PR-436

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

2000
Fruit and Vegetable Crops

RESEARCH REPORT

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

2000 Fruit and Vegetable Crops Research Report

edited by Brent Rowell

Faculty, Staff, Grower, and Industry Cooperators

Front cover photo courtesy of Brent Rowell.

Far from its home in South America, this variety of *Capsicum baccatum* was grown along with 50 other exotic peppers at the UK Horticulture Research Farm in Lexington as part of a study of capsaicin composition. Capsaicins are compounds that make some peppers hot.

Horticulture
FACULTY
Jerry Brown
Terry Jones
Brent Rowell
John Snyder
John Strang

TECHNICAL STAFF
June Johnston
Dave Lowry
Kay Oakley
Janet Pfeiffer
April Satanek
Dave Spalding
Darrell Slone
Richard Thacker
William Turner
Dwight Wolfe

Entomology
FACULTY
Ric Bessin

TECHNICAL STAFF
Kerry Kirk

Plant Pathology
John Hartman
Bill Nesmith

TECHNICAL STAFF
Paul Bachi
Julie Beale

Agronomy
FACULTY
David Ditsch

Animal Sciences
FACULTY
Joe O'Leary

Cooperative Extension Service
EXTENSION AGENT FOR HORTICULTURE
Tom Brass (Henderson County)

Grower and Industry Cooperators
Bill Papania
Joe O'Leary
Robert Mitchell
Charles Mulligan

Demonstration Cooperators
Joe York
Tim Pope
Butch Case
Clarence Murphy
Ben Cambell
Jefferson Calico
Greg Young
Donnie Coulter
John Wilhoit
Jimmy Roberts
Glen Abney
Scott Essex

Contents

Fruit and Vegetable Program Overview

Dewayne Ingram, Chair, Department of Horticulture

The faculty, staff and students in the University of Kentucky's vegetable and fruit program are pleased to offer the *2000 Fruit and Vegetable Crops Research Report.* This report is one way we share information generated from a coordinated research program involving contributions from several departments in the UK College of Agriculture. The University of Kentucky is your primary land-grant university and as such, our interdisciplinary teams of faculty, staff, and students focus their efforts on the complex needs and opportunities facing fruit and vegetable growers in the state. The research areas on which we concentrate reflect stated industry needs, expertise available at UK, and the nature of research programs in neighboring states and around the world that generate information applicable to Kentucky. If you have questions and/or suggestions about a particular research project, please do not hesitate to contact us.

Although the purpose of this publication is to report research results, please find below some highlights of how our Extension program and undergraduate and graduate degree programs are this year addressing the needs of the fruit and vegetable industries.

Extension Highlights

Extension programs targeted to Kentucky's fruit and vegetable industries include highly visible activities and some more subtle ones. The statewide and area educational conferences and seminars and the on-farm demonstrations shown during twilight farm tours are probably the most visible. Print publications, Web documents, videos, slide sets, newsletters, magazine articles, newspaper articles, radio spots, and television programs are important, visible elements of our Extension program. Activities that you may not see, however, are things like the horticultural training programs for county Extension agents, the work of the UK Plant Disease Diagnostic Laboratory, and soil testing and interpretative services.

Although many facets of the Extension program are conducted by the team of subject matter specialists and county agents, this year we would like to highlight the work of county Extension agents for horticulture.

The number of positions for county Extension agents for horticulture has increased from three to 17 in the last decade, due to the significant demand for horticulture educational programs at the county level. Each of the 120 counties have Extension agents for the program areas of Agriculture, Family and Consumer Sciences, and 4-H/Youth Development that are cooperatively funded by state, county and federal funds.

Additional agents, such as those specializing in horticulture, are funded entirely by the county. The horticulture agents are primarily located in counties with a large population center and target a major portion of their programming to consumers, mainly homeowners. A portion of their time is invested in the educational programs and service support for commercial horticultural industries. Although the size of each horticultural commodity and educational opportunities differ among counties, at least one segment of the commercial horticulture industry is important in each of these counties.

It is important to note that the county Extension agents for horticulture are part of the team of faculty, staff, agents, and students addressing horticultural opportunities through education and research. While much of their efforts is geared toward home horticulture, many of these individuals have had vital impact on commercial fruit and vegetable industries in their counties. You will see many of them working at the fruit and vegetable crops winter meeting and other events. However, I wanted to introduce them to you again here. They are:

Boone County —Michael Klahr
Campbell County—David Koester
Daviess County—Annette Meyer
Fayette County—Candace Harker
Franklin County—Edie Greer
Hardin County—Amy Aldenderfer
Henderson County—Thomas Brass
Hopkins County—Amy Fulcher
Jefferson County—Donna Michael (KSU)
Jefferson County—Vacant
Kenton County—Don Smyers
McCracken County—Kathleen Keeney
Nelson County—Robbie Smith
Pulaski County—Beth Galloway
Shelby County—Tim McClure
Warren County—Michelle Johnson
Woodford County—Patricia Savage

Undergraduate Program Highlights

The department offers areas of emphasis in horticultural enterprise management and horticultural science within a plant and soil science B.S. degree. The plant and soil science degree program had over 110 students in the fall semester of 2000, of which almost one-half were horticulture students and another one-third were turfgrass students. Six horticulture students graduated in 2000.

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 UK Horticulture Club and field trips during course laboratories, students have excellent off-campus learning experiences. Here are the highlights of such opportunities in 2000:

- A three-week study tour of Western Europe was led by Drs. Robert E. McNiel, Winston C. Dunwell, Robert L. Geneve, and Jack W. Buxton involving eight students.
- Horticulture students competed in the 2000 Associated Landscape Contractors of America (ALCA) Career Day competition at Mississippi State University in March (Dr. McNiel, faculty advisor).

- Students accompanied faculty to regional/national/international meetings, including: the Southern Region of the American Society for Horticultural Science Annual Conference, the Kentucky Landscape Industries Conference and Trade Show, the Southern Nurserymen Association Trade Show, and the Green Industry Expo, and the annual meeting of the Kentucky Vegetable Growers Association.

