to trees grown on our fertile soils. The 1993 CG-Liberty Apple Planting is an off-station cooperative effort between the University of Kentucky and a commercial grower and provides us with a way to compare rootstock performance between western and south-central Kentucky. The 1990 Plum Planting should provide us with needed information to determine if there are suitable rootstocks for growing plums in western Kentucky's wet clay soils. The 1994 Peach Planting should provide us with needed information to determine if tree survival, winter hardiness, and cropping frequency can be improved by using any of the recently developed rootstocks.

**Table 6. 1998 Results — NC-140 1990 Plum Planting.[1]**

| Rootstock[2] | Cumulative Yield per Live Tree (lb) | 1998 Yield[3] (lb/tree) | Average Wt/fruit (oz) | Number of Root-suckers | Trunk Circumference (inches) |
|---|---|---|---|---|---|
| Lovell Sdlg. | 198.4 | 11.0 | 2.0 | 1 | 16.0 |
| St. Julian A | 185.2 | 4.4 | 2.2 | 5 | 15.0 |
| Myrobolan Sdlg. | 180.8 | 4.4 | 2.0 | 49 | 15.5 |
| GF 31 | 178.6 | 4.4 | 2.3 | 7 | 15.6 |
| EMLA Pixie | 176.4 | 4.4 | 2.0 | 22 | 16.3 |
| Marianna 4001 | 174.2 | 2.2 | 2.2 | 14 | 17.7 |
| Marianna GF-8-1 | 165.3 | 0 | 2.3 | 59 | 18.3 |
| Myrobolan 29 C | 154.3 | 2.2 | 2.5 | 27 | 18.0 |
| Citation | 110.2 | 11.0 | 1.7 | 3 | 10.0 |
| Brompton | 108.0 | 4.4 | 1.9 | 8 | 11.4 |
| LSD (0.05) | 50.7 | 4.4 | 0.5 | 19 | 1.8 |

[1]University of Kentucky, Research and Education Center, Princeton, KY.
[2]Arranged by cumulative yield in descending order.
[3]Sum of both picked and drop fruit, but dropped fruit averaged less than 1 kg per tree. Yield was substantially reduced by late spring frosts.

**Table 7. 1998 Results — 1994 NC-140 Peach Rootstock Planting.[1]**

| Rootstock[2] | Cumulative Yield per Live Tree (lb) | 1998 Yield (lb/tree) | Trunk Circumference (inches) Spring | Average Fruit wt. (oz/fruit) | 90% Julian Bloom Date |
|---|---|---|---|---|---|
| Lovell | 227.1 | 178.6 | 14.9 | 2.8 | 90.7 |
| Stark's Redleaf | 165.3 | 123.5 | 13.5 | 2.4 | 89.3 |
| BY 520-8 | 149.9 | 123.5 | 13.6 | 2.8 | 88.8 |
| BY 520-9 | 147.7 | 108.0 | 13.8 | 3.0 | 88.0 |
| Montclair | 147.7 | 103.6 | 11.9 | 2.5 | 90.4 |
| Ta Tao 5 | 145.5 | 79.4 | 12.0 | 4.6 | 89.2 |
| Bailey | 138.9 | 83.8 | 11.9 | 3.5 | 90.1 |
| GF 305 | 134.5 | 108.0 | 12.0 | 2.4 | 90.6 |
| Tenn Natural | 134.5 | 92.6 | 12.2 | 3.2 | 90.3 |
| Higama | 132.2 | 97.0 | 10.0 | 2.3 | 90.0 |
| Rubira | 110.2 | 83.8 | 13.5 | 2.7 | 90.7 |
| Ishtara | 86.0 | 46.3 | 11.5 | 3.3 | 89.8 |
| Mean | 141.1 | 99.2 | 12.5 | 2.9 | 89.8 |
| LSD (.05) | 20 | 35.3 | 3.1 | 1.1 | 1.1 |

[1]University of Kentucky, Research & Education Center, Princeton, KY.
[2]Arranged by cumulative yield (kg/tree) in descending order.

The NC-140 rootstock plantings are regularly used as demonstration plots for visiting fruit growers, extension personnel, and research scientists. The research data collected in these trials will help to establish base-line production and economic records for the various rootstock combinations which can be later utilized by orchardists in Kentucky.

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1) G.R. Brown, R.T. Jones, J.G. Strang, L.A. Lester, J.R. Hartman, D.E. Hershman, R.T. Bessin. 1998 Commercial Tree Fruit Spray Guide. University of Kentucky, College of Agriculture Cooperative Extension Service, publication ID-98.
2) Midwest Tree Fruit Handbook, University of Kentucky, College of Agriculture Cooperative Extension Service, publication ID-93.

# Optimal Training of Apple Trees for High-density Plantings

*Gerald R. Brown and Dwight Wolfe*
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## Introduction

Early production and optimal fruit size on vigorous sites are obtained when photosynthates are balanced properly between flower bud initiation and vegetative growth. Kentucky growers often have a problem with excessive vegetative growth or vigor, which greatly reduces the production that can be achieved from high-density apple plantings. Pruning and training are possibly the most important techniques used by fruit growers to maintain the proper balance between flower bud initiation and vegetative growth. Identification of effective pruning and training techniques for vigorous sites is required for continued expansion of apple production in Kentucky. The University of Kentucky College of Agriculture and the Kentucky State Horticultural Society have each made a long-term commitment to help meet this need. For this reason, research was initiated to determine the training and pruning practices needed to obtain early production and optimal fruit size from trees trained to either the slender spindle or the French axe system on vigorous sites.

## Materials and Methods

One hundred eighty trees of Golden Delicious on M.9 rootstock were set out in May 1997 in a randomized complete-block design with eight treatment combinations (5 rows, 32 trees/row) and trained according to the treatment protocol outlined in Table 1. Tree spacing is 8 ft apart within rows 16.4 ft apart. Trunk circumference averaged 2 ft at planting and did not vary significantly among rootstocks. A trellis was constructed, and trickle irrigation was installed. Soil management is a 6.5 ft herbicide strip with mowed sod alleyways. Trees are fertilized and sprayed according to local recommendations (1,2). Yield (beginning with 1998 yield), trunk circumference, and maturity indices, such as soluble solids and flesh pressure, are measured annually.

## Results and Discussion

Trunk circumference and average fruit weight did not vary significantly in the analysis of variance, but yield was significantly affected by pruning level (Table 2). Since this season's fruit was left on the tree for purely training purposes, yield differences were probably more of a consequence of tree training procedures than of tree physiology. All trees are currently alive. During 1998, more than half the total time spent training the trees was spent during the first five weeks (Fig.1). In fact, there was more than a 50% reduction in time needed to train each tree from the third through fifth week than was needed during the first two weeks. About 60 seconds per week was needed to train each tree during the first five weeks, but only 40 seconds per week was needed in the 6th through the 12th week.

This planting, along with other plantings, is regularly used as a demonstration plot for visiting apple growers, Extension personnel, and research scientists. The research data collected

**Table 1. UKREC 1997 Apple Training Study — Pruning/Training Treatments.**

| System | Pruning Interval Level in Wks | | Headed at Planting | Angle[1] | Limbs[2] | Leader[3] | Color Code |
|---|---|---|---|---|---|---|---|
| French Axe | Light | 1 | No | 45 | No | D | Black/blue |
| French Axe | Moderate | 2 | 12-16 in. | 45-60 | Yes | C&D | Black/yellow |
| French Axe | Moderate | 1 | 12-16 in. | 45-60 | Yes | D | Black/green |
| French Axe | Heavy | 1 | 8-12 in. | 60-90 | Yes | D | Black/red |
| Slender Spindle | Light | 1 | No | 45 | No | A | White/blue |
| Slender Spindle | Moderate | 2 | 14-20 in. | 45-60 | Yes | B | White/yellow |
| Slender Spindle | Moderate | 1 | 14-20 in. | 45-60 | Yes | B | White/green |
| Slender Spindle | Heavy | 1 | 10-14 in. | 60-80 | Yes | C | White/red |

[1]Angle limbs are to be positioned.
[2]French Axe — completely remove overly vigorous branches with narrow angles when 3 to 6 inches long. Slender Spindle — completely remove branches that compete with leader.
[3]Leader management for 1999:
A = weak leader renewal and new leader headed at 12 inches.
B = bend leader at 60° angle, alternating direction with every 18" of new growth.
C = leader bagged 1 month prior to bud break and bag removed at appropriate time.
D = leader bent to horizontal, alternating direction after buds break on top side.

**Table 2. 1998 Training Results — KSHS-1998 Apple Training Planting.[1]**

| Pruning Level[2] — Interval in Wks | Trunk Circumference (inches) | Yield Per Tree (lb) | Average Fruit Wt (oz) | Minutes Per 10 Trees | |
|---|---|---|---|---|---|
| | | | | 1997[3] | 1998[4] |
| Light - 1 | 4.0 | 1.3 | 10.7 | 122 | 102 |
| Moderate - 2 | 4.1 | 2.0 | 9.8 | 96 | 86 |
| Moderate - 1 | 4.1 | 2.4 | 9.2 | 114 | 111 |
| Heavy - 1 | 3.9 | 0.2 | 13.4 | 119 | 120 |
| Mean | 4.0 | 1.5 | 10.2 | 113 | 103 |
| LSD (0.05) | .3 | 0.9 | 3.7 | NA | NA |

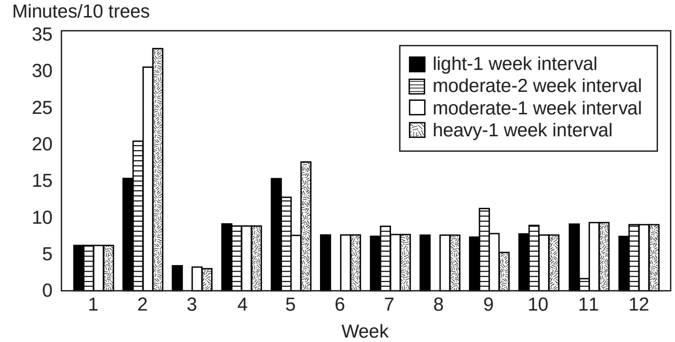
[1]University of Kentucky, Research and Education Center, Princeton, KY.
[2]As described in Table 1.
[3]For 14 weeks.
[4]For 12 weeks.

in these trials will help to establish base-line production methods and economic bases for the various orchard system/rootstock combinations which can be later utilized by orchardists in Kentucky.

## Literature Cited

1) G.R. Brown, R.T. Jones, J.G. Strang, L.A. Lester, J.R. Hartman, D.E. Hershman, R.T. Bessin. 1998 Commercial Tree Fruit Spray Guide. University of Kentucky, College of Agriculture Cooperative Extension Service, publication ID-98.
2) Midwest Tree Fruit Handbook. University of Kentucky, College of Agriculture Cooperative Extension Service, publication ID-93.

*Figure 1. Time Required in 1998 to Train Trees According to 4 Protocols.*




# Evaluation of Multi-layer Fruit Bags for Cork Spot, Sooty Blotch, and Flyspeck Control, 1997

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Department of Plant Pathology

## Introduction

Apples in Kentucky are subject to many important diseases. Among the most difficult diseases to manage in the summer are sooty blotch and flyspeck, because it is not known what time of the summer these diseases begin their fruit infections. A physiological disease, cork spot, also arises in the summer and requires management in the orchard. Sooty blotch is caused by a complex of several fungi formerly attributed to *Gloedes pomigena*, flyspeck is caused by the fungus *Zygophiala jamaicensis*, and cork spot is caused by calcium and/or boron deficiencies.

We knew from previous experiments (1-10) that little or no sooty blotch and flyspeck (SB and FS) developed on apples exposed to approximately 175 or fewer accumulated leaf wetness hours (LWH) after first cover and that disease levels increase with LWH greater than 175. The purpose of this experiment was to determine when these diseases occur by protecting susceptible fruits with multi-layer fruit bags at various times.

## Materials and Methods

The experiment was conducted in a row of a block of 10-yr-old apple trees (Malus x domestica 'York') at Browning Orchard near Flemingsburg, Kentucky. The row was approximately 150 ft east of an adjacent woods. Early season disease management was done by the grower using an air-blast sprayer. All trees were sprayed at labeled rates with Manzate 200 80W (12 oz/100 gal) at pink and on May 21, which fell between petal fall and first cover.

Each experimental treatment consisted of applying multi-layer fruit bags (Kobayashi Bag Mfg. Co., Ltd. of Japan, available from Applecorps, 700 13th St. N.E., East Wenatchee, WA 98802-4523, USA) to 15 fruits (replications), divided among six trees (2-3 fruits/tree). All treatments were applied among the same six trees. Bags were applied according to manufacturer's instructions and were randomly distributed between the tops and bottoms of trees.

For each treatment, fruits remained covered for a different period of the growing season (Table 1). The first treatments were made June 10, when fruits were about 1 inch in diameter. Succeeding bag application treatments were begun every two weeks thereafter. Fruits with bags removed prior to harvest were identified by tying surveyor tape around the fruit spurs; each treatment was assigned one tape color. Leaf wetness was detected and recorded electronically using an Envirocaster (Neogen, Lansing MI) weather monitor, starting at first cover (May 24).

All fruits in the experiment were harvested on October 8 and placed in cold storage with bagged fruits kept in their bags. Fruits were evaluated for SB and FS and cork spot on October 14. SB & FS severity was assessed by estimating the percentage of total fruit surface covered with the causal fungi. Cork spot severity was assessed by counting any sunken, dark spots on the fruit surfaces resembling typical cork spots. Representative spots were dissected to confirm the symptoms of this disorder. Treatments were evaluated for SB and FS and cork spot control by averaging the respective disease severities for all fruits in each treatment, followed by statistical analysis.

## Results and Discussion

SB and FS symptoms were first noticed on July 7, when approximately 222 LWH had accumulated. June and August had more than average rain; July and September were dry. There was no obvious predominance of either SB or FS in any treatment. Compared with previous tests (2-10), disease pressure appeared to be light based on the low SB and FS severity on the control fruits. SB and FS was significantly reduced when fruits were bagged for three months or longer. Based on 4- to

5-week bag coverage, the most critical times to cover fruit to reduce SB and FS were July and August. In 1996, only treatments in which fruits were covered for all, or the last half of, July produced disease severity levels of 5% or less (3). Maximum cork spot reductions occurred when fruits were covered during August.

There was a significant positive correlation (r = 0.85) between SB and FS severity and total LWH to which fruit were exposed between first cover and September 10. The mean SB and FS severity for fruit covered from July 22 to October 8 was significantly greater than for fruit covered from July 7 to October 8, even though only seven hours of rain were recorded between July 7 and July 22. This observation suggests that another critical factor besides wetness contributed to SB and FS development in mid-July or that bags prevented SB and FS inocula from reaching the fruit in mid-July.

**Table 1. Effect of time of coverage by fruit bags on disease severity.**

| Period of fruit coverage | Number of days fruits in bags | Number of hours of wetness between May 24 and September 10 while fruit were not covered | Sooty blotch and fly speck severity [1] | Cork spot severity [2] |
|---|---|---|---|---|
| *Variable duration of coverage with fruit bags* | | | | |
| control - no bag | 0 | 341 | 1.39 cd[3] | 1.54 c |
| June 10 - July 22 | 42 | 210 | 1.00 bc | 0.78 ab |
| June 10 - August 6 | 57 | 195 | 0.77 b | 0.54 ab |
| June 10 - August 24 | 75 | 129 | 0.36 a | 0.64 ab |
| June 10 - September 10 | 92 | 97 | 0.18 a | 0.36 ab |
| June 10 - September 22 | 104 | 97 | 0.25 a | 0.25 a |
| June 10 - October 8 | 120 | 97 | 0.00 a | 0.15 a |
| June 24 - October 8 | 106 | 170 | 0.13 a | 0.00 a |
| July 7 - October 8 | 93 | 222 | 0.20 a | 0.00 a |
| July 22 - October 8 | 78 | 229 | 0.89 b | 0.11 a |
| August 6 - October 8 | 63 | 244 | 1.00 bc | 0.63 ab |
| August 24 - October 8 | 45 | 309 | 1.38 cd | 0.25 a |
| *Four to five weeks duration of coverage with fruit bags* | | | | |
| June 10 - July 7[4] | 27 | 217 | 1.11 bc | 0.78 ab |
| July 7 - August 6 | 30 | 319 | 0.86 b | 1.14 bc |
| July 22 - August 24 | 33 | 261 | 0.86 b | 0.29 a |
| August 6 - September 10 | 35 | 244 | 0.88 b | 0.25 a |
| August 24 - September 22 | 29 | 309 | 1.00 bc | 0.75 ab |
| September 10 - October 8 | 28 | 341 | 1.65 d | 0.77 ab |

[1] Rating: 0 = no SB or FS; 1 = trace - 5%; 2 = 6 - 25% of fruit surface affected with SB & FS.
[2] Rating: 0 = no cork spot; 1 = 1-2 cork spots.
[3] Means in a column followed by the same letter are not significantly different (DMRT, P=0.05).
[4] There was no mid-June treatment.

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# Matted Row Strawberry Variety Trial

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## Introduction

New strawberry cultivars adapted to matted row production are becoming commercially available with great frequency. To evaluate their performance under Kentucky conditions, we establish a variety trial with new and a few traditional cultivars every few years. In 1997 we established such a variety trial, harvested it in 1998, and have maintained it for a 1999 harvest. The first year's results are presented here.

## Materials and Methods

Beds were fumigated with methyl bromide 3 weeks prior to planting. Dormant plants were set on May 1, 1997, in rows 3.5 ft apart and 1 ft apart within the row. Individual variety plots were allowed to develop to a 5-ft length and a 1-ft width. Excess growth was removed by cultivation. Beds were watered during the year of establishment as needed and received a fall N application at 60 lbs N/acre. The beds were mulched with straw in late fall; mulch was removed in April 1998 at the first signs of growth on a majority of the plots. The earliest varieties were first harvested on May 15, and the latest were last harvested on June 19. After harvest, beds were subjectively rated on a 1 to 5 scale for vigor based on relative area of the bed filled with plants: 1= few total plants, and 5=complete or 100% of the bed filled.

## Results and Discussion

Kent, Allstar, Cavendish, Idea, and Honeoye all exhibited yields of more than 20,000 lbs/acre (Table 1). The traditional favorite Earliglow yielded well, while the newer Delmarvel had only moderate yields. The varieties that we tested for the first time included Idea, Primetime, Winona, Latestar, and Mohawk. Of this group, only Idea and Primetime yielded well.

**Table 1. Strawberry variety performance in matted row production, 1998.**

| Variety | lbs/acre | 1st Half Yield (%) | Bed fill |
|---|---|---|---|
| Kent | 26240 | 34.3 | 4.2 |
| Allstar | 24279 | 46.8 | 4.2 |
| Cavendish | 20452 | 43.5 | 3.6 |
| Idea | 20303 | 19.0 | 4.6 |
| Honeoye | 20093 | 73.6 | 3.8 |
| Seneca | 19447 | 44.9 | 3.8 |
| Primetime | 19184 | 76.3 | 4.2 |
| Jewel | 18036 | 30.9 | 3.8 |
| Earliglow | 17390 | 84.9 | 4.4 |
| Delmarvel | 14639 | 89.9 | 5.0 |
| Lester | 14280 | 77.5 | 4.0 |
| Northeaster | 14113 | 82.6 | 4.2 |
| Redchief | 13898 | 61.9 | 3.4 |
| Lateglow | 13467 | 53.2 | 4.2 |
| Winona | 9496 | 38.0 | 4.2 |
| Latestar | 7176 | 40.3 | 2.2 |
| Mohawk | 6243 | 56.9 | 3.6 |
| | | First 5 dates/ 10 total dates | 1=low 5=high |

The earliest varieties, with more than 70% of their yields in the first half of the season, included Delmarvel, Earliglow, Northeaster, Lester, Primetime, and Honeoye. The latest varieties included Idea, Kent, Winona, and Latestar. Bed fill was generally good, with Delmarvel showing exceptional runner plant production, while Latestar was a poor runner producer. Even though Idea and Primetime look good from the data, they were not without problems. Idea produced large berries that were very soft and difficult to harvest, probably a response to the wet harvest season. Primetime produced many moderate to small berries.