A complete list of students and student activities can be viewed at <http://www.uky.edu/StudentOrgs/Horticulture>.

Graduate Program Highlights

The demand is high for graduates with M.S. or Ph.D. degrees in horticulture, entomology, plant pathology, agricultural economics, and agricultural engineering. Our M.S. graduates are being employed in the industry, the Cooperative Extension Service, secondary and postsecondary education, and governmental agencies. Graduate students contribute significantly to our ability to address problems and opportunities important to the Kentucky fruit and vegetable industries.

Life in the Slow Lane 2000

Brent Rowell, Extension Vegetable Specialist

This publication, *2000 Fruit and Vegetable Crops Research Report,* highlights results from the past year's variety trials and other research projects in Kentucky, including those for bacterial spot resistant bell peppers, hot and specialty peppers, sweet corn, blueberries, hard squash, and seedless watermelon as well as a cucumber beetle control trial in muskmelons, apple tree pruning method comparisons, and results of our on-farm demonstration program with tobacco growers.

An ongoing variety testing program producing reliable results in at least three major geographic regions of the state is needed just to preserve existing levels of competitiveness and development of the vegetable and other horticultural industries in Kentucky. We are doing only a fair job of vegetable crops research compared with other states in the region. For example, at this point in time there is no vegetable variety testing program west of Lexington in spite of the formation of significant new growers' associations in the western half of the state. There have been serious cuts in support staff and facilities available to conduct variety testing at each of the three research farms (Lexington, Quicksand, Princeton). We are presently making do with temporary employees paid for by temporary federal grant money.

It is unfortunate that Kentucky has been unwilling to step up to the plate and make the public investments required to support the type of applied, "low-tech" research described above, which is not pie-in-the-sky research conducted from an ivory tower. We simply want to do enough to enable growers to make a good living in farming. And to do that, we must keep abreast of new varieties, new sources of resistance to pests, new crops for niche markets, and new production techniques— especially true given today's competitive, complex, and rapidly changing marketplace.

But like a ripe melon, the hope that Phase I tobacco settlement funds might be used to build an adequate applied research infrastructure in horticulture[1] appears to have a brief shelf life. While an "entrepreneurship center" and other needed marketing initiatives will be funded, it appears considerably less likely that something will be done to ensure the establishment of an adequate support system of targeted horticultural research and Extension efforts.

Horticultural crops in general and vegetable crops in particular are the front line crops that most tobacco growers turn to first when they consider alternative crops. Little is being done to ensure that the requisite personal help and relevant information will be available for the flood of Kentucky's new horticultural entrepreneurs.

While it is still possible to drive our Model A Ford on many Kentucky backroads, it could prove difficult keeping up with the SUVs as we move onto the interstate highways of regional and national produce markets.

---

[1] See Tomato Saviors, Silver Bullets, and Tobacco Alternatives, pp. 7-10 in *Fruit and Vegetable Crop Research Report 1999*, University of Kentucky (publication PR-423).

Getting the Most Out of Research Reports[1]

Brent Rowell

The *2000 Fruit and Vegetable Crops Research Report* includes results of 16 field trials that were conducted at four locations in Kentucky (see map, below). The research was conducted by faculty and staff from several departments within the University of Kentucky College of Agriculture, including Horticulture, Entomology, and Plant Pathology. Most of these reports are of crop variety (cultivar) trials.

Growers usually put variety trials at the top of the list when rating projects at a public institution's research station. These trials provide a wealth of information not only to growers, but also to Extension agents, researchers, and seed companies. The reports also provide us with much of the information we need in order to include varieties in our *Vegetable Production Guide for Commercial Growers* (ID-36).

The main purpose of variety evaluation is to provide growers with practical information to assist them in selecting the most suitable variety for a given location or market. Here are some guidelines for interpreting the results of fruit and vegetable variety trials:

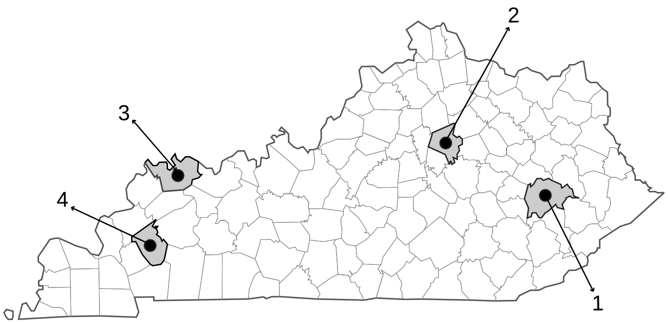
Our Yields vs. Your Yields

Yields reported in variety trial results are extrapolated from small plots. Depending on the crop, our trial plot sizes range anywhere from 50 to 500 square ft. Yields per acre are calculated by multiplying these small plot yields by correction factors ranging from 100 to 1,000. These yields per acre may not be realistic, and small errors can be amplified when correction factors are used. For example, the calculations may overestimate yields because the plots harvested do not include empty spaces normally occupied by things such as drive rows in a grower's field. These empty spaces may result in a higher per acre yield from the research plots compared to a grower's yield.

In some cases research plots may be harvested more often than is economically feasible in a grower's field. So, don't feel inadequate if our yields are higher than yours. You should be concerned, however, if our yields are lower than yours. In that case there may be good reason to suspect that the trial was conducted improperly.

It is not advisable to compare the yield of a variety at one location to the yield of a different variety at another location. The differences in performance among all varieties grown at the same location, however, can and should be used to identify the best varieties for growers nearest that locality. Results vary widely from one location or geographical region to another; a variety may perform well in one location and poorly in another for many reasons. Different locations may have different climates, microclimates, soil types, fertility regimes, and pest problems. Different trials at different locations are also subject to differing management practices. Only a select few varieties seem to perform well over a wide range of environmental conditions, and these varieties usually become the top-sellers.

Climatic conditions obviously differ considerably from one season to the next, and it follows that some varieties perform well one year and perform poorly the next. For this reason we prefer to have at least two years of trial data before coming to any hard and fast conclusions about a variety's performance. In other cases we may conduct a preliminary trial to eliminate the worst varieties while letting growers make the final choices regarding the best varieties for their farm and market conditions (see Rapid Action Cultivar Evaluation [RACE] trial description on page 8).



1. Robinson Station, Quicksand (Breathitt).
2. UK Horticulture Research Farm, Lexington (Fayette).
3. Henderson County Cooperative Extension Service, (Henderson).
4. UK Research and Education Center, Princeton (Caldwell).

Making Sense of Statistics

Most of the trial results reported here use statistical techniques to determine if there are any real (vs. accidental) differences in performance among varieties or treatments. Statistical jargon is often a source of confusion, and we hope this discussion will help. In many cases our trials are replicated, which simply means that instead of taking data from only one plot from one spot in the trial field, we plant that variety (or repeat the spray or fertilizer treatments) in other small plots in several spots in a field. If we test 20 pepper varieties, for example, we will have a small plot for each variety (20 separate plots) and then repeat this planting in two or three additional sets of 20 plots in the same trial field. These repeated sets of the same varieties are called replications, or blocks. The result is a trial field with 20 varieties x 4 replications = 80 small plots. The yield for a variety is reported as the average (also called the *mean*) of yields from the four separate small plots of that variety. The average per acre yields reported in the tables are calculated by multiplying these average small plot yields by a correction factor.

[1] Portions of this article were adapted with permission from "Tips for Interpreting Vegetable Variety Trial Results" by Joe Kemble and Edgar Vinson *in Spring 2000 Commercial Vegetable Variety Trials*, Regional Bull. 5, Auburn University.

In most reports we list the results in tables with varieties ranked from highest to lowest yielding (see Table 1 on page 24.) Small differences in yield are often of little importance, and it is sometimes difficult to separate differences due to chance or error from actual differences in performance of varieties. The last line at the bottom of most data tables will usually contain a number that is labeled *LSD*, or *Waller-Duncan LSD*. LSD is a statistical measure that stands for "Least Significant Difference."

The LSD is the minimum yield difference that is required between two varieties before we can conclude that one actually performed better than another. This number enables us to separate real differences among the varieties from chance differences. When the difference in yields of two varieties is less than the LSD value, we can't say with any certainty that there's any real yield difference. In other words, we conclude that the yields are the same. For example, in the table on page 24 cited above, variety 'Consul' yielded 32 tons per acre and 'Boynton Bell' yielded 30 tons per acre. Since the difference in their yields (32-30 = 2 tons per acre) is less than the LSD value of 4.5 tons per acre, there was no real difference between these two yields. The difference between 'Consul' and 'Legionnaire' (32-26 = 6), however, is greater than the LSD, indicating that the difference between the yields of these two varieties is real.

Sometimes these calculations have already been made, and statistical comparisons among varieties are indicated by one or more letters (a, b, c, etc.) listed after the yields in the tables (see Table 2 on page 25). If yields of two varieties are followed by one or more of the same letters, they are considered to be identical (statistically speaking, that is). Yields of two varieties are different if they have no letters in common. In this example, the AUDPC values of 'X3R Ironsides' and 'X3R Chalice' are both followed by an 'a,' so they are not different, while values for 'X3R Ironsides' and 'Crusader' have no letters in common, indicating that the difference between them is real (that is, statistically significant).

What is most important to growers is to identify the best varieties in a trial. What we usually recommend is that you identify a group of best performing varieties rather than a single variety. This is easily accomplished for yields by subtracting the LSD from the yield of the top-yielding variety in the trial. Varieties in the table having yields equal to or greater than the result of this calculation will belong in the group of highest yielding varieties. If we take the highest yielding pepper variety, 'RPP 6088', in Table 1 (page 24) and subtract the LSD from its yield (32.1-4.5 = 27.6), this means that any variety yielding 27.6 tons per acre or more will not be statistically different from 'RPP 6088.' The group of highest yielding varieties in this case will include the 15 varieties from 'RPP 6088' down the column through variety 'X3R Red Knight.'

In some cases there may be a large difference between the yields of two varieties, but this difference is not real (not statistically significant) according to the statistical procedure used. Such a difference can be due to random chance, but often it occurs if there is a lot of variability in the trial. An insect infestation, for example, could affect only those varieties nearest the field's edge where the infestation began.

It is also true that our customary standard for declaring a statistically significant difference is quite high, or stringent. Most of the trial reports use a standard of 95% probability (expressed in the tables together with the LSD as $P < 0.05$ or $P = 0.05$). This means that there is a 95% probability that the difference between two yields is real and not due to chance or error. When many varieties are compared (as in the pepper example above), the differences between yields of two varieties must often be quite large before we can conclude that they are really different.

After the group of highest yielding, or in some cases, highest income[2], varieties (see Figures 1 and 2 on page 24) has been identified, growers should select varieties within this group that have the best fruit quality (often the primary consideration), best disease resistance, or other desirable trait for the particular farm environment and market outlet being considered. One or more of these varieties can then be grown on a trial basis on your farm using your cultural practices.

Producers should also ask around to find out if other growers have had experience with the varieties in question. Growers who belong to a marketing cooperative should first ask the co-op manager about varieties, because in some cases buyers have specified the variety to be grown and packed by the co-op. Good marketing plans start with the customer's (market) requirements and work backwards to determine variety and production practices.

RACE Trials

In cases where there are too many new varieties to test economically or when we suspect that some varieties will likely perform poorly in Kentucky, we may decide to grow each variety in only a single plot for observation. In this case we cannot make any statistical comparisons but can use the information obtained to eliminate the worst varieties from further testing. We can often save a lot of time and money in the process. We can also provide useful preliminary information to growers who want to try some of these varieties in their own fields.

Since there are so many new marketing opportunities these days for such a wide variety of specialty crops, we have decided that this single-plot approach for varieties unlikely to perform well in Kentucky is better than providing no information at all. We hope that RACE trials, described on page 9, will help fill a need and best use limited resources at the research farms. The hot and specialty pepper trial on pages 22-23 is the first example of such a trial.