# Fall-planted Plasticulture Strawberry Production

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## Introduction

Interest by Kentucky growers in the strawberry production system developed in North Carolina has grown over the last few years. However, the feasibility of adapting this system to Kentucky's colder climate and shorter fall planting and spring fruiting periods is unclear. In the last five years we have learned that the dominant variety used in the system in North Carolina, Chandler, will produce high quality, large fruit in this system in Kentucky. The optimum planting date is close to Labor Day in September. Earlier dates may be possible, but high August temperatures impose significant heat stress on transplants, inhibiting their growth and affecting plant establishment. Beds have been winter-protected with spun-bonded row covers and straw, initially placed on the beds when nighttime air temperatures have been (or have been predicted to be) below 25°F for extended periods in the fall. The row covers and straw were removed when plants showed visible growth in the spring. Although row covers were placed back on the beds when weather predictions indicated that a severe frost or freeze posed a danger to open flowers, this did not provide complete protection. Overhead sprinkling for frost protection was not used.

In prior years our yield per plant and estimated yield per acre have been below those obtained in North Carolina. Our yields have not exceeded 0.9 lbs per plant or 15,300 lbs/acre, while yields of at least 1.25 lbs per plant and more than 21,000 lbs/acre are expected. Since plant size at the end of the fall after transplant establishment may be closely related to spring yield, we established a plot in 1996 at three rates of nitrogen to stimulate post-planting growth.

Due to the high cost of establishing the system, some growers have asked if the beds can be carried into a second season to offset these costs. This is not recommended in North Carolina, due in part to the increased potential for disease (especially anthracnose, to which Chandler is very susceptible) and a decline in berry size. To address this question, we maintained the nitrogen-treatment plot of Chandler for a second cropping season to study yield, fruit size, and any problems which might arise. Further, growers have also asked if other strawberry varieties might be adapted to the system. Transplants of a few cultivars in addition to Chandler were made available to us to address this question.

## Materials and Methods

### *Two-year Chandler study*

A field plot of Chandler was established on September 5, 1996. Two rows of commercially produced transplants were set at a 1-by-1-ft spacing between plants and rows on methyl bromide-fumigated, raised, black plastic-covered beds. The beds were fertilized with ammonium nitrate at 0, 30, or 60 lbs N/acre broadcast in bed sections prior to laying plastic. The beds were covered with straw and spun-bonded row covers on November 11, 1997. On April 1, 1998, row covers and straw were removed and all beds were fertigated at 15 lbs N/acre weekly for 5 consecutive weeks until first harvest.

The plot was carried over into 1998 to determine the yield potential of Chandler plants in the second season. After harvest in 1997, the plants were mowed to remove foliage. They were not fertilized and were irrigated as needed until September 1997, when they received 15 lbs N/acre once. Runners were removed manually with a sharp knife in July and again in September. Straw and row covers were placed on the beds on October 20, 1997, and removed on April 7, 1998. The beds received 22 lbs N/acre twice at weekly intervals after removal of the row covers.

**Table 1. Chandler Fall-planted Plasticulture Plots Years 1 and 2.**

| Year | lbs/acre | lbs/plant | Mean berry wt (oz) |
|---|---|---|---|
| 1 - 1997 | 12700 | 0.84 | 0.58 |
| 2 - 1998 | 18040 | 1.10 | 0.52 |

**Table 2. Alternative Variety Trial**.

| Variety | lbs/acre | lbs/plant | Mean berry wt (oz) |
|---|---|---|---|
| Camarosa | 17800 | 1.05 | 0.66 |
| Chandler | 14740 | 0.87 | 0.59 |
| Jewel | 12208 | 0.72 | 0.69 |
| Northeaster | 8691 | 0.51 | 0.77 |
| Sweet Charlie | 5262 | 0.31 | 0.45 |

### *Alternative cultivars study*

A field plot was established on September 15, 1997, by the methods described above with the varieties Chandler, Camarosa, Sweet Charlie, Jewel, and Northeaster. The beds received 15 lbs N/acre once after planting and were irrigated as needed. Straw and row covers were placed on the beds on October 20, 1997 and removed on April 7, 1998. The beds received 22 lbs N/acre twice at weekly intervals after removal of the row covers.

## Results and Discussion

### *2-year Chandler study*

Fall nitrogen rate had no effect on yield or fruit size in 1997, so the overall means are shown (Table 1). This may be because the plots all had adequate N in the fall, or the spring N application made up for any differences resulting from the fall applications. Regardless, on most sites with adequate fertility, N should be applied, but the rate will not affect spring yield. Yield per plant and per acre the first year was comparable to previous years.

In the second cropping season, yield per plant and per acre were higher than in the first season, although berry size was smaller. Fruit quality (color, shape, sugar content, flavor) was comparable both years. In 1998, fruit disease, primarily gray mold, was somewhat higher, although foliar disease was no worse than in 1997. The major problems with maintaining the plot into the second year were weed control between the beds and runner removal. Weeds were controlled with a combination of cultivation and herbicide applications using chemicals approved for use in strawberry fields. Manual runner removal was especially labor intensive.

### *Alternative variety evaluation*

Yield of Camarosa exceeded that of Chandler, while Jewel yield was slightly lower than Chandler (Table 2). Berry size of both Camarosa and Jewel was greater than Chandler. Our subjective field evaluations indicated that Jewel quality was at least as good as Chandler if not better, but that Camarosa looked as good but had less flavor. Nonetheless they both deserve more study. Neither Northeaster nor Sweet Charlie performed well in the study. It should be noted that Sweet Charlie was developed in Florida for their industry and grows in response to even a short warm period during the winter. In our plots, it was in bloom at least 2 weeks before the other cultivars, before the row covers could be safely removed, and many of the first blooms were not pollinated or suffered cold injury, which led to the low yields.

# Blueberry Cultivar Trial

*Dwight Wolfe and Gerald R. Brown*
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## Introduction

The blueberry is a fruit crop that is native to North America. At present, Kentucky has a small established commercial blueberry market and an excellent potential for local sales, U-pick, and home use.

## Materials and Methods

A blueberry cultivar trial was established in 1993 with 8 cultivars in a randomized block design with 5 replications (rows). Plant spacing is 14 feet between rows and 4 feet between bushes. The pH was reduced from above 6 to 5.4 with elemental sulfur prior to planting. The planting is mulched yearly with sawdust mulch, is trickle-irrigated with 1 gph vortex emitters, and receives 6 monthly applications per year (beginning in April) of 17-7-10 Sierra Blend Nursery Mix at the rate of 5 oz per bush per application (about 240 lbs/acre/application of this fertilizer at this plant spacing, which is 777 bushes/acre). The planting is netted during the last week of May, and fruit is harvested from mid-June through the first week of July.

## Results and Discussion

Cumulative yield, the 1998 yield, and average percent fruit ripe by June 12 are shown in Table 1. Duke and Sierra have produced the most fruit to date. Duke has also been the earliest-ripening cultivar in our planting, while Nelson has been the latest to ripen.

These results may be useful to growers in selecting a blueberry cultivar. Avoiding labor peaks and harvest times coinciding with other crops may have to be weighed against choosing the highest-yielding cultivar. Other factors important to cultivar selection are discussed in other UK publications (1,2).

**1993 Blueberry Cultivar Trial.[1]**

| Cultivar[2] | Yield (lbs/bush) Cumulative | Yield (lbs/bush) 1998 | Average Percent Fruit Ripe by June 12 |
|---|---|---|---|
| Duke | 23.1 | 7.1 | 50.7 |
| Sierra | 20.7 | 6.5 | 32.9 |
| Bluecrop | 18.1 | 4.6 | 29.5 |
| Nelson | 17.2 | 4.2 | 16.1 |
| Toro | 15.9 | 4.8 | 30.0 |
| Blue Gold | 15.6 | 0.3 | 36.6 |
| Sunrise | 12.8 | 4.6 | 49.0 |
| Patriot | 10.4 | 1.1 | 44.9 |
| LSD (.05) | 3.4 | 1.0 | 13.2 |

[1]The planting was established in April, 1993. Plant spacing is 4 feet between bushes in rows 14 feet apart. There are three bushes per cultivar/rep combination.
[2]In descending order of cumulative yield (1995-1998). Cultivars ranked from easiest to hardest to pick: Toro, Duke, Sierra, Sunrise, Bluecrop, Bluegold, Nelson, and Patriot.

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# Spring Fresh-market/Slaw Cabbage Cultivar Evaluations in Eastern Kentucky

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Department of Horticulture and Landscape Architecture

Kentucky growers produce an estimated 700 acres of spring cabbage for sale to fresh and slaw markets. 'Bravo' has been the standard cultivar grown for both markets. It has good hardiness and excellent disease resistance. It produces a head which is fairly large (4-6 lbs), and close spacing must be practiced to permit sales to fresh market. Buyers would like to be able to buy cabbage from Kentucky 10-14 days earlier than our current season in order to fill a market window that exists between the end of harvest in Georgia and the onset of Kentucky sales. Twenty-six cabbage cultivars were evaluated for spring production at the Robinson Experiment Station in Quicksand, Kentucky.

## Materials and Methods

Twenty-six cabbage cultivars were seeded on February 10 in a greenhouse at the South Farm in Lexington. They were transplanted at Quicksand on April 7. The trial consisted of a randomized complete-block design with four replications. Each replication was a single row 15 feet long. Plant spacing in row was 12 in. and rows were 36 in. apart. Fifteen plants per rep were used for a total of 45 plants for each cultivar. On April 6, prior to planting, Treflan 2E and Devrinol 50 WP (1 qt + 2 lb) were applied and tilled in for weed control. A 20-20-20 starter fertilizer was used at transplanting. Soil test results for this site are shown in Table 1.

The cabbage was fertilized three times by side dressing as follows: April 13, applied 50 lb N, P, K/acre in the form of 12-12-12; May 6 and May 20, applied 50 lb actual N/acre as am-

**Table 1. Fresh-market cabbage soil test results (lbs/acre).**

| pH | Buf pH | P | K | Ca | Mg | Zn |
|---|---|---|---|---|---|---|
| 6.6 | 7.2 | 196 | 379 | 7528 | 228 | 8.5 |

**Table 2. Yield and quality of spring fresh-market cabbage cultivars, Quicksand, KY; data are means of four replications.**

| Cultivar | Seed source | Head #/acre | Total wt (lb/acre) | Avg head wt (lb) | Core size (in) | Head size LxW (in) | Head firmness[a] Rating | Head firmness[a] Penetr. PSI | Days to harv. | Head shape[b] | Inter color[c] | Wt/ Crate 14 hd (lb) | Plant size[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gideon | BZ | 13552 | 55060 | 4.1 | 3.9 | 7.0 x 6.7 | 4.1 | 24 | 86 | 3-2 | 2 | 57.0 | 3.0 |
| | *Worthy of additional trials. Very nice, heavy dome-shaped heads, wavy leaf margins, outer leaves narrow at base don't hold water.* | | | | | | | | | | | | |
| Bronco | BZ | 14036 | 54690 | 3.9 | 3.8 | 6.7 x 6.5 | 3.9 | 27.8 | 88 | 3 | 1 | 54.7 | 2.2 |
| | *Worthy of additional trials. Nice, high-domed plant, big core, heads dense but late, outer leaves narrow at base.* | | | | | | | | | | | | |
| Ramada | BZ | 12100 | 47490 | 4.0 | 3.4 | 6.6 x 6.8 | 4.0 | 25 | 89 | 2 | 2 | 55.9 | 2.4 |
| | *Worthy of additional trials. Very nice, dense heads, leaves narrow at base, no sunburn or tip burn.* | | | | | | | | | | | | |
| Super Red | LI | 13794 | 42710 | 3.1 | 2.9 | 6.4 x 6.0 | 5.0 | 28 | 85 | 3 | 1 | 43.5 | 2.1 |
| | *Commercially acceptable. Very nice, high-domed, dense red cabbage, narrow outer leaf petioles allow water drainage.* | | | | | | | | | | | | |
| Atlantis | TI | 13552 | 55540 | 4.1 | 3.2 | 6.5 x 6.6 | 4.2 | 23 | 79 | 2 | 2 | 57.2 | 2.8 |
| | *Worthy of additional trials, nicer than Augusta. No sunburn; long, thin petiole on outer leaves does not hold water, wavy leaf margin, good wrapper cover, no tip burn seen.* | | | | | | | | | | | | |
| Morris | BZ | 14036 | 45190 | 3.2 | 3.4 | 6.6 x 6.7 | 3.4 | 22.4 | 73 | 2 | 2-3 | 45.1 | 3.0 |
| | *Worthy of additional trials. Nice, dense heads, larger than Bravo at time of harvest, frame leaves narrow at base.* | | | | | | | | | | | | |
| Charmant | LI | 14036 | 42410 | 3.1 | 3.4 | 5.8 x 6.0 | 4.0 | 24.3 | 78 | 2 | 2 | 42.3 | 1.5 |
| | *Heads attractive for small plant, good wrapper leaves, leaves wide at base hold water, a few with rot, no sunburn seen.* | | | | | | | | | | | | |
| Royal Vantage | RU | 13068 | 53740 | 4.2 | 4.1 | 7.1 x 6.7 | 3.0 | 23 | 84 | 3-2 | 2 | 58.7 | 3.4 |
| | *Leaves wide at base hold water, big core.* | | | | | | | | | | | | |
| Sure Vantage | RU | 12826 | 46520 | 1.0 | 3.7 | 6.6 x 6.7 | 2.7 | 22.3 | 84 | 3 | 2 | 50.9 | 3.6 |
| | *Outer leaves narrow at base let water drain, some air space in heads where leaves meet stem.* | | | | | | | | | | | | |
| LSD (P = 0.5) | | | 5156 | 1.2 | | | | 2.8 | | | | | |

[a] Rated 1-5 with 1= very loose; 5= very hard; also measured with penetrometer: PSI = lbs/square in.
[b] Head shape: 1. Flat, 2. Round, 3. High round
[c] Internal Color: 1. White, 2. Whitish green, 3. Yellowish green, 4. Yellow
[d] Plant size: 1. Small, 2. Medium 3. Large

**Table 3. Yield and quality of spring fresh-market cabbage cultivars, Quicksand, KY; data are means of four replications.**

| Cultivar | Seed source | Head #/acre | Total wt (lb/acre) | Avg head wt. (lb) | Core size (in) | Head size LxW (in) | Head firmness[a] | | Days to harv. | Head shape[b] | Inter color[c] | Wt/ Crate 14 hd (lb) | Plant size[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Rating | Penetr. PSI | | | | | |
| Cheers | TI | 12342 | 57230 | 4.5 | 3.8 | 6.7 x 7.7 | 2.3 | 20 | 84 | 1-2 | 2 | 63.2 | 3.4 |
| | *Worthy of another look. Blue-green, big core, leaves narrow at base excellent drainage, looks nicer than Bravo, but heads did not get hard enough.* | | | | | | | | | | | | |
| Fresco | BZ | 13794 | 60560 | 4.4 | 3.5 | 6.9 x 7.1 | 2.9 | 21 | 85 | 2 | 2 | 61.3 | 2.7 |
| | *Blue-green plant, no sunburn on heads, excellent wrapper leaves, but leaves wide at base will hold water; some heads soft/did not harden up.* | | | | | | | | | | | | |
| Green Cup | TI | 13794 | 59760 | 3.7 | 3.0 | 6.6 x 7.5 | 3.2 | 21 | 83 | 1-2 | 2 | 52.4 | 2.1 |
| | *Average, despite nice appearance in past trials. Blue-green heads, outer leaves wide at base, some heads still loose despite size/did not harden up.* | | | | | | | | | | | | |
| Bravo | H | 13068 | 67340 | 5.2 | 4.0 | 7.0 x 7.9 | 2.9 | 19 | 86 | 1-2 | 1 | 72.8 | 3.0 |
| | *Industry standard, not the best in this trial for density or appearance. Blue-green heads, leaves medium to wide at base (which holds water). Not all mature at one time/not a real solid cabbage. Some rot on outer wrapper leaves, much too heavy for a 14 count.* | | | | | | | | | | | | |
| Heads Up | TI | 13552 | 43860 | 3.2 | 4.3 | 6.8 x 6.3 | 3.0 | 19 | 74 | 3 | 2 | 45.3 | 1.9 |
| | *Garden or farmers' market cultivar but not commercially acceptable. Very uniform maturity, exposed heads (outer leaves do not protect heads), some wrapper sunburn, outer leaves wide at base hold water.* | | | | | | | | | | | | |
| Fieldsport | BZ | 13552 | 28370 | 2.1 | 2.8 | 5.7 x 5.2 | 4.4 | 29 | 73 | 3 | 3 | 29.7 | 1.7 |
| | *Blue-green plant, too small for commercial market, hard heads but small, outer leaves wide at base could allow rot.* | | | | | | | | | | | | |
| Fast Vantage | TI | 14200 | 35250 | 2.5 | 3.2 | 5.6 x 5.6 | 2.3 | 23 | 67 | 2 | 2 | 34.8 | 1.0 |
| | *Cute early home garden or farmers' market cultivar. commercially plants too small, outer leaves broad at base.* | | | | | | | | | | | | |
| Blue Pak | TI | 12584 | 37270 | 3.0 | 3.5 | 6.0 x 6.2 | 4.0 | 28 | 78 | 2 | 2 | 41.5 | 2.3 |
| | *Not commercially acceptable. Nice-looking blue-green cabbage, wide outer leaves hold water, unexplained stunting in one rep.* | | | | | | | | | | | | |
| LSD ($P = 0.5$) | | | 5156 | 1.2 | | | | 2.8 | | | | | |

[a] Rated 1-5 with 1= very loose; 5= very hard; also measured with penetrometer: PSI = lbs/square in.
[b] Head shape: 1. Flat, 2. Round, 3. High round
[c] Internal Color: 1. White, 2. Whitish green, 3. Yellowish green, 4. Yellow
[d] Plant size: 1. Small, 2. Medium 3. Large

monium nitrate ($NH_4NO_3$.) This represents a total of 150 lb N/acre applied, which is close to our current recommendations for Kentucky.

## Results and Discussion

There were many nice-looking cabbage cultivars in this year's trial. The top five green cultivars (Table 2) were 'Gideon', 'Bronco', 'Ramada', 'Atlantis', and 'Morris'. They produced heads that were harder, more attractive, and better-sized than the industry standard 'Bravo'. The cabbage cultivars 'Atlantis' and 'Morris' were earlier than 'Bravo' by 8 to 10 days and should be tested further to see if they could be used to expand the market window. They both produced large plants that handled the stress of an excessively wet spring. 'Atlantis' produced a slightly larger head than 'Morris' (4.2 vs 3.4 lb). These five cultivars are worthy of grower trials to test market acceptability against the grower standards 'Blue Vantage' (early) and 'Bravo' (late).

'Gideon', 'Bronco', and 'Ramada' matured in the same time frame as 'Bravo'. They were much harder and had better size control than the 'Bravo' grown this year (Tables 2 and 3). During this wet spring, 'Bravo' showed some wrapper leaf rot that required peeling, whereas the five cultivars mentioned above did not. Cloudy, extremely wet weather may have delayed the days to harvest by 7-10 days for many of the cabbage cultivars tested. In general, the earliest-maturing cultivars showed the greatest maturity delays. Toward the end of the growing season the weather became very warm, sunny, and dry.