Hybrid vs. Open Pollinated

In general, hybrid varieties (also referred to as F1) mature earlier and produce a more uniform crop. They often have improved horticultural qualities as well as tolerance and/or resistance to diseases. Hybrid seed is usually more expensive than is seed of open-pollinated (OP) varieties. With hybrid varieties, seeds cannot be collected and saved for planting next year's crop.

---

[2] It is often desirable to calculate a gross "income" variable for vegetable crop varieties that will receive different market prices based on pack-out of different fruit sizes and grades (bell peppers, tomatoes). In these cases yields in each size class/grade are multiplied by their respective wholesale market prices to determine gross returns (= income) for each cultivar in the trial.

Hybrid seed is now available for most vegetable crops that are grown in the United States.

Despite the advantages of hybrids, there are some crops for which few hybrids have been developed (poblano peppers, for example) or for which hybrids offer no particular advantages (most bean varieties). Interest in OP varieties has resurged in home gardeners and market gardeners who wish to save their own seed or who want to grow heirloom varieties for which only OP seed is available. Lower prices for produce in traditional wholesale market channels, however, may dictate that growers use hybrids to obtain the highest possible yields and product uniformity. Selecting a hybrid variety as a component in a package of improved cultural practices is often the first step toward improved crop quality and uniformity.

Where to Get Seeds

A seed source is listed for each variety reported in the trials. Seed source abbreviations with company names and addresses are found in Appendix A at the end of this publication. Because seeds are alive, their performance and germination rate depend on how old they are, where and how they were collected, and how they have been handled and stored. It is always preferable to purchase certified, disease-free seeds from a reputable seed dealer and to ask about treatments available for prevention of seed-borne diseases.

Many factors are considered when making a final choice of variety, including type, fruit quality, resistance or tolerance to pests, how early the variety is harvested, and cost. Keep in mind that some varieties may perform differently than in our trials, especially under different management systems. Producers should test varieties for themselves by trying two to three varieties on a small scale before making a large planting of a single variety. This method will be the best means of determining how well suited a particular variety is for your farm and market.

Variety Information Online

This publication is available online by following the links at: <http://www.ca.uky.edu/agc/pubs/pr/pr436/pr436.htm>. Other useful sources of information for commercial vegetable growers can be found at: <http://www.uky.edu/Agriculture/HLA/veglinks.htm> In addition, results of some pepper and blackberry trials will are posted on UK's New Crops Opportunities Center Web site under current research at: <http://www.uky.edu/Ag/NewCrops>.

Auburn University publishes a variety trial report twice a year in cooperation with several other universities. The Spring 2000 report is posted in pdf (Acrobat) format at: <http://www.ag.auburn.edu/resinfo/vegetables/spring2000.pdf>. Auburn has also provided a good comprehensive database of thousands of vegetable varieties that can be found at: <http://www.ag.auburn.edu/dept/hf/faculty/esimonne/vegetabl.htm>.

Rapid Action Cultivar Evaluation (RACE) trials are:

- a means of getting new information to growers in the least amount of time.
- a cultivar (variety) or cultural practice trial without replication or with a maximum of two replications.
- trials in which preferably the same set of cultivars can be replicated by location—Lexington and Quicksand stations, for example. Cultivars can be grown on station and/or in growers' fields.
- trials that can be applied to vegetables, small fruits, herbs, cut flowers, or other annual ornamentals.
- appropriate for new crops for which the market potential is unknown or, in some cases for existing crops with small niche market potential.
- appropriate for screening a large number of cultivars (not breeding lines) of unknown adaptation.
- appropriate for home garden cultivars (expensive replicated trials are not appropriate for home garden cultivars in most cases).
- a means of addressing new questions about specialty crops without compromising replicated trials of priority crops.
- a good demonstration site for growers to get a general idea of cultivar's performance.

How do RACE trials differ from "observation trials" conducted in the past?

- RACE trials are planted on the best and most uniform plot ground and are well maintained, sprayed, irrigated, etc. They do not serve as guard rows in other replicated trials.
- Crops are harvested at the appropriate time, with accurate record keeping, yield data, and quality information. Results are reported/published, as are replicated trial results.
- Whenever possible, products are evaluated with assistance from and standards of knowledgeable marketers, interested produce buyers, and growers.
- Information obtained should not be used to identify one or two best cultivars, but to eliminate the worst ones from further testing and make recommendations about a group of cultivars that can be put into further trials by growers themselves.

On-Farm Commercial Vegetable Demonstrations

Dave Spalding and Brent Rowell, Department of Horticulture

Introduction

The Department of Horticulture has been conducting on-farm commercial vegetable demonstrations for more than a decade. As a result of drastic cuts (nearly 70%) in tobacco allotments over the last two years, numerous tobacco farmers made requests in 2000 for commercial vegetable demonstration plots. Given the small size and limited budget of the program, we could accommodate only a fraction of those requesting assistance.

On-farm demonstrations were conducted in Bath, Bourbon, Harrison, Lincoln, Marion, Washington, and Woodford counties. The grower/cooperators in both Bath and Harrison counties each grew 2 A of bell peppers and the cooperator in Bourbon county grew 5 A of bell peppers. In Lincoln county, the cooperator grew 1.5 A of staked tomatoes. Cooperators in Marion and Washington counties each grew 1 A of staked tomatoes. The cooperator in Woodford County grew ½ acre of mixed vegetables (staked tomatoes, bell peppers, green beans, sweet corn, cucumbers, summer squash, cantaloupes, watermelons, okra, and pumpkins) for local farmers' market sales. One-acre bell pepper plots were planted in Marion and Washington counties but were abandoned before any harvest was made. In addition to the grower/cooperators, the Extension associate with the UK Department of Horticulture also worked closely with other first-time commercial vegetable growers in Bath, Bourbon, and Marion counties. Data from these Bath and Bourbon county growers are also included in this report.