**Table 4. Yield and quality of spring fresh-market cabbage cultivars deemed commercially unacceptable, Quicksand, KY; data are means of four replications.**

| | | | | | | | Head firmness[a] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cultivar | Seed source | Head #/acre | Total wt (lb/acre) | Avg head wt (lb) | Core size (in) | Head size LxW (in) | Rating | Penetr. PSI | Days to harv. | Head shape[b] | Inter color[c] | Wt/ Crate 14 hd (lb) | Plant size[d] |
| Blue Gem | H | 12826 | 45500 | 3.5 | 3.4 | 5.7 x 6.8 | 2.5 | 21 | 77 | 1-2 | 2 | 49.7 | 1.9 |
| | *Big core, leaves broad at base, slightly flattish heads.* | | | | | | | | | | | | |
| Discovery | RU | 13794 | 49370 | 3.6 | 3.9 | 6.4 x 6.1 | 3.0 | 24 | 84 | 3 | 2 | 49.9 | 2.2 |
| | *Nice-looking blue-green, high-domed cabbage, outer leaves wide to stalk hold water, huge core for head size.* | | | | | | | | | | | | |
| Blue Bayou | TI | 11616 | 56510 | 4.9 | 3.6 | 6.2 x 7.7 | 3.0 | 20 | 84 | 1-2 | 2 | 68.1 | 2.9 |
| | *Looks nice but tip burn in last rep. Some sunburn on wrapper leaves, leaves wide at base hold water, open space near base of core.* | | | | | | | | | | | | |
| Head Start | TI | 12826 | 50340 | 3.9 | 4.0 | 7.2 x 6.3 | 2.0 | 18 | 83 | 3 | 2 | 54.9 | 1.6 |
| | *Sunburn on wrapper leaves, tip burn in heads, large core, wide frame leaves hold water, some head split on last harvested.* | | | | | | | | | | | | |
| Pacifica | RU | 12826 | 37450 | 2.9 | 3.3 | 5.9 x 5.7 | 3.2 | 20 | 78 | 2 | 2 | 40.8 | 1.6 |
| | *Green plants and heads, too small for commercial use but a cute home garden cultivar. Some leaf sunburn on exposed heads. Heads split when mature, leaves broad at base hold water.* | | | | | | | | | | | | |
| Augusta | TI | 13310 | 61350 | 4.6 | 4.3 | 6.4 x 7.6 | 2.7 | 21 | 80 | 1-2 | 2 | 65.0 | 2.5 |
| | *Slight sunburn on heads, tip burn in heads, huge core, wide leaves hold water at base of plant.* | | | | | | | | | | | | |
| CB2 | TI | 12826 | 37750 | 3.0 | 3.7 | 6.1 x 5.6 | 3.2 | 24 | 74 | 2 | 2 | 42.1 | 1.5 |
| | *Sunburn on heads, wide outer leaves hold water at base, large core (especially for small heads).* | | | | | | | | | | | | |
| Bejo 1772 | BZ | 13794 | 73270 | 5.4 | 3.8 | 7.4 x 8.1 | 2.9 | 20 | 88 | 1-2 | 1 | 74.6 | 3.4 |
| | *Tip burn, most outer leaves wide at base, air space at base of leaves and core, turns brown quickly when cut, big core.* | | | | | | | | | | | | |
| Supreme Vantage | TI | 14036 | 59650 | 4.3 | 3.8 | 7.0 x 6.9 | 3.3 | 22 | 91 | 2 | 2 | 60.0 | 2.0 |
| | *Tip burn in every rep., leaves wide at base hold water, some rot on a few heads as a result.* | | | | | | | | | | | | |
| LSD (P = 0.5) | | | 5156 | 1.2 | | | | 2.8 | | | | | |

[a] Rated 1-5 with 1= very loose; 5= very hard; also measured with penetrometer: PSI = lbs/square in.
[b] Head shape: 1. Flat, 2. Round, 3. High round
[c] Internal Color: 1. White, 2. Whitish green, 3. Yellowish green, 4. Yellow
[d] Plant size: 1. Small, 2. Medium 3. Large

# Spring Fresh-market/Slaw Cabbage Cultivar Evaluations in Central Kentucky

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*Chuck Owen and Lee Ann Hayes*
Bud's Produce, Elizabethtown

## Introduction

Cabbage was evaluated at the University of Kentucky South Farm in Lexington, Kentucky. This study was initiated to select cultivars that mature 7 to 14 days earlier than the industry standard cultivar, 'Bravo'.

## Materials and Methods

Twenty-six cabbage cultivars were planted on February 6 in the greenhouse. Transplants were set on May 14 in a randomized block design with 4 replications. Plots were 15 ft long, and plants were set in double rows with plants spaced 12 in. in the row, with 15 in. between rows on 4 ft centers. There were 30 plants per plot. A 20-20-20 starter solution was used at transplanting. Preplant fertilizer consisted of 140 lb of actual N, P, and K per acre as 19-19-19. Plants were side dressed on June 20 with 100 lb actual N as ammonium nitrate. Command 4EC at 1 pt/acre and Treflan 5E at 2 pt/acre were applied 2 weeks before planting for weed control. Pounce was used for insect control, while Bravo and Kocide were used for disease control. Ten feet of row were harvested in each plot on July 17, 21, and 29. Following harvest, 5 heads of each cultivar were taken to Bud's Produce in Elizabethtown and evaluated for slaw acceptability and shelf life by Lee Ann Hayes and Chuck Owen.

**Table 1. Yield and head characteristics of fresh-market/slaw cabbage, Lexington, KY, 1998.**

| Cultivar | Seed source | Days to harvest | Total yield (lb/acre) | Head (no/acre) | Avg. head wt (lb) | Core length[2] (in) | Head size[2] L x W (in) | Head firmness penetr.[3] (PSI) | Shape[4] (1-3) |
|---|---|---|---|---|---|---|---|---|---|
| Morris | BZ | 65-70 | 82,791 a[1] | 21,508 | 3.8 | 3.5 | 21 x 20 | 19 | 2 |
| Fresco | BZ | 69-70 | 70,104 ab | 18,785 | 3.7 | 3.5 | 21 x 21 | 17 | 2 |
| Cheers | TI | 70-77 | 69,968 ab | 20,691 | 3.4 | 3.3 | 19 x 20 | 18 | 2 |
| Bejo 1772 | BZ | 77 | 68,607 ab | 17,969 | 3.8 | 3.1 | 20 x 21 | 15 | 1,2 |
| Supreme Vantage | TI | 65-70 | 66,102 bc | 20,147 | 3.3 | 3.1 | 19 x 19 | 20 | 1,2,3 |
| Blue Vantage | AC | 69-70 | 64,523 bcd | 21,780 | 3.0 | 3.7 | 19 x 20 | 19 | 2 |
| Augusta | TI | 69-77 | 66,209 bcde | 21,508 | 2.9 | 3.0 | 18 x 19 | 20 | 2 |
| Atlantis | TI | 69-70 | 60,793 bcde | 22,052 | 2.8 | 3.2 | 20 x 18 | 19 | 2 |
| Blue Gem | H | 69-70 | 60,113 bcde | 20,691 | 2.0 | 3.0 | 18 x 19 | 17 | 1,2 |
| Heads Up | TI | 65-69 | 59,922 bcde | 19,874 | 3.0 | 3.4 | 20 x 19 | 21 | 2,3 |
| Bravo | H | 77 | 59,487 bcde | 19,330 | 3.1 | 3.5 | 19 x 21 | 17 | 1,2 |
| Blue Bayou | TI | 65-70 | 58,888 bcdef | 19,602 | 3.0 | 3.6 | 18 x 19 | 19 | 1,2 |
| Bronco | BZ | 69-70 | 58,806 bcdef | 19,874 | 2.9 | 3.3 | 20 x 18 | 22 | 3 |
| Head Start | TI | 65 | 58,234 bcdef | 20,691 | 2.8 | 3.4 | 20 x 18 | 23 | 2 |
| Green Cup | TI | 69-70 | 56,628 bcdef | 20,491 | 2.8 | 2.8 | 17 x 19 | 20 | 1 |
| Pacifica | RU | 65 | 53,415 cdefg | 16,880 | 3.2 | 3.1 | 19 x 18 | 18 | 2,3 |
| Ramada | BZ | 69-77 | 52,953 cdefg | 21,508 | 2.5 | 2.4 | 17 x 17 | 24 | 2 |
| Sure Vantage | RU | 69-70 | 52,817 cdefg | 19,874 | 2.6 | 3.7 | 19 x 18 | 22 | 2,3 |
| Fieldsport | BZ | 69 | 50,230 defg | 21,508 | 2.4 | 2.7 | 18 x 17 | 23 | 2 |
| Gideon | BZ | 70 | 40,052 efg | 19,602 | 2.5 | 2.6 | 19 x 17 | 20 | 3 |
| Charmant | LI | 65-70 | 47,644 efg | 20,691 | 2.3 | 3.1 | 17 x 17 | 23 | 2 |
| Royal Vantage | RU | 65-70 | 44,295 fg | 19,058 | 2.3 | 2.7 | 18 x 18 | 21 | 2 |
| Fast Vantage | TI | 65 | 44,268 fg | 11,979 | 3.7 | 3.1 | 20 x 18 | 17 | 2 |
| CB2 | TI | 65-70 | 43,968 fg | 19,330 | 2.3 | 2.9 | 18 x 16 | 23 | 3 |
| Blue Pak | TI | 69-70 | 43,832 fg | 19,330 | 2.3 | 2.7 | 18 x 16 | 26 | 2 |
| Super Red 80 | LI | 69-70 | 38,578 g | 22,052 | 1.7 | 3.5 | 18 x 15 | 24 | 3 |

[1]Yields followed by the same letter are not significantly different, Waller-Duncan (5%).
[2]Based on 12 heads.
[3]Head firmness using a fruit pressure tester, 5/16 in. diameter head, avg. of 12 heads.
[4]Head shape 1=flat, 2=round, 3=high round.

## Results and Discussion

The season was initially very wet, and irrigation was not needed. The top earliest-producing fresh-market cultivars were 'Blue Vantage', 'Atlantis', 'Blue Bayou', 'Bronco', and 'Gideon'. 'Blue Bayou' was 7 to 12 days earlier than 'Bravo', while the others were 7 to 8 days earlier. The top later-maturing cultivars were 'Augusta' and 'Ramada'. All of these cultivars looked very nice and were firmer and more attractive than 'Bravo'. All had whitish-green interiors. 'Super Red 80' was the only red cultivar, and it also produced very nice heads; however, the internal color was not quite as dark as the industry would like. 'Blue Vantage' was the only cultivar that had 18 days of shelf life that slaw processors would like.

Several cultivars appeared to be more sensitive to clomozone (Command) injury than others. The top cultivars, 'Augusta', 'Blue Bayou', 'Bronco', 'Gideon', and 'Super Red 80' all showed some injury. Although very high tonnages per acre were obtained using double rows, head sizes tended to be on the small side for some cultivars.

**Table 2. Herbicide injury, head defects, and fresh-market potential of fresh-market/slaw cabbage, Lexington, KY, 1998.**

| Cultivar | Command injury rating[1] (1-5) | Soft or failed to head (%) | Rotten heads (%) | Split heads (%) | Fresh market potential[2] (1-5) | Wt/crate 16 heads (lb) |
|---|---|---|---|---|---|---|
| Morris | 1.4 | 0 | 3.7 | 0 | — | 61 |
| Fresco | 1.1 | 4.0 | 2.7 | 0 | 3.8 | 59 |
| Cheers | 2.5 | 0 | 1.3 | 0 | 2.5 | 54 |
| Bejo 1772 | 1.0 | 1.5 | 1.5 | 0 | 3.3 | 61 |
| Supreme Vantage | 1.0 | 1.3 | 0 | 1.3 | 3.5 | 53 |
| Blue Vantage | 1.4 | 4.8 | 0 | 0 | 1.5 | 48 |
| Augusta | 3.1 | 0 | 0 | 0 | 1.8 | 46 |
| Atlantis | 1.1 | 2.4 | 1.2 | 0 | 3.0 | 45 |
| Blue Gem | 3.8 | 0 | 2.5 | 1.3 | 2.5 | 32 |
| Heads Up | 1.5 | 1.3 | 2.5 | 5.0 | — | 48 |
| Bravo | 3.5 | 1.4 | 2.7 | 0 | 3.3 | 50 |
| Blue Bayou | 2.8 | 5.1 | 2.6 | 0 | 3.0 | 48 |
| Bronco | 1.6 | 1.3 | 1.3 | 0 | 1.5 | 47 |
| Head Start | 2.0 | 0 | 0 | 1.3 | — | 45 |
| Green Cup | 1.4 | 3.8 | 1.3 | 0 | 2.3 | 45 |
| Pacifica | 1.8 | 0 | 11.4 | 10.0 | — | 51 |
| Ramada | 1.0 | 3.6 | 1.2 | 0 | 2.3 | 40 |
| Sure Vantage | 1.3 | 1.3 | 1.3 | 0 | 2.5 | 40 |
| Fieldsport | 1.1 | 0 | 2.0 | 0 | 1.5 | 38 |
| Gideon | 1.5 | 5.2 | 0 | 0 | 2.5 | 40 |
| Charmant | 1.0 | 0 | 4.9 | 1.2 | 2.0 | 37 |
| Royal Vantage | 1.5 | 6.6 | 0 | 1.3 | 4.0 | 37 |
| Fast Vantage | 1.6 | 0 | 24.6 | 11.6 | — | 59 |
| CB2 | 1.1 | 1.3 | 5.2 | 1.3 | 2.0 | 37 |
| Blue Pak | 1.3 | 5.3 | 0 | 0 | 2.5 | 36 |
| Super Red 80 | 3.0 | 0 | 0 | 0 | 3.0 | 27 |

[1]Command injury: 1=none, 5=severe.
[2]Fresh-market potential: 1=excellent, 5=poor.

**Table 3. Processing quality for fresh-market/slaw cabbage and comments, Lexington, KY, 1998.**

| Cultivar | Quality 7/24[1] | Firmness 7/24 | Processed Quality 6 days[2] | 11 days[2] | 18 days[2] | Comments |
|---|---|---|---|---|---|---|
| Morris | G | G | G | G | | Very uniform & attractive, mild, sweet, several with internal physiological browning at leaf bases, probably B deficiency, adequate leaf cover |
| Fresco | G | B | B | D | | Uniform & attractive, crisp, tender, juicy, mild, core a little dark colored, some stem browning |
| Cheers | — | — | — | — | | Uniform in size, attractive, some loose heads, crisp, dry, mild to spicy, good leaf cover |
| Bejo 1772 | — | — | — | — | | Variable size, attractive, mild, tender, juicy, good leaf cover |
| Supreme Vantage | B | B | G | D | | Some variability in size, attractive, mild, sweet, tender, crisp, some black spots in head |
| Blue Vantage | G | G | G | G | G | Very uniform, attractive, tender, crunchy, juicy, spicy, loose inside, good leaf cover |
| Augusta | G | B | G | D | | Heads asymmetrical, attractive, crunchy, mild to strong, dry, good wrapper leaves, core slightly yellow |
| Atlantis | G | G | G | D | | Very uniform, attractive, crunchy, sweet, mild, tender, good leaf cover |
| Blue Gem | G | B | G | G | | Varied size & head shape, attractive, tender, crunchy, spicy, juicy, some tip burn, good wrapper leaves |
| Heads Up | B | G | G | | | Fairly uniform, attractive, juicy, tender, very mild taste |
| Bravo | — | — | — | — | | Variable in size, attractive, crisp, dry, mild, tender, some loose heads, good leaf cover |
| Blue Bayou | G | E | G | D | | Very uniform & attractive, very tender, crunchy, mild taste |
| Bronco | G | G | G | B | | Uniform, attractive, mild, juicy to dry, crunchy, good leaf cover |
| Head Start | B | G | D | | | Variable in size, fairly attractive, mild, sweet, tender, moderate to severe sunburn |
| Green Cup | G | B | G | | | Uniform in size, slightly asymmetrical, attractive, short core, crunchy, mild, dry, good leaf cover |
| Pacifica | — | — | — | — | | Some variability in size, very attractive, tender, tasty, sweet, splitting problem |
| Ramada | G | G | G | G | | Attractive, variable in size, mild, crunchy & sweet to spicy, very dense interior, good leaf cover |
| Sure Vantage | B | B | G | G | | Variable in size, asymmetrical, dry, tough, crunchy, mild to spicy, good leaf cover |
| Fieldsport | B | G | M | M | | Fairly uniform heads, mild, juicy, sweet, some leaf splitting & spotting, good leaf cover |
| Gideon | G | B | G | G | | Variable size, attractive, tender, crisp, mild, juicy, compact heads, good leaf cover |
| Charmant | G | G | D | | | Very uniform & attractive, mild, tender, sweet, dry |
| Royal Vantage | B | B | G | D | | Variable in size, attractive, crunchy, slightly tough, dry, mild, dense heads, good leaf cover |
| Fast Vantage | B | G | G | G | | Uniform size, not as attractive, tender, sweet, good, some with B deficiency, severe head splitting & severe soft rot losses |
| CB2 | B | G | B | D | | Very variable in size, crisp, mild, dry |
| Blue Pak | G | G | G | D | | Variable in size, attractive, mild, crisp, juicy, tender, good wrapper leaves |
| Super Red 80 | G | G | G | D | | Uniform, attractive, very crisp, juicy, mild, slightly sweet, dense heads, good leaf cover, light purple interior |

[1]Quality and cabbage firmness at start of test, 3 days after harvest; E=excellent, G=good, B=bad. Quality based on visual defects. Dashed spaces are where data was lost.

[2]Processed quality of slaw after storage at 50° F for 6, 11, and 18 days. E=excellent; G=good, still edible; M=marginal; B=bad; D=dump, product severely decayed.

# Cabbage Insect Control with a New Insecticide

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## Introduction

Imported cabbageworm, cabbage looper, and diamondback moth larvae can be early-season pests of cabbage. These pests can cause serious damage to young transplants as well as causing serious leaf-feeding damage to older plants. Damage to the head or wrapper leaves often reduces marketability. Because many of these pests are much more difficult to control as large larvae, controls will always be most effective when directed toward small larvae. Therefore, early detection of economic infestations is critical to the management of these pests.

Watch for cabbage loopers particularly on the undersides of leaves along leaf margins— but they can be found anywhere on the plant. The larvae are light green, with a pale white stripe along each side. There are three pairs of slender legs near the head and two pairs of club-shaped prolegs toward the other end. Because the larvae have no legs in the middle area of their body, this area arches when the insect moves. All larval stages of the insect move with this looping motion. Large larvae will often curl up and drop down to the base of the plant when the leaf is disturbed. As they grow, they move toward the center of the plant. They generally feed on areas between leaf veins. When scouting, examine the undersides of the lower leaves for newly hatched larvae. Pull back loose wrapper leaves and examine around the base of the head for larger larvae. Evidence of frass at the base of the head aids in the detection of larvae. Because larger loopers are more difficult to control, it is important to time applications for younger larvae.

Diamondback moth larvae, despite their small size, can be very destructive to cole crops. Larvae are small, yellowish-green, spindle shaped, and have a forked tail. When mature, larvae are 5/16 in. in length. Larvae feed on all plant parts but prefer to feed around the bud of young plants. Larvae often drop from the plant on silk threads as soon as the leaf is disturbed. Monitoring should begin when the plants are young. During cupping, larvae that feed on heart leaves are difficult to find unless the outer leaves are pulled back. Heart leaves of preheading plants should be examined if feeding damage is present. Their feeding on the bud may cause malformation of the cabbage head.

Imported cabbageworm larvae are velvety green, with a narrow, light yellow stripe down the middle of the back, and have four pairs of prolegs in addition to the three pairs of legs toward the head. When mature the larvae reach 1 1/4 in. in length. The adult is a white butterfly about 1 3/4 in. long tinged with yellow on the undersides of the wings and black spots on the front wings. Imported cabbageworms cause similar damage to loopers but feed closer to the center of the plant. Large larvae can be particularly damaging to young plants and can cause significant yield reductions. Scouting should begin as soon as the white butterflies are seen flying about during the day.

## Materials and Methods

Three insecticides were evaluated for control of diamondback moth, cabbage looper, and imported cabbageworm larvae. The study was located at the University of Kentucky Spindletop Research Farm in Lexington. The test was arranged as a randomized block design with 4 replicates. Individual plots consisted of a single row, 25 ft. long, with 6 ft between rows. Cabbage plants were transplanted on May 19. All insecticide treatments were applied with a $CO_2$ backpack sprayer using 40 psi and 30 gallons finished spray per acre using three TX12 hollow cone nozzles. Insecticides were applied on June 20 and July 1, when larval infestations exceeded 30% of plants infested. On June 19, 23, and 29, and July 5 and 9, the number of larvae were recorded from each of 5 plants per plot.

## Results and Discussion

Cool, wet late-spring and early-summer conditions delayed the onset of diamondback moth and imported cabbageworm infestations. All treatments provided significant control of imported cabbageworm for all dates. All treatments provided significant control of diamondback moth larvae for all treatment dates except for the low rate of Spintor on July 29. All treatments provided significant control of cabbage looper on July 5 and 9.

| | | Imported cabbageworm larvae per 5 plants | | | | |
|---|---|---|---|---|---|---|
| Treatment | Rate/acre | 19 Jun[1] | 23 Jun | 29 Jun | 5 Jul | 9 Jul |
| SpinTor 2SC | 3 fl. oz. | 13.3 a | 0.0 b | 0.3 b | 0.0 b | 0.0 b |
| SpinTor 2SC | 6 fl. oz. | 10.3 a | 0.0 b | 0.0 b | 0.0 b | 0.0 b |
| Warrior 1 EC | 1.96 fl. oz. | 8.0 a | 0.0 b | 0.0 b | 0.0 b | 0.3 b |
| Control | | 8.7 a | 6.0 a | 3.0 a | 4.3 a | 5.7 a |

[1]Means within the same column followed by the same letter are not significantly different (LSD p>0.05).

| | | Diamondback moth larvae per 5 plants | | | | |
|---|---|---|---|---|---|---|
| Treatment | Rate/acre | 19 Jun[1] | 23 Jun | 29 Jun | 5 Jul | 9 Jul |
| SpinTor 2SC | 3 fl. oz. | 0.0 b | 0.0 a | 1.0 ab | 0.3 b | 0.0 b |
| SpinTor 2SC | 6 fl. oz. | 3.3 a | 0.0 b | 0.0 b | 0.0 b | 0.0 b |
| Warrior 1 EC | 1.96 fl. oz. | 6.7 a | 0.0 b | 0.0 b | 0.7 b | 0.0 b |
| Control | | 4.0 a | 5.0 a | 2.0 a | 6.3 a | 5.7 a |

[1] Means within the same column followed by the same letter are not significantly different (LSD p>0.05).

| | | Cabbage looper larvae per 5 plants | | | | |
|---|---|---|---|---|---|---|
| Treatment | Rate/acre | 19 Jun[1] | 23 Jun | 29 Jun | 5 Jul | 9 Jul |
| SpinTor 2SC | 3 fl. oz. | 0.0 a | 0.7 a | 3.0 a | 0.3 b | 0.7 b |
| SpinTor 2SC | 6 fl. oz. | 0.0 a | 0.0 a | 1.3 a | 0.0 b | 0.3 b |
| Warrior 1 EC | 1.96 fl. oz. | 0.0 a | 0.0 a | 1.3 a | 0.3 b | 0.7 b |
| Control | | 0.0 a | 1.3 a | 7.3 a | 4.7 a | 4.0 a |

[1] Means within the same column followed by the same letter are not significantly different (LSD p>0.05).

# Sugar Enhanced, Everlasting Heritage (E.H.), Sweet Breed, and Sweet Gene Corn Evaluations in Central Kentucky

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Sweet corn cultivars were evaluated at the University of Kentucky South Farm in Lexington.

## Materials and Methods

Twenty-eight sugar enhanced (se), 1 sweet gene, and 2 E.H. varieties were planted by hand on June 27, 1998. Plots consisted of a 20-ft long row of each cultivar replicated four times. Rows were spaced 3.5 ft apart, and 100 seeds were planted in each 20-ft row. Plants were thinned to a distance of 8 in. apart following emergence. Prior to planting, 138 lb of actual N, P, and K were applied as 19-19-19 and tilled in. Plants were side dressed with 20 lb of actual N as ammonium nitrate. Three quarts of Lasso 4E and 2 lb of Bladex 90 DF per acre were applied preemergence, and 1 qt of Atrazine 4L was applied on July 2 for weed control. Warrior and Sevin were used for insect control.

## Results and Discussion

The season was initially very wet and then turned very dry. The plot was not irrigated, so some butt end blanking was noted, and obtaining good tip fill was more difficult, particularly on later-maturing varieties. Cultivars that were the better performers in this trial should perform well under hot, dry conditions. Seneca Sensation, Divinity, Silver Princess, Immaculata, Sweet Ice, and Argent were the better-performing white varieties. Kandy Plus, Sugar Ace, Tuxedo, GH-4881, and Legend were the best-performing yellow varieties. Sugar Ace, a sweet gene variety, had the best husk coverage and tip fill in the trial. GH-4881 was rated as being the best-tasting variety. Jackpot was the best of the two bicolor varieties, although this trial was initially designed to evaluate just yellow and white varieties. Ruby Queen is a new orange se variety

**Table 1. Plant characteristics and yield of sugar-enhanced, E.H., sweet breed, and sweet gene corn cultivars, Lexington, 1998.**

| Cultivar | Seed source | Days to maturity | Plant stand[1] (%) | Seedling vigor[2] (1-5) | Seedling uniformity[3] (1-5) | Height to first harvested ear (in.) | Ease of ear harvest[4] (1-5) | Yield (dozen ears per acre) |
|---|---|---|---|---|---|---|---|---|
| Seneca Sensation | SW | 73 | 90 | 4 | 3.8 | 19 | 3.5 | 1737 |
| Divinity | ST | 78 | 84 | 3.8 | 3.5 | 16 | 3.1 | 1737 |
| Silver Princess | RG, ST, SW | 75 | 79 | 4 | 3.3 | 18 | 3.3 | 1698 |
| Immaculata | ST, SW | 78 | 86 | 4.5 | 4.0 | 16 | 3.3 | 1608 |
| Kandy King E.H. | RG | 73 | 87 | 2.8 | 3.0 | 15 | 2.9 | 1608 |
| Kandy Plus | RG | 79 | 80 | 2.3 | 2.3 | 22 | 2.8 | 1582 |
| Sugar Ace (sweet gene) | H | 79 | 84 | 4.0 | 3.5 | 20 | 2.6 | 1530 |
| Tuxedo | SW | 78 | 86 | 3.8 | 2.5 | 16 | 3.4 | 1530 |
| Sweet Ice (sweet breed) | H | 74 | 74 | 4.0 | 3.0 | 18 | 3.5 | 1517 |
| WHT-2972 | RG | 67 | 91 | 4.8 | 4.5 | 15 | 3.4 | 1452 |
| Seneca Daybreak | N | 64 | 76 | 3.8 | 2.8 | 15 | 3.5 | 1426 |
| Kandy Korn E.H. | BU, SW, TR | 89 | 84 | 3.8 | 3.0 | 26 | 3.6 | 1413 |
| Brilliance | H | 79 | 88 | 3.5 | 2.8 | 18 | 3.4 | 1387 |
| GH-4881 | RG | 79 | 73 | 2.8 | 3.0 | 21 | 2.1 | 1361 |
| Incredible | SW | 85 | 72 | 2.8 | 2.0 | 22 | 3.8 | 1335 |
| Legend | H | 73 | 73 | 3.5 | 2.8 | 14 | 3.6 | 1322 |
| Miracle | TR, N | 84 | 70 | 2.5 | 2.3 | 16 | 4.0 | 1296 |
| Argent | ST, SW | 83 | 73 | 3.5 | 2.8 | 21 | 3.4 | 1296 |
| King Arthur's | ST | 66-73 | 85 | 3.5 | 3.0 | 18 | 3.9 | 1258 |
| Silver King | H, RG, ST, SW | 82 | 68 | 2.8 | 2.0 | 24 | 3.6 | 1245 |
| Jackpot | RG | 82 | 82 | 3.0 | 2.8 | 20 | 2.4 | 1245 |
| Sugar Snow II | PA, ST | 66-74 | 85 | 3.8 | 3.3 | 12 | 3.4 | 1219 |
| BC-4885 | RG | 82 | 78 | 2.8 | 2.8 | 20 | 3.3 | 1193 |
| Silver Choice | BU, SW | 75 | 80 | 3.0 | 2.3 | 18 | 3.9 | 1128 |
| Spring Treat | SW | 68 | 75 | 2.8 | 2.0 | 12 | 3.8 | 1076 |
| Star Dust | PA | 70 | 53 | 2.8 | 2.0 | 14 | 3.6 | 1037 |
| Sweet N' Slim | BU | 74 | 61 | 2.0 | 2.0 | 18 | 3.3 | 998 |
| Spring Snow | H | 66 | 75 | 3.0 | 2.5 | 14 | 4.0 | 920 |
| Early Choice | BU, SW | 65 | 84 | 3.8 | 3.0 | 13 | 3.5 | 869 |
| Seneca Starshine | TR | 75-85 | 33 | 1.3 | 1.5 | 14 | 3.4 | 700 |
| Ruby Queen | BU | 75 | 12 | 1.5 | 1.5 | 16 | 4.2 | 480 |

[1] Plant stand is percent emergence based on planting 100 seeds.
[2] Seedling vigor: 1 = poor, 5 = excellent.
[3] Seedling uniformity: 1 = poor, 5 = excellent.
[4] Ease of harvest: 1 = hard, 5 = easy.

that was released this year. There were not enough seed to give this a fair test for yield; however, it did not color up as expected, and there was quite a bit of variation in color intensity from ear to ear.

**Table 2. Ear characteristics of sugar-enhanced, E.H., sweet breed, and sweet gene corn, Lexington, 1998**.

| Cultivar | Husk coverage[1] (1-10) | Ear length (in) | Ear width (in) | Tip fill[2] (1-10) | Row straightness[3] (1-10) |
|---|---|---|---|---|---|
| Seneca Sensation | 9 | 7.1 | 1.8 | 2.8 | 5.3 |
| Divinity | 9.5 | 7.4 | 1.7 | 7 | 7.3 |
| Silver Princess | 8 | 7.4 | 1.9 | 6.5 | 7.3 |
| Immaculata | 9.8 | 7.1 | 1.8 | 8 | 7.0 |
| Kandy King E.H. | 5.3 | 7.4 | 1.8 | 3 | 6.0 |
| Kandy Plus | 7.5 | 8.2 | 1.9 | 5 | 6.0 |
| Sugar Ace (sweet gene) | 10.0 | 7.6 | 1.7 | 9.5 | 8.0 |
| Tuxedo | 7.0 | 7.9 | 1.7 | 7.0 | 8.0 |
| Sweet Ice (sweet breed) | 9.0 | 7.5 | 7.5 | 8.5 | 6.7 |
| WHT - 2972 | 0 | 6.7 | 1.9 | 5.7 | 5.3 |
| Seneca Daybreak | 0 | 7.3 | 1.9 | 3.0 | 8.0 |
| Kandy Korn E.H. | 2.3 | 8.3 | 1.7 | 0 | 7.0 |
| Brilliance | 4.5 | 8.3 | 1.8 | 5.8 | 6.8 |
| GH-4881 | 8.3 | 8.0 | 1.8 | 3.0 | 6.0 |
| Incredible | 5.3 | 7.8 | 1.9 | 4.0 | 6.0 |
| Legend | 8.3 | 7.0 | 1.8 | 8.0 | 5.5 |
| Miracle | 4.5 | 8.1 | 1.8 | 3.0 | 8.0 |
| Argent | 9.5 | 7.8 | 1.7 | 3.0 | 7.5 |
| King Arthur’s | 2.5 | 6.9 | 1.9 | 3.0 | 5.0 |
| Silver King | 4.0 | 7.7 | 1.8 | 4.8 | 5.5 |
| Jackpot | 8.0 | 8.0 | 1.8 | 2.8 | 6.3 |
| Sugar Snow II | 4.3 | 6.6 | 1.8 | 2.5 | 5.3 |
| BC-4885 | 8.3 | 7.9 | 1.8 | 3.3 | 6.3 |
| Silver Choice | 6.3 | 7.5 | 1.7 | 6.8 | 6.0 |
| Spring Treat | 2.8 | 6.9 | 1.8 | 5.0 | 6.0 |
| Star Dust | 5.0 | 6.9 | 1.8 | 8.0 | 3.7 |
| Sweet N’ Slim | 8.5 | 7.2 | 1.4 | 9.0 | 6.0 |
| Spring Snow | 3.3 | 6.3 | 1.7 | 3.0 | 5.0 |
| Early Choice | 1.3 | 6.7 | 1.7 | 4.0 | 5.0 |
| Seneca Starshine | 6.5 | 6.5 | 1.7 | 6.3 | 7.5 |
| Ruby Queen | 5.8 | 6.4 | 1.7 | 6.3 | 4.5 |

[1]Number of ears out of 10 that had tight husk coverage over the ear tip.
[2]Number of ears out of 10 that had good tip fill.
[3]Number of ears out of 10 that had straight rows of kernels.

**Table 3. Ear quality characteristics of sugar-enhanced, E.H., sweet breed, and sweet gene corn cultivars, Lexington, 1998.**

| | Cooked Corn | | | | |
|---|---|---|---|---|---|
| **Cultivar** | **Pericarp tenderness[1] (1-4)** | **Kernel tenderness[2] (1-4)** | **Sweetness[3] (1-4)** | **Kernel color[4]** | **Comments** |
| Seneca Sensation | 2.5 | 3.0 | 3.5 | W | Very attractive ear |
| Divinity | 3.5 | 3.5 | 3.5 | W | Attractive ear, excellent husk coverage, long flags, some butt end blanking |
| Silver Princess | 2.5 | 3.0 | 3.0 | W | Attractive husk & ear, ear snaps easily from husk, some bird damage |
| Immaculata | 3.5 | 3.5 | 3.0 | W | Attractive ear, excellent husk coverage, long flags, shuck snaps off easily, slight smut |
| Kandy King E.H. | 3.5 | 3.5 | 3.5 | Y | Attractive ear, shuck snaps off easily, some butt end blanking, some bird damage |
| Kandy Plus | 4.0 | 3.5 | 3.5 | Y | Attractive husk & ear, butt end blanking |
| Sugar Ace (sweet gene) | 3.0 | 3.5 | 3.5 | Y | Attractive husk, very tight husk coverage, some butt end blanking |
| Tuxedo | 3.0 | 4.0 | 3.0 | Y | Attractive husk & ear, some butt end blanking, bird & raccoon damage |
| Sweet Ice (sweet breed) | 2.0 | 3.0 | 3.0 | W | Very attractive husk & ear, long flags, some butt end blanking |
| WHT - 2972 | — | — | — | W | Severe bird & raccoon damage |
| Seneca Daybreak | 2.5 | 2.0 | 2.5 | Y | Severe bird & raccoon damage |
| Kandy Korn E.H. | 4.0 | 3.5 | 2.5 | Y | Burgundy-colored husk, attractive ear, some butt end blanking |
| Brilliance | 3.5 | 3.0 | 2.5 | W | Very attractive husk & ear, long flags, some butt end blanking |
| GH-4881 | 4.0 | 4.0 | 4.0 | Y | Very attractive ear |
| Incredible | 4.0 | 3.5 | 3.0 | Y | Attractive ear & dark green husk, short flags, some butt end blanking |
| Legend | 2.5 | 3.0 | 3.0 | Y | Attractive husk & ear, some ears w/tassels, slight bird damage |
| Miracle | 4.0 | 3.5 | 3.0 | Y | Attractive husk & ear |
| Argent | 3.5 | 3.5 | 3.5 | W | Attractive husk & ear, long flags |
| King Arthur's | 3.5 | 4.0 | 3.5 | Y | Deep, tender kernels; bird & raccoon damage |
| Silver King | 3.5 | 3.0 | 3.0 | W | Very attractive ear, some butt end blanking |
| Jackpot | 4.0 | 3.5 | 3.5 | BC | Attractive husk & ear, short flags, butt end blanking |
| Sugar Snow II | 3.0 | 3.5 | 3.5 | W | Severe bird & raccoon damage |
| BC-4885 | 3.0 | 3.5 | 3.0 | BC | Attractive ear, small kernels |
| Silver Choice | 3.5 | 3.5 | 3.5 | W | Attractive ear |
| Spring Treat | 3.0 | 3.0 | 2.5 | Y | Severe bird & raccoon damage |
| Star Dust | — | — | — | W | Severe bird & raccoon damage |
| Sweet N' Slim | 3.0 | 3.0 | 3.0 | Y | Attractive long, slim husk & ear; 12 rows of kernels |
| Spring Snow | 3.0 | 3.5 | 3.0 | W | Attractive ear, dark green husk, severe bird & raccoon damage |
| Early Choice | 3.5 | 3.0 | 2.5 | Y | Severe bird & raccoon damage |
| Seneca Starshine | 3.0 | 3.0 | 2.5 | W | Severe bird & raccoon damage |
| Ruby Queen | 3.5 | 3.0 | 3.0 | O | Orange color did not develop well |

[1] 1 = tough, 4 = tender.
[2] 1 = crisp, 4 = creamy and tender.
[3] 1 = starchy, 4 = very sweet, ratings are based on one ear.
[4] Y = yellow, W = white, BC = bicolor, O = orange.

# Sweet Corn Insect Control

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## Introduction

Consumer demand for damage-free sweet corn means that growers must develop the best possible management program for insect pests, especially those that attack the ear. European corn borer populations fluctuate from year to year and can be more severe in some fields than others. There are two generations of this insect each year. The first generation occurs from early June to early July and is most damaging to early-planted corn. The second generation in August and September is a greater threat to sweet corn. Borers of this generation attack the ears and ear shanks.

| | Application[1] | | Percentage of damaged ears[2] | | | |
|---|---|---|---|---|---|---|
| **Treatment** | **Rate / acre** | **Dates** | **ECB** | **CEW** | **FAW** | **Clean** |
| Control | — | — | 47.3 a | 13.3 a | 14.0 a | 34.7 b |
| Baythroid 2 EC | 2.0 fl oz | 1,2,3,4 | 3.6 b | 2.1 b | 3.7 b | 90.6 a |
| Baythroid 2 EC | 2.5 fl oz | 1,2,3,4 | 0.7 b | 1.3 b | 4.7 b | 93.3 a |
| Baythroid 2 EC | 2.5 fl oz | 1,2 | 4.0 b | 3.3 b | 4.0 b | 88.7 a |
| Pounce 3.2 EC | 8 fl oz | 1,2,3,4 | 0.7 b | 0.7 b | 1.3 b | 97.3 a |
| Pounce 3.2 EC | 8 fl oz | 1,2 | 3.3 b | 2.7 b | 2.0 b | 92.0 a |
| Warrior 1 EC | 2.56 fl oz | 1,2,3,4 | 0.0 b | 0.0 b | 2.0 b | 97.3 a |
| Warrior 1 EC | 3.2 fl oz | 1,2,3,4 | 2.0 b | 1.3 b | 6.0 b | 90.7 a |
| Warrior 1 EC | 3.2 fl oz | 1,2 | 3.3 b | 3.3 b | 5.3 b | 88.0 a |
| Warrior T 1CS | 3.2 fl oz | 1,2,3,4 | 0.0 b | 2.0 b | 0.0 b | 97.3 a |

[1]Application dates: 25 Jul (1), 30 Jul (2), 4 Aug (3), and 11 Aug (4).
[2]Means in the same column followed by the same letter are not significantly different (LSD: $p < 0.05$).

The corn earworm is the most serious sweet corn pest because it feeds directly on the ear tips. Once worms have become established within the ear, control is impossible. Earworms are variable in color but have a brown head without markings and numerous microscopic spines covering their body. Earworms spend a relatively short period of their life feeding in a site that can receive an adequate insecticide application. A preventive program, especially on late-season corn, is necessary to ensure that damaged ears are at a minimum.

Infestations of fall armyworm are most likely to occur on corn that is knee to waist high in July. Late-planted sweet corn, especially in the southern tiers of counties, should be watched closely for fall armyworm activity. The larvae or worms feed on leaves and in the whorl. They will enter the ear and cause damage similar to that from the corn earworm.

## Materials and Methods

Nine insecticide treatments were evaluated for control of insects attacking sweet corn ears. The test plot was planted in a 4th-year corn field on the UK Spindletop Research Farm in Fayette County on June 22 as a randomized block design with 3 replicates. All plots received Bicep 6L at 2.4 quarts per acre and Roundup 3L at 2 pints/acre at planting. Individual plots consisted of four rows, 75 feet long with 36-inch row spacing. Insecticides were applied using a $CO_2$ backpack sprayer using 40 PSI and 23 gallons finished spray per acre. Insecticide applications were made on July 25 and 30 and August 4 and 11; however, some treatments were only applied on the first two application dates. Fifty ears per plot were examined for damage by European corn borer, corn earworm, and fall armyworm on August 19 and 20.

## Results and Discussion

All treatments significantly reduced the number of European corn borer- and corn earworm-damaged ears. In general, corn earworm levels were low at this point in the season, possibly due to cool early-summer temperatures. All treatments increased the number of clean ears relative to the control.