Materials and Methods

As in previous years, grower/cooperators were provided with transplants, black plastic mulch, and drip irrigation lines for up to 1 A and were allowed to use the Department of Horticulture's equipment for raised bed preparation and transplanting. The cooperators supplied all other inputs, including labor and management of crops. In addition to identifying and working closely with cooperators, county Extension agents took soil samples from each plot and scheduled, promoted, and coordinated field days at each site. The Extension associate made regular weekly visits to each plot to scout crops and make appropriate recommendations.

The bell pepper demonstration plots were transplanted using three different bacterial spot-resistant varieties ('Enterprise,' 'Lexington,' and 'X3R Ironsides'). Peppers were transplanted into 6-inch high raised beds covered with black plastic with drip lines under the plastic. Plants were transplanted 12 inches apart in an offset manner in double rows that were 15 inches apart. Raised beds were 6 ft from center to center. The staked tomato demonstration plots were transplanted with the variety 'Mountain Fresh.' Tomatoes were transplanted into 6-inch-high raised beds covered with black plastic with drip lines under the plastic. Plants were transplanted 18 inches apart in single rows with the raised beds spaced 6 ft apart from center to center. Tomatoes were pruned, staked, and tied using the Florida Weave System. The plots were sprayed with the appropriate fungicides and insecticides on an as-needed basis, and the cooperators were asked to follow the fertigation schedules provided in the *2000-01 Vegetable Production Guide for Commercial Growers* (ID-36). The independent growers in Bath and Bourbon counties provided all their own inputs and equipment. The Extension associate made regular visits to those farms to scout the crops and make recommendations. Production practices on these farms were essentially the same as those for the demonstration plots.

Results and Discussion

The summer of 2000 was a much better growing season than the drought year of 1999. Most of the plots were transplanted in a timely manner, and growing conditions were good. Two of the original bell pepper demonstration plots were transplanted later than the optimum planting period and suffered as a result. Both of these plots were abandoned prior to harvest, and no data could be collected.

Although 2000 wholesale bell pepper prices were moderate, yields were high, resulting in high net returns ranging from $2,000/A to an incredible $5,000/A for the grower/cooperators (Table 1). The Bath county pepper demonstration plot was nearly destroyed by a severe hailstorm after the first harvest. The cooperator fortunately had crop insurance, and this is reflected in returns in Table 1. The independent pepper growers advised by the program achieved $3,309/A and $4,825/A net returns (Table 3). Figures in Tables 1 and 3 include sales of both fresh market green peppers sold through the Central Kentucky Grower's Cooperative in Georgetown and red mature fruits sold to a processor at the end of the harvest season.

Overall, weeds seemed to be the biggest problem for all the growers. Bacterial spot occurred in some pepper fields but never became a serious problem. Bacterial spot, or speck, was common and affected marketable yields in some tomato fields. Relatively low wholesale prices hurt the staked tomato producers the most (Table 2). These plots were located in central Kentucky where harvests were 10 to 14 days later than those of south-central and western Kentucky, where considerably better returns were achieved. The usual midseason glut occurred so that prices had declined by the time production peaked in the central Kentucky demo plots. Returns ranged from a loss of $690/A to a profit of $2,657/A.

The one grower/cooperator in Woodford County who chose to grow a variety of vegetable crops on a half-acre for direct market sales did extremely well, reporting the highest net return of $7,368/A.

Most of the grower/cooperators used migrant labor in their operations and seemed well pleased with the way in which vegetable production complemented their tobacco production. Most of the cooperators and independent growers assisted by this program, all of whom were growing vegetables commercially for the first time, achieved high yields and in the case of bell peppers, exceptional returns. Most of them indicated that they intended to continue vegetable production, with several planning to expand in 2001.

Table 1. Bell pepper costs and returns of grower/cooperators.

Inputs	Bath County (2 A)	Bourbon County (5 A)	Harrison County (2 A)
Plants	$ 1,440.00	$ 2,757.15	$ 1,838.50
Fertilizer	82.00	180.00	82.04
Black Plastic	245.00	680.00	320.00
Drip Lines	270.00	702.00	400.00
Fertilizer Injector	55.00*	55.00*	55.00*
Herbicide	--	33.60	26.80
Insecticide	72.00	349.00	212.00
Fungicide	54.00	348.00	290.05
Water	(320,000 gal)	(1,350,000 gal)	(580,000 gal)
	116.00	651.60**	571.87**
Labor	(119 hrs)	(520 hrs)	(676 hrs)
	812.00***	3,100.00***	4,056.00***
Machine Costs	(51 hrs)	(135 hrs)	(340 hrs)
	240.00	640.00	2,000.00
Co-op Marketing Fees	50.00	100.00	50.00
Total Expenses	3,436.00	9,596.35	9,902.26
Yield	26,760 lb	98,414 lb	67,103 lb
Income	$10,042.53****	$19,613.53	$19,964.67
Net Income	$6,606.53	$10,017.21	$10,062.41
Net Income/A	**$3,303.26**	**$2,003.44**	**$5,031.20**
Dollar Return/ Dollar Input	2.92	2.04	2.02

* Cost amortized over three years.
** Includes cost of fuel and five-year amortized cost of irrigation equipment.
*** Does not include operator and family labor.
**** Includes $3,840 crop insurance payment for hail damage.

Table 2. Staked tomato costs and returns of grower/cooperators.

Inputs	Marion County (1 A)	Lincoln County (1.5 A)	Washington County (1 A)
Plants	$ 204.60	$ 302.40	$ 204.60
Fertilizer	43.40	64.20	93.43
Black Plastic	130.00	195.00	130.00
Drip Lines	145.00	217.50	145.00
Fertilizer Injector	55.00*	55.00*	55.00
Stakes	225.00*	320.00*	225.00*
Herbicide	60.00	--	60.00
Insecticide	94.00	90.00	63.90
Fungicide	112.00	110.00	45.00
Water	(640,000 gal)	(1,310,000 gal)	(520,000 gal)
	680.00**	1,000.00	540.00**
Labor	(698 hrs)	(520 hrs)	(331 hrs)
	4,491.50	3,120.00	1,985.00
Machine	(60 hrs)	(72 hrs)	(56 hrs)
	284.40	341.28	265.44
Total Expenses	6,524.90	5,815.38	3,812.37
Yield	39,525 lb	53,750 lb	30,150 lb
Income	$5,835.63	$9,800.00	$3,696.00
Net Income (loss)	($689.27)	$3,985.00	($116.37)
Net Income (loss)/A	**($689.27)**	**$2,656.67**	**($116.37)**
Dollar Return/ Dollar Input	0.89	1.69	0.97

* Cost amortized over three years.
** Includes the cost of fuel and five-year amortized cost of irrigation equipment.