# Pumpkin Cultivar Trial

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## Introduction

As a fall crop, pumpkins allow Kentucky growers to extend their marketing season and take advantage of labor used to cut and house tobacco. Both wholesale and direct-market pumpkin acreage has increased dramatically during the past five years. ‘Howden’ has been the predominant cultivar grown for jack-o-lantern sales. However, problems with fruit set during high temperatures and *Fusarium* fruit rot have created a need for better cultivars. As a result, a pumpkin cultivar trial was conducted at the University of Kentucky’s Robinson Experiment Station in Quicksand, Kentucky. Seventeen cultivars, six of which were small or miniature pumpkins, were evaluated in 1998.

## Materials and Methods

Lime at the rate of 2 tons/acre was applied to the planting site in May and tilled in (Table 1). Seeds were planted directly in the field on June 17. Each cultivar was replicated three times in a randomized complete block design. Each replication consisted of a single row 30 ft long containing 12 plants (2/hill). Seeds were hand sown 5 ft apart in the row with 14 ft between rows.

Fifty lb/acre of N, P, and K (19-19-19) were applied as a side dressing 2 weeks after planting. A final side dressing of ammonium nitrate was applied at the rate of 100 lb actual N/ acre when the vines began to run (July 16). Thus, a total of 150 lb of actual N was applied during the growing season. Curbit EC at 4 pt/acre was applied after planting on 6/22/98. Four preventative sprays containing Thiodan or Pounce and Bravo or Bravo plus Benlate were applied during the growing season for disease and insect control as conditions warranted. Irrigation was applied once during the growing season. Growing conditions went from cool and excessively wet in the spring to hot and very dry in August.

**Table 1. Pumpkin Cultivar Soil Test, Quicksand, KY. (lb/acre).**

| pH | Buf-pH | P | K | Ca | Mg | Zn |
|---|---|---|---|---|---|---|
| 5.0 | 6.5 | 167 | 364 | 1752 | 75 | 5.2 |

## Results and Discussion

The two best-looking large jack-o-lantern pumpkins in the trial were ‘Pro Gold 510’ and ‘Gold Strike’. They produced good yields of 20-pound pumpkins that were blocky and dark orange in color with excellent stems (Table 2). ‘Appalachian’ also gave acceptable yields of large, attractive fruit, but it was not as attractive as ‘Pro Gold 510’ or ‘Gold Strike’. For the first time in several years at Quicksand, ‘Howden’, the industry standard, also did very well. Because of excessively wet weather in late May and early June, the intended planting time was delayed 10 to 14 days. Planting this late may have hurt the yield of ‘Gold Rush’, which is a 120-day pumpkin. It was very hot and dry by the time ‘Gold Rush’ began fruiting.

**Table 2. Yield and quality of standard size pumpkin cultivars, Quicksand, KY; data are means of three replications.**

| Cultivar | Seed Source | Number/ acre | Cwt./ acre | Avg Wt. (lb) | Shape[a] | Smoothness[b] | Ribbing[c] | Color[d] | Stem Quality[e] | Stem Color[f] |
|---|---|---|---|---|---|---|---|---|---|---|
| Gold Rush | RUP | 1,520 | 373 | 24.6 | 2 | 3.0 | 2.8 | MO | 3.5 | dg |
| | *Huge stem looked best on highest ground, not planted quite early enough due to wet weather.* | | | | | | | | | |
| Mother Lode | RUP | 1,867 | 354 | 19.0 | 2 | 3.5 | 3.2 | MO | 3 | dg |
| | *Fair appearance, a few green fruit, occasionally one rotted.* | | | | | | | | | |
| Gold Strike | RUP | 2,454 | 521 | 21.2 | 2 | 2.8 | 3.2 | DO | 3 | dg |
| | *Very nice large pumpkin! Attractive stem.* | | | | | | | | | |
| Howden | TV | 2,489 | 435 | 17.5 | 2 | 2.7 | 3.0 | DO | 3 | dg |
| | *Nice looking pumpkins.* | | | | | | | | | |
| Pro Gold 510 | RUP | 2,959 | 689 | 23.3 | 2 | 3.0 | 3.0 | DO | 3 | dg |
| | *Very nice looking pumpkins.* | | | | | | | | | |
| Tallman | ST | 1763 | 307 | 17.4 | 2 | 2.7 | 2.5 | MO | 3 | dg |
| | *Variable fruit size, not as attractive as some.* | | | | | | | | | |
| Early Autumn | RG | 3,042 | 447 | 14.7 | 2 | 4.0 | 4.0 | MO | 2.7 | dg |
| | *Nice, very uniform pumpkin, yellow band around stem base.* | | | | | | | | | |
| Big Autumn | RG | 3,906 | 635 | 16.2 | 2 | 4.0 | 3.5 | MO | 3 | dg |
| | *Very nice uniform fruit, yellow ring around stem base, nicer than Early Autumn.* | | | | | | | | | |
| Jumpin Jack | RUP | 2,282 | 470 | 20.6 | 2 | 3.3 | 3.0 | DO | 3 | dg |
| | *Fairly attractive, some fruit still green.* | | | | | | | | | |
| Appalachian | PS | 2,316 | 457 | 19.7 | 2 | 3.0 | 2.8 | DO | 3 | dg |
| | *Attractive large pumpkin.* | | | | | | | | | |
| Trax | SW | 1970 | 431 | 21.9 | 2 | 2.0 | 2.8 | MO | 3 | dg |
| | *Uneven fruit size and shape, not as attractive as most of the others.* | | | | | | | | | |
| LSD (P = 0.05) | | ns | 63 | 2.5 | | | | | 0.12 | |

[a]1 = oblate or flat, 2 = blocky, 3 = round
[b]1 = rough warty skin, 5 = very smooth
[c]1 = heavy ribbed, 5 = no ribbing smooth
[d]lo = light orange, mo = medium orange, do = dark orange, ro = reddish orange, w = white
[e]1 = weak, small breaks off; 3 = strong and large
[f]lg = light green, mg medium green, dg = dark green, t = tan

Among the small decorative pumpkins, 'Baby Bear' and RWS 6260 gave the best yields of attractive small fruit (Table 3). 'Peek-A-Boo' and 'Hybrid Pam' had attractive fruit, but their yields were lower than desired. 'Big Autumn' (Table 2) gave high yields of a very uniform mid-sized pumpkin that would be well suited for school children who might not be able to pick up the larger-fruited pumpkin cultivars. 'Wee-Be-Little' was a very attractive, dark orange small pumpkin. As a bush-type plant, a closer row spacing might improve its yields. Additional testing of this cultivar is necessary. 'Sweetie Pie' gave nice-sized fruit, but they were a very pale yellowish orange, which we feel caused them to be less attractive.

**Table 3. Yield and quality of small/miniature pumpkin cultivars, Quicksand, KY; data are means of three replications.**

| Cultivar | Seed Source[a] | Number/ acre | Cwt./ acre | Avg Wt. (lb) | Shape[b] | Smoothness[c] | Ribbing[d] | Color[e] | Stem Quality[f] | Stem Color[g] |
|---|---|---|---|---|---|---|---|---|---|---|
| Baby Bear | RUP | 11,097 | 163 | 1.5 | 1 | 3 | 3 | DO | 3 | dg |
| | *Very attractive, small, flattish pumpkin.* | | | | | | | | | |
| Sweetie Pie | ST | 18,425 | 730 | 0.4 | 1 | 3 | 2.8 | LO | 3 | dg |
| | *Pale yellowish orange fruit, wish they were darker.* | | | | | | | | | |
| Peek-A-Boo | RG | 4,459 | 153 | 3.4 | 2 | 3 | 3 | MO | 3 | dg |
| | *Nice looking small pumpkin, yield only fair.* | | | | | | | | | |
| Wee-Be- Little | RG | 7,726 | 46 | 0.6 | 1 | 4 | 4.5 | DO | 3 | dg |
| | *Bush type plant, nice small pumpkin but yield at this spacing not high.* | | | | | | | | | |
| RWS 6260 | RG | 8,054 | 174 | 2.2 | 2 | 3 | 3 | DO | 3 | dg |
| | *Very nice small pumpkin!* | | | | | | | | | |
| Hybrid Pam | SW | 2,212 | 99 | 4.5 | 2 | 3 | 3 | MO | 3.5 | dg |
| | *Very nice looking small pumpkin with a huge stem for size, but not a high yield.* | | | | | | | | | |
| LSD (P = 0.05) | | 2631 | 63 | 3.5 | | | | | 0.12 | |

[a]1= oblate or flat, 2 = blocky, 3 = round
[b]1 = rough warty skin, 5 = very smooth
[c]1 = heavy ribbed, 5 = no ribbing smooth
[d] lo = light orange, mo = medium orange, do = dark orange, ro = reddish orange, w = white
[e]1 = weak, small breaks off; 3 = strong and large
[f]lg = light green, mg medium green, dg = dark green, t = tan

# Powdery Mildew Resistant Pumpkin Cultivar Observation Trial

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*Dale DePoyster*
Big Clifty

Powdery mildew resistant pumpkin cultivars and breeding lines were evaluated at Dale DePoyster's farm in Big Clifty.

## Materials and Methods

Nine powdery mildew resistant pumpkin cultivars and breeding lines from Harris Moran Seed Company were planted on July 20, 1998, in a nonreplicated observation trial. Twenty seeds of each cultivar were planted to make a 40-ft-long row of each cultivar. Seeds were spaced 2 ft apart on 12-ft row centers. No herbicides or fungicides were used. Insecticides were used only until early August.

## Results and Discussion

Atlantic Giant, HMX 6687, and HMX 8691 had the lowest plant powdery mildew incidence. Both of these numbered lines had very nice fruit quality. HMX 6689 had the highest yield and produced nice-quality pumpkins. HMX 8696 was the lowest-yielding line but produced very attractive, small 5-6 in. diameter pumpkins. The other small pumpkin, HMX 6688, contained a large number of fruit that had not colored up completely at harvest. However, these colored up after harvest and were very nice.

Only two lines, HMX 8694 and HMX 8692, were judged to be less desirable due to stem decay problems, and these had the highest incidence of powdery mildew in the study. Most cultivars had very dark orange fruit that was quite attractive.

**Table 1. Powdery mildew resistant pumpkin cultivar observation yield and fruit characteristics, Big Clifty, 1998.**

| Cultivar | Yield (T/A) | Fruit (no/A) | Avg. fruit wt. (lb) | Fruit length (in)[1] | Fruit width (in) | Fruit shape | Fruit smoothness[2] (1-5) | Fruit ribbing[3] (1-5) | Fruit color | Stem quality (1-3)[4] | Overall looks[5] (1-5) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HMX 6689 | 16.0 | 3,267 | 9.9 | 8.8 | 8.3 | slightly elongated | 3 | 3 | v. dark orange | 2.5 | 3 |
| HMX 8694 | 12.0 | 2,360 | 10.6 | 10.0 | 8.5 | elongated | 3.5 | 3 | light orange | 1.5 | 2 |
| HMX 6687 | 11.0 | 1,997 | 10.4 | 8.7 | 8.5 | round | 3 | 2 | v. dark orange | 2.5 | 4 |
| HMX 8692 | 10.9 | 3,267 | 6.7 | 9.0 | 8.0 | round | 3 | 2.5 | dark orange | 2.5 | 2.5 |
| Magic Lantern HMX 5683 | 10.0 | 2,360 | 8.3 | 9.2 | 8.5 | round & elongated | 2 | 2 | dark. orange | 2.5 | 4.5 |
| HMX 8691 | 9.5 | 3,086 | 6.2 | 8.7 | 7.5 | elongated | 3 | 2 | dark orange | 2.5 | 3.5 |
| HMX 6688 | 6.1 | 2,904 | 4.2 | 5.8 | 6.3 | round | 2 | 2 | v. dark orange | 3.0 | 4 |
| HMX 8696 | 5.5 | 2,541 | 4.3 | 5.8 | 6.5 | flat to round | 4 | 4 | v. dark orange | 3.0 | 4.5 |

[1]Fruit measurements based on 3 fruit.
[2]Smoothness: 1=rough, 5=smooth.
[3]Ribbing: 1=heavily ribbed, 5=smooth.
[4]Stem quality: 1=weak, small breaks off, 3=strong and large.
[5]Overall looks: 1=poor, 5=excellent.

**Table 2. Pumpkin cultivar powdery mildew incidence and comments, 1998.**

| Cultivar | PM overall incidence 9/24 (%) | PM severity 9/24 (%) | PM rating 9/24[1] (%) | PM overall incidence 10/16 (%) | PM severity 10/16 (%) | PM rating 10/16[1] (%) | PM stem rating[2] (1-5) | Comments |
|---|---|---|---|---|---|---|---|---|
| HMX 6689 | 80 | 20 | 16 | 95 | 90 | 86 | 2.0 | Attractive, slight variation in size, light to dark green stem, small vine |
| HMX 8694 | 30 | 10 | 3 | 95 | 95 | 90 | 3.0 | Stem decay problems, lighter weight fruit, tan to dark green stem, small vine |
| HMX 6687 | 5 | 5 | 0.3 | 50 | 20 | 10 | 1.5 | Attractive, fairly uniform fruit size, dark green stems, large vine |
| HMX 8692 | 90 | 50 | 45 | 95 | 95 | 90 | 2.5 | Attractive, variable in size, tan to dark green stems, small vine |
| Magic Lantern HMX 5683 | 60 | 40 | 24 | 70 | 75 | 53 | 1.5 | Variable in shape and size, dark green stems, large vine |
| HMX 8691 | 50 | 5 | 2.5 | 75 | 20 | 15 | 2.0 | Attractive, some variation in size, medium to dark green stems, large vine |
| HMX 6688 | 60 | 40 | 24 | 90 | 85 | 77 | 2.0 | Most fruit still somewhat green at harvest, large light to dark green stems, large vine, small pumpkin |
| HMX 8696 | 50 | 10 | 5 | 90 | 80 | 72 | 1.5 | Attractive fairly uniform small pumpkin, dark green stems, small vine |
| Atlantic Giant | 5 | 5 | 0.3 | 15 | 10 | 2 | 1.0 | |

[1]Powdery mildew rating is percent overall powdery mildew incidence on the plant X percent powdery mildew severity on the plant.
[2]Powdery mildew stem rating: 1=0 incidence, 3=50 percent brown and shriveled, 5=100 percent brown and shriveled.

One advantage of most of these cultivars was that the powdery mildew resistance helped to improve stem quality, and the stems held up very well after harvest.

This trial was planted very late in the season because the seed had not been available earlier. Late-summer dry weather probably reduced fruit size, because the plot was not irrigated. Unfortunately, a powdery mildew susceptible cultivar was not included in this plot, so it is difficult to determine the extent of resistance in these new breeding lines and/or cultivars.

# Orange and Purple Pepper Cultivar Trials

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Department of Horticulture and Landscape Architecture
*Dan Moore and Mike Klahr*
Hebron and Burlington

Orange and purple pepper cultivars were evaluated at the University of Kentucky South Farm in Lexington, Kentucky, and on Dan Moore's farm in Hebron.

## Materials and Methods

Six orange and six purple pepper cultivars were seeded in the greenhouse and transplanted to the field on May 19 in a randomized block design. All plants were set on raised beds, covered with black plastic mulch, and trickle irrigated. Individual treatments were 12 ft long, and plants were set in double rows with plants spaced 12 in. apart in the row with 15 in. between rows on 6-ft row centers. Preplant fertilizer consisted of 230 lb of actual N, P, and K as 19-19-19. Plants were fertigated with 2.3 lb of actual N/acre as ammonium nitrate on July 9 and June 10 and 18. Dual 8E at 1.5 pt/acre was applied to the unmulched area of the field following transplanting. Asana, Pounce, and Orthene were used for insect control, and Kocide was used for disease control. Peppers were harvested on July 27, August 14 and 27, September 9, and October 10 and graded into extra large, large, medium, small, and cull categories. Plants were transplanted on May 28 on Dan Moore's farm in a sandy soil along the Ohio River. No herbicide was used, and the planting was sidedressed and irrigated twice. The purpose of this portion of the study was to assess cultivar marketability in a direct-marketing situation.

## Results and Discussion

### *Lexington*

Mandarin, a long, very large, European-type pepper, was the best of the dark orange cultivars, although it was relatively susceptible to *Alternaria*. Valencia was the best dark orange blocky bell pepper, while Oriole was the best light orange cultivar. All of the orange varieties were very juicy and sweet when ripe.

Lilac was the best lavender-colored purple pepper, while Purple Beauty was the best dark purple pepper. Purple peppers are picked in an immature state, and the skin of all the cultivars tended to be tough and the fruit slightly bitter. It was very difficult to harvest these varieties in the purple state and hard to get good size during hot weather. The tendency was to wait for a better purple color to develop; however, by then they had started turning orange and red. A number of these varieties changed to orange and red very quickly during hot weather, and individual fruits were often purple, orange, and red at the same time. Sunburn was a problem on most of the cultivars in August.

### *Hebron*

Dan Moore rated Mandarin as the best orange pepper and Purple Pepper as the best purple. Purple Pepper was slightly better than Blue Jay, although both sold very well. He felt that Purple Beauty was very good for an open-pollinated variety. Dan will raise Mandarin, Purple Pepper, Blue Jay, and Purple Beauty again and may look at Lilac and Bendigo.

**Table 1. Orange and purple bell pepper yields and fruit characteristics, Lexington, 1998**.

| Cultivar | Seed source | Color | Days to harvest | Total X-large[1] (lb./A) | Total X-large (no/A) | Total X-large + large [2] (lb./A) | Total X-large + large (no/A) | Avg. wt/fruit X-large + large (lb) | Total mkt. (lb) | Fruit lobes (no.) |
|---|---|---|---|---|---|---|---|---|---|---|
| Purple Pepper | JS | purple | 60 | 26,318 | 55,028 | 37,754 a | 92,220 | .41 | 43,713 | 4 |
| Mavras | EZ | purple | 74 | 24,839 | 51,983 | 36,616 ab | 89,610 | .41 | 41,314 | 3-4 |
| Oriole | ST | orange | 74 | 14,616 | 31,103 | 29,602 abc | 69,818 | .43 | 30,972 | 4 |
| Blue Jay | ST | lilac | 73 | 4,437 | 10,875 | 29,167 abc | 88,958 | .33 | 40,760 | 3 |
| Purple Beauty | PK | purple | 74 | 19,901 | 42,630 | 29,145 abc | 72,645 | .40 | 35,126 | 3-4 |
| Bendigo | EZ | orange | 74 | 4,154 | 10,005 | 29,905 abc | 78,083 | .34 | 33,647 | 3-4 |
| Mandarin | RG | orange | 74-78 | 16,726 | 30,668 | 26,687 abcd | 53,940 | .50 | 27,579 | 3-4 |
| Valencia | JS, RG, SW | orange | 68-72 | 22,403 | 48,720 | 25,709 abcd | 60,248 | .43 | 26,318 | 4 |
| Queen | EZ | orange | 68 | 17,291 | 37,845 | 24,578 cd | 60,248 | .41 | 25,491 | 3 |
| Lilac | PK, RG,SW | lavender | 68 | 5,916 | 13,050 | 23,882 cd | 61,770 | .39 | 38,084 | 3-4 |
| Lavender | JS | lavender | 56 | 3,110 | 7,830 | 23,816 cd | 70,253 | .34 | 38,128 | 4 |
| Orange Grande | ST | orange | 76 | 11,006 | 23,708 | 16,922 d | 41,108 | .41 | 17,661 | 4 |

[1]Extra large >3.5 in. diam.; large 3-3.5 in. diam.; medium 2.5-3 in. diam.
[2]Yields followed by the same letter are not significantly different by Waller-Duncan (5%).