Table 3. Bell pepper (independent growers, Bath and Bourbon counties) and mixed vegetable (grower-cooperator, Woodford County) costs and returns.

Inputs	Bath County (2 A)	Bourbon County (5 A)	Woodford County (0.5 A)
Plants	$ 1,200.00	$ 1,137.60	$ 209.93
Fertilizer	105.00	77.00	15.00
Black Plastic	291.00	650.00	65.00
Drip Lines	328.00	700.00	80.00
Fertilizer Injector	55.00*	55.00*	21.00*
Herbicide	--	100.00	12.00
Insecticide	84.00	371.50	65.00
Fungicide	125.00	371.50	70.00
Water	(480,000 gal)	(1,300,000 gal)	(55,000 gal)
	280.00**	381.00**	107.41
Labor	(300 hrs)	(850 hrs)	****
	1,800.00***	5,098.50***	
Machine costs	(116 hrs)	(137 hrs)	(13 hrs)
	550.00	650.00	61.62
Total Expenses	4,818.00	9,591.10	706.96
Yield	58,650 lb	192,500 lb	N/A
Income	$11,435.79	$33,715.00	$4,390.80
Net Income	$6,617.79	$24,123.90	$3,683.84
Net Income/A	**$3,308.90**	**$4,824.78**	**$7,367.68**
Dollar Return/ Dollar Input	2.37	3.52	6.21

* Cost amortized over three years.
** Includes cost of fuel and five-year amortized cost of irrigation equipment.
*** Operator and family labor not included.
**** All family and operator labor.

Rootstock and Interstem Effects on Pome and Stone Fruit Trees

Gerald R. Brown and Dwight Wolfe, Department of Horticulture

Introduction

Although apples are the principal tree fruit grown in Kentucky, the hot, humid summers and heavy clay soils make apple production more difficult for growers in this state than those in the major apple producing regions where soil and climate are more favorable. Kentucky still imports more apples than it produces. Peach production can be expected to be erratic because of our extreme temperature fluctuations occurring in the winter and spring.

In spite of these challenges, productive orchards are one of the highest income enterprises suitable for upland rolling soil; they also have a low potential for soil erosion. Also, the strong market for peaches continues to encourage growers to plant peach trees.

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 three provinces in Canada in the Cooperative Regional NC-140 Project: Rootstocks and Interstem Effects on Pome and Stone Fruit.

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 in the future when they become commercially available.

The 1994 and 1999 Apple Rootstock Planting will provide us with needed information on adaptability of the slender spindle and the vertical axe systems to trees grown on our fertile 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.

The NC-140 orchard systems 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 orchard system/rootstock combinations that can be used later by orchardists in Kentucky.

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 has three NC-140 rootstock plantings at the UK Research and Education Center at Princeton:

- 1994 apple rootstock planting consisting of 'Red Gala' on six rootstocks and 10 replications/rootstock. Trees are spaced 13 ft apart within rows 18 ft apart.
- 1999 dwarf and semidwarf apple rootstock planting consisting of two groups of apple rootstocks:
  - i) dwarfing group with 11 rootstocks planted on a 10 x 16 ft spacing.
  - ii) a semidwarfing group with six rootstocks planted on a 13 x 20 ft spacing.
- 1994 peach rootstock planting consisting of 'Redhaven' peach on 12 different rootstocks and eight replications/rootstock. Trees are spaced 16 ft apart within rows 20 ft apart.

Trees of each rootstock were allocated to blocks (rows) in a randomized block design (that is, each rootstock appears once and at random within each block [row]). Soil management is a 6.5 ft herbicide strip with mowed-sod alley ways. Trees are fertilized and sprayed according to UK 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 1999-2000 in Kentucky was mild, followed by a late freeze and adequate rainfall throughout the growing season. Fruit generally had excellent quality in terms of color, size, and flavor.

1994 Apple Semidwarf Rootstock Planting. The 1994 semidwarf 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 the UK Research and Education Center, Princeton.

Table 1. 2000 Results NC-140 1994 Apple Semidwarf Rootstock Planting.[1]

Rootstock[2]	Cumulative Yield per Live Tree (lb)	Picks (lb/tree)	Drops (lb/tree)	2000 Yield (lb/tree)	Fruit Size (oz/fruit)	Mean Pressure of Blush & Offsides (lb)	Percent Soluble Solids	Truck Circumference (in)	Number of Root Suckers
CG.30	386	126	9	134	6.2	16.7	12.5	10.3	11
V.2	340	99	11	110	6.3	15.7	12.1	9.4	1
M.26 EMLA	287	55	9	75	4.9	16.2	11.7	7.9	0
B.9	170	46	4	49	5.4	17.9	12.8	6.1	2
Average	*295*	*90*	*9*	*97*	*5.9*	*16.8*	*12.4*	*8.6*	*4*
LSD (.05)	*95*	*31*	*9*	*31*	*0.9*	*2.9*	*1.1*	*1.5*	*10*

[1] University of Kentucky Research and Education Center, Princeton.
[2] Arranged by cumulative yield in descending order.
Note: Trunk circumference and yield are usually directly correlated.

This planting was established as planned, except for the substitution of B.9 for P.1. Trickle irrigation was installed, and a trellis system was constructed in 1995. The mortality of trees on M.26 (10% survival) differed significantly from trees on the other three rootstocks (100% survival for trees on CG.11 and 90% for the others). The percent soluble solids, the weight of picked and dropped fruit, cumulative yield, 2000 yield, trunk circumference, and the number of root suckers varied significantly by rootstock (Table 1). Flesh firmness did not vary significantly by rootstock.