**Table 2. Orange and purple bell pepper fruit characteristics and comments, Lexington, 1998.**

| Cultivar | Overall appr.[1] (1-5) | Color quality[1] (1-5) | Decay rating 8/14[1] (1-5) | Color change | Comments |
|---|---|---|---|---|---|
| Purple Pepper | 2.3 | 3.1 | 2.6 | green - purple - red | Very large blocky fruit, purple-green color, turn red too rapidly, some asymmetrical & multi-lobed |
| Mavras | 2.8 | 3.3 | 2.5 | green - purple - red | Blocky, some flat and malformed, shape not good, not a good purple, turn red too rapidly, |
| Oriole | 4.3 | 4.5 | 2.1 | green - lt. orange | Nice uniform orange color, very attractive, color & blocky shape hold up all season |
| Blue Jay | 2.8 | 2.8 | 2.4 | lilac - grape - orange - red | Smaller size, multicolored fruit, nice red when mature, some scarf skin & shoulder cracking |
| Purple Beauty | 3.0 | 3.5 | 2.1 | green - dark purple - red | Dark purple has green in it, turns red quickly, irregular shape |
| Bendigo | 3.4 | 3.0 | 2.3 | green - reddish orange - red | Smaller size, orange-red color turns red quickly, looks more red than orange |
| Mandarin | 3.8 | 3.4 | 3.4 | green - dark. orange | Large & very long, very attractive dark orange, takes longer to color up, *Alternaria* rot is a problem |
| Valencia | 3.7 | 4.0 | 2.5 | green - dark. orange | Nice dark orange, very attractive, some variation in shape |
| Queen | 3.8 | 3.8 | 3.3 | green - yellow - lt. orange | Blocky shape that held up over the season, some with multiple lobes, *Alternaria* susceptibility |
| Lilac | 3.2 | 3.4 | 2.4 | lavender - red | Short, blocky shape, best lilac color, very attractive, turns red quickly |
| Lavender | 3.1 | 3.1 | 3.3 | lavender - orange - red | Blocky small fruit, many fruit multicolored, some scarf skin & shoulder cracking |
| Orange Grande | 3.8 | 4.2 | 3.4 | green - lt. orange | Attractive, blocky large fruit, *Alternaria* susceptibility |

[1]Overall appearance, color quality, and decay rating: 1=poor, 5=excellent.

**Table 3. Orange and purple pepper quality, marketability, and yield rating, Dan Moore's farm, Hebron,1998**.

| Cultivar | Quality[1] (1-5) | Marketability[1] (1-5) | Packout[1] (1-5) | Field yield[1] (1-5) | Comments |
|---|---|---|---|---|---|
| Mandarin | 4 | 5 | 4 | 5 | Very large; excellent yield; tendency to rot on plants, sometimes before they turn color |
| Orange Grande | 4 | 5 | 4 | 4 | |
| Bendigo | 4 | 4 | 4 | 4 | Many large peppers in center of plant at 1st harvest, best foliage protection from sunburn |
| Oriole | 3 | 3 | 3 | 3 | |
| Valencia | 3 | 4 | 2 | 2 | |
| Queen | 2 | 3 | 3 | 2 | |
| Purple Beauty | 4 | 4 | 4 | 3 | Dark purple color & best taste of any red pepper, thick walls |
| Blue Jay | 4 | 5 | 4 | 4 | Good seller |
| Purple Pepper | 4 | 5 | 4 | 4 | A little better than Blue Jay, good seller |
| Lavender | 3 | 3 | 3 | 2 | |
| Lilac | 3 | 4 | 3 | 3 | |
| Mavras | 3 | 1 | 2 | 2 | Did not sell well at brownish green stage |

[1]Rating system: 1=poor, 2=fair, 3=good, 4=very good, 5=excellent.

# Evaluation of Newly Registered Insecticides for European Corn Borer Control on Bell Pepper

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## Introduction

European corn borer remains the key insect pest attacking peppers in Kentucky. European corn borer can cause severe damage to peppers in commercial fields throughout Kentucky. Feeding by corn borer larvae can cause several problems, the most serious of which is direct damage to the fruit and premature drop of small fruit. Borer entrance holes in larger pods allow water to enter, resulting in fruit rot. When rotting begins, borers often leave and move to infest new fruit. In this way, one larva can damage several pods. In addition, plants may break due to tunneling by the borers in the stems.

European corn borer moths tend to congregate in tall grassy areas around field margins, called action sites. Females fly into fields at night to lay their eggs. Weather conditions during egg laying can greatly affect the severity of corn borer problems. Calm, warm nights are most favorable for moth activity, while few eggs are laid on windy, stormy nights.

European corn borer eggs are laid in masses of 15 to 30 eggs. Eggs are round and flattened and overlap each other like fish scales. Often they are placed on the underside of the pepper leaf near the midrib. Age of the egg mass is indicated by its color: freshly laid eggs are white, then cream. When a distinct black spot (the head of the larva) can be seen in the egg, it will hatch in about 24 hours.

Newly hatched larvae, about 1/16 in. long, leave the mass and crawl toward the developing pods. They do little feeding on pepper leaves. Within 2 to 24 hours after hatching, young larvae reach the calyx of the pepper pods. Once under the calyx, they are protected from insecticides and natural enemies.

There are two to three generations of this pest each year. The first appears in late May through early June. The second generation develops from late July through August. A partial third generation may occur in some years in early September. The second, or midsummer generation, is most likely to cause problems for commercial pepper producers.

| Treatment[1] | Rate / acre | Percentage of ECB damage[2] | Total fruit[2] |
|---|---|---|---|
| Spintor 2 SC | 3 fl oz | 26.6 ab | 63.8 a |
| Spintor 2 SC | 6 fl oz | 14.8 b | 62.5 a |
| Warrior 1 EC | 1.96 fl oz | 14.0 b | 70.3 a |
| Control | — | 37.7 a | 62.0 a |

[1] Application dates: 5, 13, 20, and 27 Aug.
[2] Means in the same column followed by the same letter are not significantly different (LSD: $p < 0.05$).

## Materials and Methods

Three insecticide treatments were evaluated for control of European corn borer insects attacking bell pepper. 'California Wonder' pepper plants were transplanted on the UK Spindletop Research Farm in Fayette County on May 19 as a randomized block design with 4 replicates. Individual plots consisted of single rows, 23 ft long, with plants spaced 20 in. apart in the rows. All insecticides were applied using $CO_2$ backpack sprayers with drop nozzles using 40 PSI and 30 gallons finished spray per acre. Insecticide applications were made on 5, 13, 20, and 27 Aug. On Sept 1, all the mature fruit in each plot were removed and examined for damage by European corn borer.

## Results and Discussion

European corn borer pressure was high during the course of this study, and the initial sprays were applied after some of the larvae had already penetrated into the fruit. Because of this, the damage observed in the Warrior and Spintor treatments is likely to be higher than would be expected in a commercial situation. The Warrior 1 EC and the Spintor 2SC at 6 fl oz per acre significantly reduced the number of European corn borer-damaged fruit. However, the low rate of Spintor was not significantly different from the control.

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# Yield, Disease Resistance, and Quality of Staked Tomato Cultivars

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## Introduction

Kentucky growers currently produce about 1,200 acres of staked, vine-ripened tomatoes for both local and national markets. Kentucky tomatoes have an excellent reputation for quality in some market areas like Chicago. Merchandising managers at the Kentucky Distribution Center of the Kroger Company (serves 100 supermarkets in Kentucky, Illinois, and West Virginia) expressed a strong interest and commitment to marketing local produce in general and Kentucky tomatoes in particular. We began fresh-market tomato trials in 1998 in order to evaluate new commercial cultivars and to identify a variety which might be featured in supermarkets as a premium "Kentucky Tomato." We evaluated new varieties for yields and quality and compared them with established commercial varieties such as 'Mountain Spring' and 'Mountain Fresh'. We were looking specifically for the following characteristics in the "Kentucky Tomato" variety:

1. Large slicer that tastes good
2. Ships well (firm, but not necessarily the most firm among cultivars)
3. High yields of extra-large and larger fruit
4. Reasonably free from defects

## Materials and Methods

A carefully selected group of 16 determinate tomato varieties from four seed companies was evaluated at two locations in Kentucky. All trial entries for both locations were seeded in the greenhouse at the South Farm in Lexington (LEX) on March 3 and transferred to 72-cell plastic trays on April 1. All cultivars were transplanted to the field on May 12 at the South Farm in LEX and at the Robinson Experiment Station at Quicksand (QSND). Varieties at both locations were planted in a randomized complete-block design with four replications. Plots at LEX consisted of eight plants spaced 18 in. apart in a single row on 6-in.-high raised beds spaced 6 ft apart with black plastic mulch and trickle irrigation. Plots at QSND were similar except that ten plants per plot were used, and beds were spaced 7 ft apart. Plants at both locations were staked and tied using the Florida weave system and were pruned to two main stems.

Eighty-eight lb N, no phosphorus, and 178 lb $K_2O$/acre were applied prior to bed formation at QSND, while 116 lb/acre each of N, $P_2O_5$, and $K_2O$ were applied at LEX. A total of 26 lb/acre of supplemental N (ammonium nitrate) was fertigated at QSND from June 10 until July 28 in six applications ranging from 2.5 to 5.0 lb N per acre per application. No supplemental N was applied through the drip system at LEX. Both plots were sprayed weekly with protectant fungicides (Bravo at QSND and maneb or Bravo at LEX). In addition, two and three applications of Bravo + Quadris or Quadris alone were made at QSND and LEX, respectively.

A total of eight harvests were made at LEX from July 13 until Aug. 26, while seven harvests were made at QSND from July 14 until Aug. 17. Fruit were graded into the following size classes prior to counting and weighing: Jumbo (>3.5 in. diameter), extra-large (>2.75 in. but <3.5 in.), large (>2.5 in. but <2.75 in.), medium and smalls (<2.5 in.), and culls. Fruits were also sorted according to U.S. No. 1 or U.S. No. 2 grades. In order to approximate the present marketing situation in Kentucky, "marketable yield" included only the "large" and above size classes. Yields of the "medium" size class are reported together with smalls, as they are not considered worth marketing by most grower/shippers in the state. All yields reported in Tables 1 and 2 and shown in Figures 1 and 2 are of U.S. No. 1 fruit unless otherwise indicated. Yields of No. 2 fruits, although marketable in most years, were not included in "marketable yield" and are reported in separate columns in the tables.

**Table 1. Yields and early blight ratings of staked tomatoes at Quicksand, KY, 1998; all data are means of four replications.**

| Entry (Seed Co.) | —#1 Jumbo+XL[t]— | | | #1 Large[u] | Tot. mkt.[v] | # 2's[w] | Meds.+ Smalls[x] | Culls | Av. frt. wt.[y] | Early blight ratings[z] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | boxes/acre | % | lbs/acre x 1000 | | | | | | oz. | 20 July | 7 Aug | Avg. |
| Fabulous (SW) | 2137 | 85 | 53.4 | 8.8 | 62.2 | 3.6 | 5.2 | 3.7 | 11.2 | 0.7 | 2.1 | 1.4 |
| Emperador (PS) | 1949 | 79 | 48.7 | 12.2 | 60.9 | 3.2 | 9.5 | 4.2 | 10.4 | 0.9 | 2.4 | 1.6 |
| Sunbrite (AS) | 1767 | 80 | 44.2 | 10.2 | 54.4 | 6.4 | 6.1 | 2.1 | 9.9 | 1.1 | 2.6 | 1.9 |
| Sunbeam (AS) | 1665 | 73 | 41.6 | 14.3 | 55.9 | 3.7 | 10.6 | 1.8 | 9.2 | 0.7 | 2.2 | 1.5 |
| Enterprise (SW) | 1608 | 71 | 40.2 | 16.8 | 57.0 | 5.5 | 10.5 | 7.8 | 9.3 | 1.1 | 2.9 | 2.0 |
| Sunleaper (RG) | 1495 | 65 | 37.4 | 19.6 | 57.0 | 3.3 | 12.7 | 3.6 | 9.2 | 1.2 | 2.6 | 1.9 |
| Mtn. Fresh (H) | 1431 | 67 | 35.8 | 17.8 | 53.6 | 2.7 | 9.6 | 1.5 | 9.1 | 0.5 | 1.9 | 1.2 |
| Florida 47 (AS) | 1410 | 71 | 35.2 | 13.9 | 49.2 | 3.1 | 8.0 | 2.3 | 9.5 | 1.1 | 3.0 | 2.1 |
| SunGem (AS) | 1365 | 73 | 34.1 | 12.4 | 46.6 | 6.7 | 11.9 | 4.0 | 9.5 | 1.7 | 3.1 | 2.4 |
| Mtn. Spring (RG) | 1307 | 71 | 32.7 | 11.7 | 44.3 | 6.1 | 9.9 | 5.3 | 9.4 | 1.6 | 3.2 | 2.4 |
| Floralina (PS) | 1285 | 64 | 32.1 | 15.0 | 47.1 | 3.9 | 12.1 | 3.7 | 8.5 | 1.2 | 3.1 | 2.2 |
| FTE 30 (SW) | 1272 | 67 | 31.8 | 14.5 | 46.3 | 4.6 | 9.0 | 4.1 | 8.6 | 1.1 | 2.2 | 1.7 |
| RFT 4413 (RG) | 1239 | 70 | 31.0 | 12.5 | 43.5 | 3.8 | 8.5 | 2.4 | 9.3 | 1.7 | 2.9 | 2.3 |
| Sunstart (AS) | 1230 | 68 | 30.7 | 13.4 | 44.1 | 7.4 | 10.2 | 7.4 | 8.9 | 1.4 | 3.5 | 2.4 |
| Sunpride (AS) | 1074 | 60 | 26.8 | 17.3 | 44.1 | 2.4 | 11.9 | 2.7 | 8.5 | 0.9 | 2.6 | 1.7 |
| Mtn. Supreme (AS) | 1021 | 58 | 25.5 | 18.6 | 44.1 | 1.9 | 17.7 | 2.9 | 7.9 | 0.0 | 0.6 | 0.3 |
| Waller-Duncan LSD (P = 0.05) | 538 | 10 | 13.5 | 4.5 | 16.9 | 1.96 | 4.7 | 2.2 | 0.7 | — | — | 0.9 |

[t]Yields of USDA No. 1 fruit of jumbo (>3.5 in. diameter) *plus* extra large (>2.75 in but ≤ 3.5 in) size classes; boxes/acre = number of 25-lb cartons per acre; "%" = percentage of the total of these two size classes out of the *total marketable yield.*

[u]Yields of USDA No. 1 fruit of the large (>2.5 in but ≤2.75 in) size class.

[v]Total marketable yield = yield of No. 1 fruit of jumbo + extra large + large size classes; mediums not included.

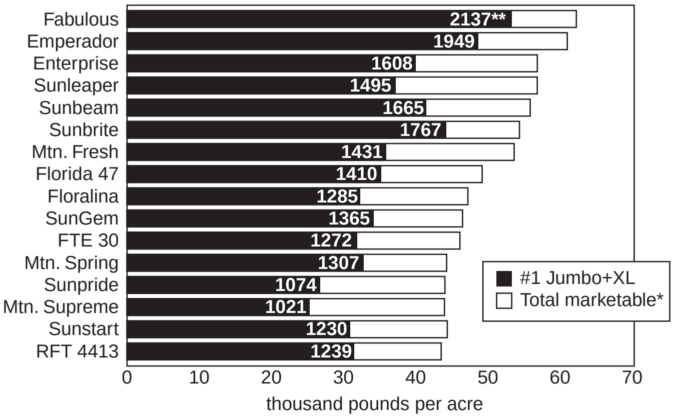
[w]Yield of USDA No. 2 fruit from all size classes.

[x]Yield of medium + small size classes (≤2.5 in, unmarketable in most years in KY).

[y]Average fruit weight; includes size classes jumbo, extra large, and large only.

[z]Assessed for foliar symptoms of *Alternaria solani* on 20 July and 7 Aug using a 0-5 rating scale where 0 = no symptoms, 1 = slight symptoms, 3 = moderate symptoms, 5 = severe symptoms and some defoliation; "Avg." is the average rating of the two assessment dates.

*Figure 1. Jumbo+XL and Total Marketable* Yields.*




* Total marketable = (U.S. #1 Jumbo+XL+Large); does not include Mediums.
** Numbers within shaded bars are (Jumbo+XL) yields expressed as number of 25 lb cartons per acre; Waller-Duncan LSD (P=0.05) = 538, 1998, Quicksand, KY.

In addition to reporting yields in terms of pounds per acre and cartons per acre, variety performance is also expressed as income per acre (Figures 3 and 4). Actual 1998 tomato weekly market prices were multiplied by yields from the different size classes for each variety. Higher prices were used for the earlier harvests in order to favor earlier-maturing varieties. Higher prices were also used for the "extra large and jumbo size" class. Yields of No. 2 fruits were also used in these calculations, but with lower prices than No. 1 fruits. We consider the incomes per acre together with the fruit quality observations in Table 3 to provide the best indication of overall variety performance. Means of all variables were compared using Waller-Duncan's K-ratio T test (P = 0.05).

## *Disease assessments*

Varieties at QSND were rated for the extent of foliar early blight (*Alternaria solani*) symptoms on July 20 and August 7. In addition, varieties at LEX were assessed for virus incidence and severity on July 9 and August 6, respectively. Leaf samples collected from all cultivars together with fruit samples from selected cultivars in the LEX trial were sent to Agdia, Inc. of Elkhart, Indiana, for ELISA testing.

## *Fruit quality ratings*

All fruits of each variety from one replication in the QSND trial were graded and laid out for careful examination and quality ratings on Aug. 11. Varieties were rated for smoothness, blossom scar size, extent of cracking, firmness, and internal color (Table 3). The overall appearance rating took most of these factors into account.

**Table 2. Yields and Tomato Mosaic Virus (ToMV) ratings of staked tomatoes at Lexington, Kentucky, 1998; all data are means of four replications.**

| | —Jumbo+XL[t]— | | | #1 Large[u] | Tot. mkt [v] | # 2's[w] | Meds.+ Smalls[x] | Culls | Avg. frt. wt.[y] | Virus [z] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Entry (Seed Co.)** | **boxes/acre** | **%** | **—lbs/acre x 1000—** | | | | | | **oz.** | **Incidence %** | **Severity** rating |
| Fabulous (SW) | 1803 | 98 | 45.0 | 0.7 | 45.8 | 7.7 | 1.5 | 12.7 | 9.8 | 12 | 0 |
| Emperador (PS) | 1791 | 95 | 44.8 | 1.8 | 46.6 | 4.8 | 0.6 | 11.4 | 10.5 | 25 | 0.2 |
| Sunleaper (RG) | 1745 | 91 | 43.6 | 3.9 | 47.5 | 4.2 | 1.1 | 6.2 | 8.7 | 87 | 1.7 |
| SunGem (AS) | 1574 | 96 | 39.3 | 1.5 | 40.8 | 3.0 | 0.4 | 4.7 | 9.5 | 100 | 3.0 |
| Enterprise (SW) | 1561 | 95 | 39.0 | 1.9 | 40.9 | 7.5 | 0.5 | 18.4 | 9.4 | 6 | 0 |
| Sunpride (AS) | 1509 | 88 | 37.7 | 5.2 | 42.9 | 3.3 | 5.0 | 6.8 | 7.9 | 94 | 1.7 |
| Sunbeam (AS) | 1414 | 90 | 35.3 | 3.7 | 39.0 | 6.4 | 0.7 | 7.6 | 8.5 | 91 | 2.0 |
| Mtn. Fresh (H) | 1374 | 91 | 34.3 | 3.5 | 37.8 | 5.3 | 0.6 | 8.4 | 9.1 | 100 | 2.0 |
| Florida 47 (AS) | 1368 | 88 | 34.2 | 5.2 | 39.4 | 7.1 | 0.8 | 10.2 | 9.5 | 97 | 2.2 |
| Mtn. Spring (RG) | 1353 | 95 | 33.8 | 1.7 | 35.5 | 4.4 | 0.4 | 8.1 | 9.1 | 100 | 3.0 |
| Floralina (PS) | 1348 | 93 | 33.7 | 2.5 | 36.2 | 3.9 | 0.8 | 7.0 | 8.5 | 97 | 2.5 |
| Sunbrite (AS) | 1336 | 97 | 33.4 | 1.0 | 34.4 | 4.9 | 0.4 | 8.8 | 9.9 | 75 | 2.5 |
| RFT 4413 (RG) | 1335 | 96 | 33.4 | 1.3 | 34.7 | 2.9 | 0.1 | 9.7 | 9.0 | 100 | 1.5 |
| Sunstart (AS) | 1063 | 88 | 26.6 | 3.9 | 30.5 | 3.9 | 0.8 | 9.8 | 8.3 | 100 | 3.0 |
| FTE 30 (SW) | 1048 | 95 | 26.2 | 1.4 | 27.6 | 5.5 | 0.5 | 11.7 | 8.9 | 94 | 2.7 |
| Mtn. Supreme (AS) | 726 | 72 | 18.1 | 6.8 | 25.0 | 0.9 | 3.7 | 2.8 | 6.6 | 100 | 2.5 |
| Waller-Duncan LSD (P = 0.05) | 306 | 6 | 7.6 | 3.3 | 8.4 | 2.6 | ns | 3.9 | 0.8 | 24 | 0.2 |

[t]Yields of USDA No. 1 fruit of jumbo (>3.5 in. diameter) *plus* extra large (>2.75 in but ≤ 3.5 in) size classes; boxes/acre = number of 25-lb cartons per acre; "%" = percentage of the total of these two size classes out of the *total marketable yield.*
[u]Yields of USDA No. 1 fruit of the large (>2.5 in but ≤2.75 in) size class.
[v]Total marketable yield = yield of No. 1 fruit of jumbo + extra large + large size classes; mediums not included.
[w]Yield of USDA No. 2 fruit from all size classes.
[x]Yield of medium + small size classes (≤2.5 in, unmarketable in most years in KY).
[y]Average fruit weight; includes size classes jumbo, extra large, and large only.
[z]Foliar symptoms of ToMV; incidence (%) = percentage of plants exhibiting symptoms on 9 July; severity of visual symptoms on 6 Aug where 0 = no ToMV symptoms visible, 1 = late symptom development and/or mild mosaic visible, 2 = intermediate symptom development, 3 = strong mosaic and leaf deformation at all levels of the plant.

**Table 3. Fruit quality characteristics; observations from all fruits from one replication at Quicksand, 11 August 1998. Cultivars ranked in order of yield of jumbo and extra large fruits.**

| Cultivar (Seed Co.) | Shape[t] | Blossom scar[u] | Smoothness[v] | Cracking[w] | Appearance[x] | Firmness[y] | Internal color[z] | Comments |
|---|---|---|---|---|---|---|---|---|
| Fabulous (SW) | do | s | 3 | 2 | **7** | 4 | 2 | Large fruits are angular |
| Emperador (PS) | do | s | 2.5 | 3 | **6.5** | 3 | 2 | Some radial cracking; air spaces in locules in few fruits. |
| Sunbrite (AS) | do | s | 3 | 4 | **5** | 3 | 2 | Large radial cracks; air spaces in locules frequent |
| Sunbeam (AS) | do-g | s | 2 | 3 | **6** | 3.5 | 2.5 | Some radial cracking. |
| Enterprise (SW) | g | s-m | 2 | 2 | **6** | 4 | 5 | Nice internal color. |
| Sunleaper (RG) | do | s | 2 | 2 | **7** | 4 | 4 | Few concentric cracks & rain checking |
| Mtn. Fresh (H) | g | s | 2 | 2 | **7** | 4 | 4 | No complaints! |
| Florida 47 (AS) | g | s | 2 | 2 | **7** | 4 | 4 | Some rain checking. |
| SunGem (AS) | do | s | 2 | 2 | **7** | 4 | 3 | Some rain checking. |
| Mtn. Spring (RG) | do | s | 2 | 1 | **8** | 4 | 3 | Nice; light internal color. |
| Floralina (PS) | do-g | s-m | 2 | 1 | **8** | 4 | 3.5 | Nice fruits. |
| FTE 30 (SW) | do | s | 2.5 | 2.5 | **6** | 3.5 | 3.5 | Some cracking. |
| RFT 4413 (RG) | do-g | s | 2 | 2 | **7** | 4.5 | 3 | Some fruits. with few locules |
| Sunstart (AS) | do | s | 2 | 2.5 | **5** | 3 | 2.5 | Severe rain checking, rough skin. |
| Sunpride (AS) | do | s | 2 | 3 | **5** | 4 | 5 | Serious radial cracking. |
| Mtn. Supreme (AS) | do | s | 2 | 1 | **8** | 4 | 4 | |

[t]Fruit shape: "do" = deep oblate (diameter somewhat greater than height), "g" = globe (spherical).
[u]Blossom scar size: "s" = small (< 1/8 in. diameter), "m" = medium (1/8 to 1/4 in).
[v]Smoothness of fruit rating: 1 = smooth (best), 5 = ribbed on top (worst).
[w]Fruit cracking: 1 = none, 5 = severe.
[x]Overall fruit appearance rating: 1 = worst, 9 = best.
[y]Fruit firmness by feel: 1 = soft, 3 = medium firm, 5 = very firm.
[z]Internal fruit color: 1 = whitish (worst), 5 = uniformly deep red (best).

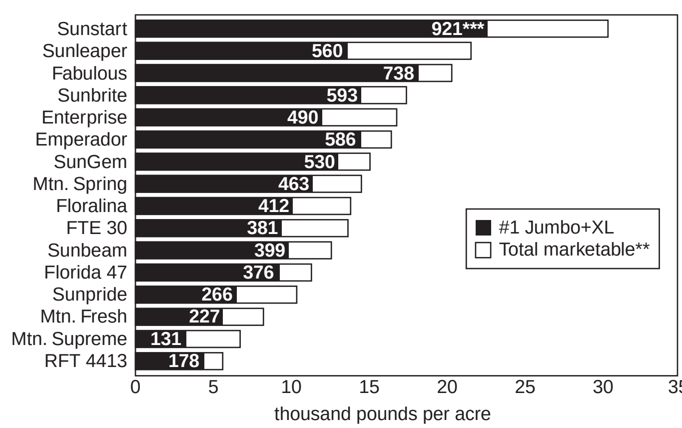
## *Taste tests*

All varieties were evaluated informally for taste by a group of four people. From among the 16 varieties, 6 were selected for further evaluation by a much larger group of consumers. Results were still being tabulated at the time of writing and will be presented at a later date.

## Results and Discussion

Disease epidemics at both locations affected tomato yields in these trials. A severe epidemic of Tomato Mosaic Virus (ToMV)[1] occurred in the LEX trial. The disease was first observed in transplants of a home garden variety that had been grown in the same greenhouse as the trial entries. Six plants of this variety were transplanted to one of the LEX trial guard rows for observation together with some "cluster" type greenhouse tomato varieties from Israel. Virus symptoms were observed in this variety only *after* staking, pruning, and tying, so that the disease was inadvertently spread throughout the field. The resulting epidemic appeared quite uniform, and leaf samples collected at midseason from all 16 cultivars tested positive for ToMV. We decided to continue with the trial in order to evaluate the impact of ToMV on yield and quality of these varieties. Although ToMV epidemics have rarely occurred in the field in Kentucky, this could change as popular, new (but TMV-susceptible) tobacco cultivars displace cultivars that have TMV resistance. Given the unusual persistence of ToMV/TMV, this disease may also become a problem when greenhouses constructed for tobacco transplant production are used for tomato production during the fall and winter months.

*Figure 2. Early* Jumbo+XL and Total Marketable**.*

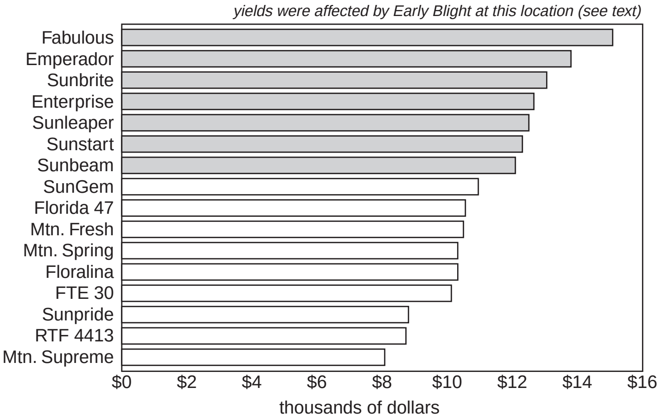



* Yields from the first 3 harvest dates: July 13-23, 1998, Quicksand, KY.
** Early total marketable = (U.S. #1 Jumbo+XL+Large); does not include Mediums, first 3 harvests.
*** Numbers within shaded bars are (Jumbo+XL) yields expressed as number of 25 lb cartons per acre; Waller-Duncan LSD (P=0.05) = 176, 1998, Quicksand, KY.

Heavy and frequent rains in May and June resulted in standing water in the trial field on at least one occasion at QSND. A moderate natural early blight epidemic occurred in the trial at this location in spite of our best efforts at field drainage and

[1]*ToMV is closely related to Tobacco Mosaic Virus (TMV) found in tobacco. Tomato varieties that claim TMV resistance are resistant to ToMV.*

*Figure 3. Income Per Acre*.*



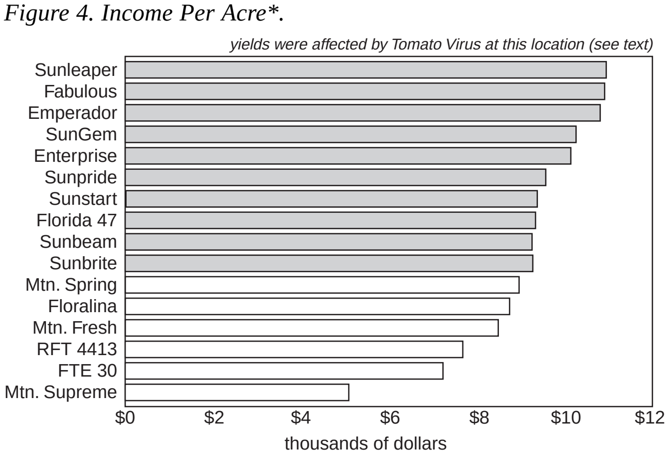

* Varieties generating high incomes per acre reflect higher prices for earlier harvests and for yielding greater portions of No. 1 extra-large and jumbo sized fruits. Income figures indicated by the shaded bars are not significantly different from "Fabulous," Quicksand, 1998.

weekly spraying with protectant fungicides. Although early blight always occurs in tomato trials conducted at this location, the extent of the disease in this year's trial was slightly greater than usual. Since early blight often severely reduces tomato yields in eastern Kentucky, we were especially interested in how cultivars tolerated the disease.

In spite of different diseases occurring at the two locations, 10 out of the 16 cultivars evaluated had the same relative ranking for yields of U.S. No. 1 jumbo and extra large fruit at LEX and QSND; in addition, there were no statistically significant variety x location interactions for this important yield variable in a combined statistical analysis of data from both locations.

'Mountain Spring', the most widely grown commercial variety in the state, was lower yielding this year than in previous trials. Its mediocre performance at QSND was probably the result of high susceptibility to early blight associated with this early-maturing variety (Table 1). There was a highly significant negative correlation ($r = -0.63$, $P < 0.01$) between total

*Figure 4. Income Per Acre*.*




* Varieties generating high incomes per acre reflect higher prices for earlier harvests and for yielding greater portions of No. 1 extra-large and jumbo sized fruits. Income figures indicated by the shaded bars are not significantly different from "Sunleaper," Quicksand, 1998.

marketable yield and the amount of early blight symptoms observed among varieties. Some of the highest-yielding varieties at QSND ('Fabulous' and 'Sunbeam') appeared to have some tolerance to early blight. Other cultivars in this highest-yielding group were 'Emperador', 'Enterprise', 'Sunleaper', and 'Sunbrite' (Table 1; Figure 1). All of these varieties, with the exception of 'Sunbrite', had fruit quality we considered acceptable for commercial markets (Table 3) and will be tested again in 1999. Varieties with *early* marketable yields at QSND that were greater than or equal to 'Mountain Spring' were 'Sunstart', 'Fabulous', 'Sunbrite', 'Emperador', 'Sunleaper', and 'SunGem' (Table 1; Figure 2). 'Sunstart' was the earliest-maturing variety in the trial, yielding 75% of its season-long yield in the first three harvests. This variety, together with 'Mountain Spring', 'SunGem', and RFT 4413, appears to be highly susceptible to early blight (Table1). Although plants of 'Sunstart' were smaller and less vigorous than most of the other varieties, it was in the group of highest-income varieties (Figure 3) because of its earliness.

As in QSND, 'Fabulous', 'Emperador', and 'Sunleaper' were in the group of highest-yielding and highest-income varieties in LEX (Table 2; Figure 4). In addition, 'SunGem' and 'Sunpride' were among the highest yielders at LEX. Superior performance by 'Fabulous', 'Emperador', and 'Enterprise' is to be expected in this trial since each of these cultivars carry the single dominant gene for TMV/ToMV resistance. This is reflected by their low virus incidence and severity ratings in Table 2; however, we observed severe ringspot-like symptoms on most fruits from two plants in one plot of 'Enterprise' and occasionally on fruits from plots of 'Emperador' and 'Fabulous'. ELISA tests conducted on 'Enterprise' whole fruit samples and on cut-out samples of the ringspot symptoms revealed that these fruits contained very high levels of ToMV. Extracts from these fruits also produced typical TMV/ToMV symptoms when rubbed onto tobacco indicator plants. Similar symptoms have been observed on other TMV/ToMV-resistant tomato varieties (F1 hybrids heterozygous for the resistance gene) exposed to severe TMV/ToMV infections (Jaap Hoogstraten, Asgrow/Seminis, personal communication). 'Sunleaper' and 'Sunpride' appeared to be somewhat tolerant to TMV in this trial; 'Sunleaper' produced the highest income at this location even without the TMV resistance gene (Figure 4). 'SunGem' was in the highest-yielding and highest-income group of cultivars in spite of having high virus incidence and severity ratings. There were significant negative correlations between yields of "jumbo and extra large" fruits and both virus incidence ($r = -.44$, $P < .01$) and severity ($r = -.55$, $P < .01$).

All things considered, new cultivars 'Sunleaper', 'Fabulous', 'Emperador', 'SunGem', and 'Enterprise' deserve further testing alongside varieties such as 'Mountain Spring', 'Mountain Fresh', and 'Sunbeam', which are already popular in the state. 'Sunleaper' is a heat-tolerant variety that has also performed well in late plantings. Another variety we liked was 'Floralina', which, together with 'Mountain Spring' and 'Mountain Supreme', had the highest ratings for overall fruit appearance (Table 3); 'Floralina' also scored very high in the taste test (data not shown). 'Sunstart' was the earliest-maturing variety tested but did not have very attractive fruits; some growers may want to try it for local markets where they receive a premium for the first tomatoes of the season. It should probably be pruned less than other varieties. The search for the "Kentucky Tomato" will continue next year.

## Acknowledgments

The authors would especially like to thank Darrell Slone, Chris Lindon, and Larry Swartz for their hard work and generous assistance in conducting these trials. We also gratefully acknowledge financial support from the cooperating seed companies.

# Analysis of Organic Fertilizers for Use in Vegetable Transplant Production

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## Introduction

Many farmers have an interest in using organic fertilizers for vegetable transplant production. There are no general recommendations for using organic fertilizers, because historically, organic fertilizers are generally insoluble in water, and nutrients are slowly available. Because of their insolubility, organic fertilizers have not been applied through the use of injectors in a typical greenhouse transplant production system. This research was conducted to observe how vegetable transplants would grow on a modified "float" bed using organic fertilizers.

## Materials and Methods

### *The "raft" system*

The transplant growing technique used, called the "raft" system, is an adaptation of the controlled water table subirrigation system developed by Dr. Jack Buxton. The raft system utilizes a piece of polystyrene floating on the water of the "float" bed. A capillary mat (water absorbent fabric) is draped across the polystyrene and into the water on each side. Water is wicked up to the surface by capillarity to keep plants uniformly moist during production. The capillary mat is covered with a landscape fabric, Weed-X, that prevents root penetration into the mat yet allows water to pass through to the plants. This system allows the use of slowly soluble organic fertilizers for transplant production.

Five organic fertilizers were selected based on their advertised solubility in water and their use by growers. These products were purchased from Peaceful Valley Farm Supply, P.O. Box 2209, Grass Valley CA 95945, (916) 272-4769, and are listed below.

Inorganic fertilizers are generally simple to use, because it is easy to determine the fertilizer concentration with the use of a conductivity meter. Standard tables allow plants to be fertilized with a desired amount of nitrate nitrogen by its relation to the electrical conductivity of the fertilizer solution—so it is easy to mix a fertilizer solution and determine the nitrate nitrogen concentration before applying it to the plants.

Organic fertilizers have been difficult to apply at a specific rate because the amount of nutrients per unit of fertilizer solution were not known. In order to determine amounts of the selected fertilizers that should be used for transplants, mixtures of the fertilizers were analyzed. The fertilizers were mixed at ½, 1, 2½, and 5 times the manufacturer's recommended rates

**Table 1. Organic fertilizers with reputed solubility in water for applications in plant production systems.**

| Fertilizer Name | Guaranteed Analysis | Origin | Manufacturer | Recommended Rate |
|---|---|---|---|---|
| Algamin (liquid) | **0.2-0.0-0.4**<br>0.2% water-soluble organic nitrogen | Extract of processed seaweed from Norway, *Ascophyllum nodulosum*. | Peaceful Valley Farm Supply,<br>P.O. Box 2209<br>Grass Valley CA 95945 | 2 Tbs/gal |
| Bat Guano | **10-3-1**<br>5.0% water-soluble organic nitrogen<br>5.0% water-insoluble organic nitrogen | Dried bat manure from dry caves in South America. | Down to Earth Distributors, Inc,<br>Eugene, OR 97401 | 4 Tbs/gal |
| GreenAll Fish Emulsion (liquid) | **5-2-2**<br>0.4% ammoniacal nitrogen<br>3.6% water-soluble organic nitrogen<br>1.0% water-insoluble organic nitrogen | Liquid concentration of fish scraps. | E.B. Stone & Sons, Inc.<br>Suisun CA 94585 | 2 Tbs/gal |
| Ohrstrom's Garden Maxicrop (powder) | **1.0-0.0-4.0**<br>1.0% water-soluble nitrogen | Extract of processed seaweed from Norway, *Ascophyllum nodulosum*. | Maxicrop USA, Inc.<br>P.O. Box 964<br>Arlington Heights IL 60006 | 1 tsp/gal |
| Mermaid's Fish Powder | **12-0.25-1**<br>2.0% ammoniacal nitrogen<br>6.0% other water-soluble nitrogen<br>4.0% water-insoluble nitrogen | Dried fish protein digest. | Integrated Fertility Management, Inc.<br>333 Ohme Gardens Rd.<br>Wenatchee WA 98801 | 2 Tbs/gal |

in one gallon of water. The mixtures were allowed to stabilize for 2 hours; then a subsample of 1 pint of fertilizer water was removed. This sample was refrigerated to stop metabolic activity and brought to the Soil Testing Lab for water solution analysis. The analyses are presented in Tables 2 through 6.

## Results and Discussion

The organic fertilizers were successful for plant production. Plants grown on the "raft" subirrigation system appeared normal. Vegetable transplants would typically be grown with 50 to 70 ppm nitrate nitrogen of an inorganic fertilizer in a subirrigation system. Based on the standardized water analyses reported here, Algamin would be used at 4 to 5 Tbs per gallon, bat guano at 1.5 to 2 Tbs per gallon, fish emulsion at 4 to 5 Tbs per gallon, Maxicrop at 3/4 to 1 tsp per gallon, and Mermaid's Fish Powder at 2 to 4 Tbs per gallon to meet this standard.

Based on the standards for inorganic fertilizers, the analyses demonstrated that there would be advantages and disadvantages to the use of these organic fertilizers.

- Algamin is a good source of potassium, calcium, and magnesium, but is low in phosphorus. Additionally, the pH is somewhat high for growing plants in growing media.
- Bat guano has high concentrations of nutrients that are released when mixed with water. Potassium levels are fine for this fertilizer, while calcium and magnesium levels are low. Phosphorus concentrations are quite high—this would be a disadvantage, because plant height is controlled better at low P levels. The biggest problem with bat guano is the low pH, which could be a significant problem for the use of this fertilizer.