1999 Dwarf and Semidwarf Apple Rootstock Plantings. This planting consists of two groups of apple rootstocks, a dwarfing group with 11 rootstocks, and a semidwarfing group with six rootstocks. Eight of the dwarfing rootstocks and three of the semidwarfing ones have not been tested at the Princeton station.

Ninety trees out of a possible 108 are included in our planting because 12 were not available for our site (one CG.16N, two CG.13, three CG.41, one CG.814, and four CG.30N). Furthermore, three trees never leafed out after planting (one CG.16T, one CG.16N, and one CG.41N). In spite of the 1999 drought, all the others appear to be alive.

Significant differences were observed for the number of flower clusters/tree and for trunk circumference for both groups of rootstocks (Table 2). Significant differences were observed for growth in trunk circumference for the semidwarfing rootstocks but not for the dwarfing ones. Conversely, the number of root suckers did not vary significantly for either the dwarfing rootstocks or the semidwarfing ones.

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 the 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 in this trial are alive (80% survival). Statistical differences were observed for trunk circumference, 2000 yield, and date of 90% bloom (Table 3), but not for cumulative yield, average fruit weight, number of root suckers, and soluble solids. The Julian date for 10% maturity was 189 for all trees, except for those on Ishtara and Ta Tao, which was 193.

Literature Cited

1. Brown, Gerald R. and Dwight Wolfe. 2000. Rootstock and Interstem Effects on Pome and Stone Fruit Trees. *Fruit and Vegetable Crop Research Report: 1998.* University of Kentucky (publication PR-410:8-11).

2. Brown, Gerald R. and Dwight Wolfe. 2000. Optimal Training of Apple Trees for High-Density Plantings. *Fruit and Vegetable Crop Research Report: 1998.* University of Kentucky (publication PR-410:12-13).

Table 2. 2000 results NC-140 1999 Apple Dwarf and Semidwarf Rootstock Planting.[1]

Rootstock	Trunk Circumference (in)		Trunk Circumference Growth (in)	No. Flowers/ Tree	No. Trees Planted	No. Trees Lost[3]
Dwarfing[2]	Mar 00	Oct 00				
CG.13	3.0	5.2	2.3	155	4	0
G.16N	2.0	4.9	2.9	57	5	1
G.16T	2.0	4.7	2.6	108	6	1
CG.41	2.0	4.1	2.0	42	3	1
Sup.1	2.0	4.0	2.0	79	6	0
Sup.3	2.0	4.0	2.0	71	6	0
CG.179	1.9	4.2	2.3	59	6	0
Sup.2	1.9	4.2	2.3	56	6	0
CG.202	1.9	4.1	2.3	7	5	0
M.9	1.6	3.2	1.6	33	6	0
M.26	1.5	3.3	1.8	12	6	0
Average	*1.9*	*4.2*	*2.2*	*60*	--	--
LSD (0.05)	*1.6*	*0.9*	*0.9*	*61*	--	--
Semidwarfing[2]						
CG.30N	2.4	5.0	2.6	85	2	0
Sup.4	2.4	3.8	1.4	31	6	0
M.7	1.9	4.2	2.3	39	6	0
CG.707	1.7	4.1	2.5	8	6	0
CG.814	1.6	3.8	2.3	12	5	0
M.26	1.5	3.6	2.1	17	6	0
Average	*1.9*	*4.0*	*2.1*	*26*	--	--
LSD (0.05)	*2.4*	*0.7*	*0.7*	*29*	--	--

[1] University of Kentucky Research and Education Center, Princeton.
[2] Ranked by size of trunk circumference at planting, indescending order.
[3] These trees never leafed out after planting (first week in March 1999).

Table 3. 2000 Results 1994 NC-140 Peach Rootstock Planting.[1]

Rootstock[2]	Cumulative Yield/ Live Tree (lb)	2000 Yield (lb/tree)	Trunk Circumference (in) Spring	Average Fruit Wt (oz fruit)	90% Julian Bloom Date
Lovell	390	115	17.6	6.6	82.7
BY 520-8	362	168	16.5	6.0	80.3
CF 305	362	141	16.9	6.0	79.1
Montclar	359	148	17.0	6.3	81.4
BY 520-9	357	152	16.8	6.3	81.7
Rubira	353	159	16.1	6.1	81.1
Stark's Redleaf	351	146	16.5	6.2	82.6
Ta Tao 5	317	84	14.3	5.9	84.7
Tenn Natural	315	128	14.8	5.9	82.0
Bailey	315	121	14.2	6.0	82.3
Ishtara	293	97	12.5	5.7	83.0
Higama	293	121	15.1	6.1	81.4
Average	*340*	*132*	*15.7*	*60.7*	*81.7*
LSD (.05)	*75*	*88*	*1.4*	*0.7*	*2.1*

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

Optimal Training of Apple Trees for High Density Plantings

Gerald R. Brown and Dwight Wolfe, Department of Horticulture

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 made a long-term commitment to help meet this need for effective pruning and training techniques. 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 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 at Princeton in a randomized complete block design with eight treatment combinations (five rows, 32 trees/row). Trunk circumference averaged 2 ft at planting and did not vary significantly among rootstocks. A trellis was constructed, and trickle irrigation was installed. Tree spacing is 8 ft apart within rows with the rows 16.4 ft apart. Soil management is a 6.5 ft herbicide strip with mowed sod alley ways. Trees are fertilized and sprayed according to Kentucky recommendations (1,2). Yield (beginning with 1998), trunk circumference, and maturity indices such as soluble solids and flesh pressure are measured annually.

The trees were trained according to a prescribed treatment protocol (Table 1). Trees began to fill their allotted space in 1999, and leader management was modified to maintain leaders at specified heights (Table 1). Limbs of one tree overlapping or touching those of adjacent trees were headed back into two-year-old wood.