**Table 2. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Algamin organic fertilizer in one gallon of water.**

| | 1 Tbs per gallon (½ rate) | 2 Tbs per gallon (recommended rate) | 5 Tbs per gallon (2½ rate) | 10 Tbs per gallon (5 rate) |
|---|---|---|---|---|
| pH | 6.78 | 6.68 | 6.28 | 5.62 |
| Conductivity (mmho/cm) | 0.45 | 0.63 | 1.08 | 1.95 |
| Alkalinity (ppm) | 33 | 47 | 43 | 52 |
| Nitrate-Nitrogen (ppm) | 17 | 25 | 80 | 111 |
| Phosphorus (ppm) | 1 | 1 | 2 | 4 |
| Potassium (ppm) | 16 | 27 | 56 | 133 |
| Calcium (ppm) | 25 | 31 | 38 | 62 |
| Magnesium (ppm) | 29 | 42 | 76 | 143 |
| Zinc (ppm) | 0.1 | 0.1 | 0.1 | 0.3 |
| Copper (ppm) | 0 | 0 | 0 | 0 |
| Iron (ppm) | 0 | 0.1 | 0.3 | 0.8 |

**Table 3. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of bat guano organic fertilizer in one gallon of water.**

| | 2 Tbs per gallon (½ rate) | 4 Tbs per gallon (recommended rate) | 10 Tbs per gallon (2½ rate) | 20 Tbs per gallon (5 rate) |
|---|---|---|---|---|
| pH | 4.14 | 3.51 | 3.16 | 2.96 |
| Conductivity (mmho/cm) | 0.52 | 0.9 | 1.8 | 3.5 |
| Alkalinity (ppm) | 0 | 0 | 0 | 0 |
| Nitrate-Nitrogen (ppm) | 64 | 128 | 247 | 520 |
| Phosphorus (ppm) | 19 | 50 | 85 | 210 |
| Potassium (ppm) | 25 | 62 | 127 | 305 |
| Calcium (ppm) | 33 | 34 | 37 | 47 |
| Magnesium (ppm) | 9 | 10 | 14 | 22 |
| Zinc (ppm) | 0.3 | 0.5 | 1 | 2.1 |
| Copper (ppm) | 0 | 0 | 0 | 0 |
| Iron (ppm) | 0 | 0.1 | 0.4 | 0.9 |

**Table 4. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of fish emulsion organic fertilizer in one gallon of water.**

| | 1 Tbs per gallon (½ rate) | 2 Tbs per gallon (recommended rate) | 5 Tbs per gallon (2½ rate) | 10 Tbs per gallon (5 rate) |
|---|---|---|---|---|
| pH | 7.33 | 7.34 | 7.46 | 7.37 |
| Conductivity (mmho/cm) | 0.54 | 0.68 | 1.1 | 1.8 |
| Alkalinity (ppm) | 76 | 80 | 146 | 236 |
| Nitrate-Nitrogen (ppm) | 12 | 32 | 68 | 110 |
| Phosphorus (ppm) | 68 | 122 | 191 | 462 |
| Potassium (ppm) | 66 | 147 | 240 | 593 |
| Calcium (ppm) | 34 | 33 | 35 | 39 |
| Magnesium (ppm) | 13 | 15 | 20 | 25 |
| Zinc (ppm) | 0 | 0 | 0 | 0.2 |
| Copper (ppm) | 0 | 0 | 0 | 0.1 |
| Iron (ppm) | 0 | 0 | 0 | 0.1 |

- Fish emulsion has low concentrations of nitrate nitrogen in comparison to relatively high rates of phosphorus and potassium. Calcium and magnesium levels are moderate for a liquid fertilizer solution. The pH of the solution is relatively high but stable even at higher fertilizer rates.
- Maxicrop analyses produced results like the similar material Algimin, with high potassium and low phosphorus. Calcium and magnesium were at moderate levels. The pH was relatively high as was the alkalinity, which would prevent easy pH changes.
- Mermaid's fish powder has moderate levels of phosphorus and potassium as well as low but uniform levels of calcium and magnesium. The pH remains at a somewhat high level, and the alkalinity is so high that the pH could not easily be reduced for plant production.

The knowledge of the efficacy of inorganic fertilizers is based on years of testing and experience. The efficacy of organic fertilizers for plant growth in greenhouse systems will require a significant amount of time because there is little knowledge of how the organic nutrients become available to plant roots and how specific mixtures of organic fertilizers can be adapted for good plant nutrition.

**Table 5. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Maxicrop organic fertilizer in one gallon of water.**

| | ½ tsp per gallon (½ rate) | 1 tsp per gallon (recommended rate) | 2½ tsp per gallon (2½ rate) | 5 tsp per gallon (5 rate) |
|---|---|---|---|---|
| pH | 7.63 | 7.33 | 7.21 | 6.89 |
| Conductivity (mmho/cm) | 0.56 | 0.75 | 1.6 | 2.1 |
| Alkalinity (ppm) | 123 | 150 | 265 | 350 |
| Nitrate-Nitrogen (ppm) | 32 | 69 | 176 | 370 |
| Phosphorus (ppm) | 0 | 0 | 1 | 1 |
| Potassium (ppm) | 113 | 150 | 500 | 714 |
| Calcium (ppm) | 28 | 25 | 33 | 35 |
| Magnesium (ppm) | 12 | 9 | 17 | 20 |
| Zinc (ppm) | 0.2 | 0 | 0.2 | 0.3 |
| Copper (ppm) | 0 | 0 | 0 | 0 |
| Iron (ppm) | 0 | 0 | 0.1 | 0.7 |

**Table 6. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Mermaid's Fish Powder organic fertilizer in one gallon of water.**

| | 1 Tbs per gallon (½ rate) | 2 Tbs per gallon (recommended rate) | 5 Tbs per gallon (2½ rate) | 10 Tbs per gallon (5 rate) |
|---|---|---|---|---|
| pH | 6.82 | 6.57 | 6.52 | 6.41 |
| Conductivity (mmho/cm) | 0.35 | 0.49 | 1.0 | 1.1 |
| Alkalinity (ppm) | 95 | 165 | 463 | 529 |
| Nitrate-Nitrogen (ppm) | 14 | 40 | 91 | 170 |
| Phosphorus (ppm) | 6 | 11 | 20 | 38 |
| Potassium (ppm) | 15 | 30 | 66 | 97 |
| Calcium (ppm) | 27 | 26 | 21 | 20 |
| Magnesium (ppm) | 10 | 10 | 11 | 11 |
| Zinc (ppm) | 0 | 0 | 0 | 0 |
| Copper (ppm) | 0 | 0 | 0 | 0 |
| Iron (ppm) | 0 | 0 | 0 | 0 |

# Fruit and Vegetable Disease Observations from the Plant Disease Diagnostic Laboratory

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Department of Plant Pathology

## Introduction

Plant disease diagnosis is an ongoing educational and research activity of the UK Department of Plant Pathology. We maintain two branches of the Plant Disease Diagnostic Laboratory: one on the UK campus in Lexington and one at the UK Research and Education Center in Princeton. Of the more than 4,000 plant specimens examined annually, approximately 5% are commercial fruit and vegetable plant specimens (1). Although there is no charge to the growers for plant disease diagnosis at UK, the estimated direct expenditure to support diagnosis of fruit and vegetable specimens by the laboratory is $8,500, excluding UK physical plant overhead costs.

## Materials and Methods

Making a diagnosis involves a great deal of research into the possible causes of the plant problem. Most visual diagnoses include microscopy to determine what plant parts are affected and to identify the microbe involved. In addition, many specimens require special tests such as moist-chamber incubation, culturing, enzyme-linked immunosorbent assay (ELISA), electron microscopy, nematode extraction, or soil pH and soluble salts tests. Diagnoses that require consultation with UK faculty plant pathologists and horticulturists, and that need culturing and ELISA, are common for commercial fruits and vegetables. These exceptional measures are efforts well spent because of the high value of fruits and vegetable crops in Kentucky. Computer-based laboratory records are maintained to provide information used for conducting plant disease surveys, identifying new disease outbreaks, and formulating educational programs.

Much of the 1998 growing season was very favorable for fruit and vegetable diseases. Kentucky orchards, vineyards, and farms experienced fluctuating, but mild, winter temperatures, an early-spring freeze, heavy late-spring and early-summer rains, and dry late-summer and fall weather, each of which contributed to the development of different kinds of diseases.

## Results and Discussion

### *Tree fruit diseases*

An abiotic weather-related problem of tree fruits in some locations was the sudden collapse of shoots and foliage at the first onset of warm spring weather. This dieback could be attributed to temperatures below 10°F on March 12, at which time most plants had broken dormancy; many peaches were in full bloom. Browning of phloem tissues was observed in cold-injured trees and followed by a variety of canker diseases. Mild winter temperatures and wet spring weather resulted in abundant peach leaf curl (*Taphrina deformans*). Peaches later showed considerable brown rot (*Monilinia fructicola*) fruit decay. Rainy spring weather favored apple scab (*Venturia inaequalis*) and cedar-apple rust (*Gymnosporangium juniperi-virginianae*). Rust-susceptible apples showed significant leaf spotting, while unsprayed apples were practically defoliated by August. In many apple orchards, white rot (*Botryosphaeria dothidia*) was the major fruit rot in late summer. Different types of leaf wetness monitors, used for plant disease management, were compared for accuracy and precision at the UK Experiment Farm orchard in western Kentucky.

### *Small fruit diseases*

Strawberry leaf spot (*Mycosphaerella fragariae*) and strawberry scorch (*Diplocarpon earlianum*), affecting stolons and petioles, were apparently favored by wet spring and early summer weather. Similarly, wet weather and poorly drained soils stimulated root rot (*Phytophthora* spp.) of raspberries.

### *Vegetable diseases*

Black rot (*Xanthomonas campestris* pv. *campestris*) was observed from commercial cabbage fields in the spring. Tomatoes in commercial plantings were infected by several different bacterial diseases this year. Bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*) and bacterial speck *(Pseudomonas syringae* pv. *tomato*) were found in transplants and in the field. Bacterial canker (*Clavibacter michiganensis*) and pith necrosis (*Pseudomonas corrugata*) caused serious tomato losses. Powdery mildew (*Leveillula taurica*), a disease only recently found in the United States, was observed on Kentucky greenhouse tomatoes.

Peppers continue to develop bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*), and the plant disease diagnostic laboratory is monitoring for the possible breakdown of the single-gene resistance to races 1, 2, and 3 of the bacteria in cultivars like 'Boynton Bell', 'Enterprise', etc. The laboratory has also uncovered a root and stem rot complex of pepper involving the fungus Fusarium; it is possibly a new disease.

Pumpkins and other cucurbits are becoming more popular in Kentucky, and their diseases continue to be economically important. Powdery mildew, caused by two different fungi (*Sphaerotheca fuliginea* or *Erysiphe cichoracearum*), is serious every year, so the laboratory is monitoring for development of powdery mildew strains that may be resistant to currently available fungicides. Downy mildew (*Pseudoperonospora cubensis*) was present at high levels in some fields in the fall.

The laboratory has been conducting a survey of the viruses infecting commercial vegetables in Kentucky for the past three years. Using ELISA tests, a broad range of virus diseases were found; no new viruses were detected in 1998.

The plant disease diagnostic laboratory has been shown to be of great value to some fruit and vegetable growers. However, many commercial growers are still not using the plant disease diagnostic laboratory often enough, or they are waiting until their disease problem has become well established. By that time it may be too late to do anything to treat the problem or in some cases to correctly diagnose the sequence of events/diseases that may have led to the final outcome. Growers are urged to consult with their county Extension agents on a regular basis so that appropriate plant specimens are sent to the laboratory in a timely manner.

## Literature Cited

1. Bachi, P.R., J.W. Beale, J.R. Hartman, D.E. Hershman, W.C. Nesmith, and P.C. Vincelli. 1999. Plant Diseases in Kentucky - Plant Disease Diagnostic Laboratory Summary, 1998. UK Department of Plant Pathology (in press).

# Appendix A: Sources of Vegetable Seeds*

| Code | Company Name and Address |
|---|---|
| AAS | All America Selection Trials, 1311 Butterfield Road, Suite 310, Downers Grove, IL 60515 |
| AS/ASG | Asgrow Seed Co., 7000 Portage Rd., Kalamazoo, MI 49001 |
| AC | Abbott and Cobb, Inc., Box 307, Feasterville, PA 19047 |
| AG | Agway, Inc., P.O. Box 1333, Syracuse, NY 13201 |
| AM | American Sunmelon, P.O. Box 153, Hinton, OK 73047 |
| AR | Aristogenes, Inc., 23723 Fargo Road, Parma, ID 83660 |
| AT | American Takii Inc., 301 Natividad Road, Salinas, CA 93906 |
| BBS | Baer's Best Seed, 154 Green St., Reading, MA 01867 |
| BK | Bakker Brothers of Idaho, Inc., P.O. 1964, Twin Falls, ID 83303 |
| BR | Bruinsma Seeds b.v., P.O. Box 1463, High River, Alberta, Canada, TOL 1B0 |
| BS | Bodger Seed Ltd., 1800 North Tyler Ave., South El Monte, CA 91733 |
| BU | W. Atlee Burpee & Co., P.O. Box 6929, Philadelphia, PA 19132 |
| BZ | Bejo Zaden B.V., 1722 ZG Noordscharwoude, P.O. Box 9, Netherlands |
| CA | Castle, Inc., 190 Mast St., Morgan Hill, CA 95037 |
| CH | Alf Christianson, P.O. Box 98, Mt. Vernon, WA 98273 |
| CIRT | Campbell Inst. For Res. And Tech., P-152 R5 Rd 12, Napoleon, OH 43545 |
| CL | Clause Semences Professionnelles, 100 Breen Road, San Juan Bautista, CA 95045 |
| CN | Canners Seed Corp., (Nunhems) Lewisville, ID 83431 |
| CR | Crookham Co., P.O. Box 520, Caldwell, ID 83605 |
| CS | Chesmore Seed Co., P.O. Box 8368, St. Joseph, MO 64508 |
| D | Daehnfeldt Inc., P.O. Box 947, Albany, OR 97321 |
| DN | Denholm Seeds, P.O. Box 1150, Lompoc, CA 93438-1150 |
| DR | DeRuiter Seeds, Inc., P.O. Box 20228, Columbus, OH 43320 |
| EB | Ernest Benery, P.O. Box 1127, Muenden, Germany |
| EX | Express Seed, 300 Artino Drive, Oberlin, OH 44074 |
| EZ | ENZA Zaden, P.O. Box 7, 1600 AA, Enkhuisen, Netherlands 02280-15844 |
| FM | Ferry-Morse Seed Co., P.O. Box 4938, Modesto, CA 95352 |
| G | German Seeds, Inc., Box 398, Smithport, PA 16749-9990 |
| GB | Green Barn Seed, 18855 Park Ave., Deephaven, MN 55391 |
| GL | Gloeckner, 15 East 26th St., New York, NY 10010 |
| GO | Goldsmith Seeds, Inc., 2280 Hecker Pass Highway, P.O. Box 1349, Gilroy, CA 95020 |
| HL/HOL | Hollar & Co., Inc., P.O. Box 106, Rocky Ford, CO 81067 |
| H/HM | Harris Moran Seed Co., 3670 Buffalo Rd., Rochester, NY 14624, Ph: (716) 442-0424 |
| HN | HungNong Seed America, Inc., 3065 Pacheco Pass Hwy., Gilroy, CA 95020 |
| HO | Holmes Seed Co., 2125-46th St., N.W., Canton, OH 44709 |
| HZ | Hazera Seed, Ltd., P.O.B. 1565, Haifa, Israel |
| J | Jordon Seeds, Inc., 6400 Upper Afton Rd., Woodbury, MN 55125 |
| JS/JSS | Johnny's Selected Seeds, Foss Hill Road, Albion, MA 04910-9731 |
| KS | Krummrey & Sons, Inc., P.O. 158, Stockbridge, MI 49285 |
| KY | Known-You Seed Co. Ltd, 26 Chung Cheng 2nd Rd., Kaohsiung, Taiwan, R.O.C. 07-2919106 |
| LI | Liberty Seed, P.O. Box 806, New Philadelphia, OH 44663 |
| MB | Malmborg's Inc., 5120 N. Lilac Dr. Brooklyn Center, MN 55429 |
| MK | Mikado Seed Growers Co., Ltd., 1208 Hoshikuki, Chiba City 280, Japan 0472 65-4847 |
| ML | J. Mollema & Sons, Inc., Grand Rapids, MI 49507 |
| MM | MarketMore, Inc., 4305-32nd St. W., Bradenton, FL 34205 |
| MN | Dr. Dave Davis, U of MN Hort Dept., 305 Alderman Hall, St. Paul, MN 55108 |
| MR | Martin Rispins & Son, Inc., 3332 Ridge Rd., P.O. Box 5, Lansing, IL 60438 |
| MS | Musser Seed Co., Inc., Twin Falls, ID 83301 |
| MWS | Midwestern Seed Growers, 10559 Lackman Road, Lenexa, Kansas 66219, Ph: (800) 873-7333 |
| NE | Neuman Seed Co., 202 E. Main St., P.O. Box 1530, El Centro, CA 92244 |
| NI | Clark Nicklow, Box 457, Ashland, MA 01721 |
| NU | Nunhems (see Canners Seed Corp.) |
| NZ | Nickerson-Zwaan, P.O. Box 19, 2990 AA Barendrecht, Netherlands |
| OE | Ohlsens-Enke, NY Munkegard, DK-2630, Taastrup, Denmark |
| OS | L.L. Olds Seed Co., P.O. Box 7790, Madison, WI 53707-7790 |
| P | Pacific Seed Production Co., P.O. Box 947, Albany, OR 97321 |
| PA/PK | Park Seed Co., 1 Parkton Ave., Greenwood, SC 29647-0002 |
| PE | Peter-Edward Seed Co., Inc., 302 South Center St., Eustis, FL 32726 |
| PL | Pure Line Seeds Inc., Box 8866, Moscow, ID |
| PM | Pan American Seed Company, P.O. Box 438, West Chicago, IL 60185 |
| PR | Pepper Research Inc., 980 SE 4 St., Belle Glade, FL 33430 |
| PS | Petoseed Co., Inc., P.O. Box 4206, Saticoy, CA 93004 |
| R | Reed's Seeds, R.D. #2, Virgil Road, S. Cortland, NY 13045 |
| RB/ROB | Robson Seed Farms, P.O. Box 270, Hall, NY 14463 |
| RC | Rio Colorado Seeds, Inc., 47801 Gila Ridge Rd., Yuma, AZ 85365 |
| RG | Rogers Seed Co., P.O. Box 4727, Boise, ID 83711-4727, Ph: (208) 322-7272, Fax: (208) 378-6625 |
| RI/RIS | Rispens Seeds, Inc., 3332 Ridge Rd., P.O. Box 5, Lansing, IL 60438 |
| RS | Royal Sluis, 1293 Harkins Road, Salinas, CA 93901 |
| RU/RP/RUP | Rupp Seeds, Inc., 5-17919-B, Wauseon, OH 43567 |
| S | Seeds Trust, P.O. Box 1048, Halley, ID 83333-1048 |
| SI | Siegers Seed Co., 8265 Felch St., Zeeland, MI 49464-9503 |
| SK | Sakata Seed America, Inc., P.O. Box 880, Morgan Hill, CA 95038 |
| ST | Stokes Seeds, Inc., 737 Main St., Box 548, Buffalo, NY 14240 |
| SU/SS | Sunseeds, 18640 Sutter Blvd., P.O. Box 2078, Morgan Hill, CA 95038 |
| SW | Seedway, Inc., 1225 Zeager Rd., Elizabethtown, PA 17022 |
| T | Territorial Seed Company, P.O. Box 157, Cottage Grove, OR 97424 |
| TR | Territorial Seed Company, 20 Palmer Ave., Cottage Grove, OK 97424 |
| TS | Tokita Seed Company, Ltd., Nakagawa, Omiya-shi, Saitama-ken 300, Japan |
| TW | Twilley Seeds Co., Inc., P.O. Box 65, Trevose, PA 19047 |
| V | Vesey's Seed Limited, York, Prince Edward Island, Canada |
| VL | Vilmorin Inc., 6104 Yorkshire Ter., Bethesda, MD 20814 |
| VS | Vaughans Seed Co., 5300 Katrine Ave., Downers Grove, IL 60515-4095 |
| VTR | VTR Seeds, P.O. Box 2392, Hollister, CA 95024 |
| WI | Willhite Seed Co., P.O. Box 23, Poolville, TX 76076 |
| ZR | Zeraim Seed Growers Company Ltd. P.O. Box 103, Gedera 70 700, Israel |

** We would like to express our appreciation to these companies for providing seeds at no charge for vegetable variety trials.*
*The abbreviations used in this appendix correspond to those listed after the variety names in tables of individual trial reports.*

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