Results and Discussion

Cumulative yield and yield for the year 2000 was significantly less for the light pruning level compared to the other three levels of pruning (Table 2). No differences among the four pruning levels were observed in fruit size (average fruit weight), trunk circumference, number of root suckers, flesh firmness, and soluble solids. Differences between the French axe and slender spindle systems were not observed for any of the above variables. Less than 25% of the time that was spent in previous years was required to train the trees in the year 2000.

This and other plantings are regularly used as demonstration sites for visiting apple growers, Extension personnel, and researchers. The data collected in these trials will help to establish baseline production methods and provide an economic basis 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).

Table 1. Summer pruning/training treatments of the UK-KSHS 1997 apple training study at Princeton, KY.

System	Pruning Level	Amount of 1-Year-Old Wood Left after Heading at Planting	Angle[1]	Limbs[2]	Leader Management 1999[3]	Leader Management 2000[4]
French Axe	Light	Not headed	45°	No	D	12
French Axe	Moderate	12-16 in	45-60°	Yes	C&D	11
French Axe	Moderate	12-16 in	45-60°	Yes	D	11
French Axe	Heavy	8-12 in	60-90°	Yes	D	10
Slender Spindle	Light	Not headed	45°	No	A	9
Slender Spindle	Moderate	14-20 in	45-60°	Yes	B	9 Y
Slender Spindle	Moderate	14-20 in	45-60°	Yes	B	9 Y
Slender Spindle	Heavy	10-14 in	60-80°	Yes	C	9 Z

[1] Angle to which limbs are to be positioned.
[2] For French Axe, yes = completely remove overly vigorous branches with narrow angles when 3 to 6 inches long. For Slender Spindle, yes = completely remove branches that compete with leader, no = limbs not pruned. In 2000, for both training systems, limbs overlapping or touching those of adjacent trees were headed back into 2-year-old wood.
[3] A = weak leader renewal and new leader headed at 12 inches. B = bend leader at 60° angle, alternating direction with every 18 inches 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.
[4] Leaders were maintained at specified heights (in ft) by cutting to an alternate leader when necessary. Y = Alternate leader was bent to horizontal for 6 weeks. Z = alternate leader was "snaked" throughout growing season.

Table 2. Time requirements and effects of summer apple pruning/training treatments on apple yields at Princeton KY, 2000.

Pruning Level—Interval in Weeks[1]	Trunk Circumference (in)	Yield[2] /Tree (lb)		Avg Fruit Wt (oz)	Time Required for Pruning/Training (minutes/trees)[3]				Total Minutes/ Tree	Pruning/ Training (minutes/lb fruit)
		Cumulative	2000		1997	1998	1999	2000		
Light - 1	6.9	30.4	11.2	8.9	12.2	10.2	18.2	4.4	45.0	1.5
Moderate - 2	6.6	47.5	23.4	8.7	09.6	08.6	16.5	3.4	38.1	0.8
Moderate - 1	6.7	43.4	23.7	8.4	11.4	11.1	19.1	2.1	43.7	1.0
Heavy - 1	6.6	42.3	21.4	8.3	11.9	12.0	21.6	2.5	48.0	1.1
Average	*6.7*	*41.4*	*19.9*	*8.7*	*11.3*	*10.3*	*18.9*	*3.0*	*43.5*	*1.0*
LSD (P=0.05)	*0.5*	*7.50*	*6.60*	*0.7*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

[1] The protocol was changed in year 2000 from 1) pruning every week and 2) pruning every other week to pruning once early in the season on all treatments.
[2] Yield is the sum of picked and dropped fruit. Dropped fruit averaged less than 3 lb/tree.
[3] Total summer pruning and training periods were 14 weeks (1997), 12 weeks (1998), 16 weeks (1999), and four weeks (2000).

Practices of Kentucky Apple Growers and Cider Producers

Ric Bessin and Kerry Kirk, Department of Entomology; John Hartman, Department of Plant Pathology; Joe O'Leary, Department of Animal Sciences; and Jerry Brown and John Strang, Department of Horticulture

Introduction

A survey was sent to apple growers and cider producers in Kentucky to determine common practices, with a focus on food safety in several areas of production including:

- cultural practices.
- pest management.
- harvest.
- sanitation practices, with special attention to microbial contamination, production amounts, pesticide usage, and key problems.

Survey results will be used to design educational materials for both producers and consumers in an ongoing effort to ensure the high quality and safety of apple products and the continued productivity of Kentucky apple growers.

Materials and Methods

The survey contained 70 questions, which included 62 graded multiple choice questions and eight open response questions. The questions were grouped to cover the following topics.

- Cultural practices—manure handling and exposure.
- Pest management—pest monitoring, pesticide usage, weed management, soil testing, equipment usage, and calibration.
- Harvest and juicing—techniques, sanitation, and packaging.
- Storage facilities—sanitation, storage, and treatment of produce.
- Water—sanitation and usage.
- Workers—education and sanitation.
- Production amounts—apples and cider.
- Pesticide amounts—applications of fungicides/bactericides, insecticides, and herbicides.
- Key problems reported—disease, insect, and production problems.

Addresses of potential growers were obtained using current subscription information from a grower mailing list, grower directories, and phone records. It should be noted that not all addresses were strictly those of apple producers, as the mailing list and grower directories were for producers of all fruit types in Kentucky. A total of 110 surveys were sent out. Responses to the first mailing were few, so another mailing to the addresses that did not respond to the first attempt was made within 60 days. Phone numbers were available for some addresses, and surveys were filled out by telephone for respondents at some of these addresses. A total of 31 surveys were completed. It can be expected that many of the surveys were not completed or returned due to bad addresses, nonapplicability, or lack of interest.

Results and Discussion

Growers reported a total of 439 A of apples, with the largest farm at 118 A and the smallest at 0.06 A. The survey sample represents about 44% of the total apple acreage in the state (total Kentucky apple acreage is estimated at about 1,005 A). The average farm size reported was 14.7 A. Cider production amounts were reported from 13 growers in the open response questions, but 18 growers answered cider production questions. From those listing a production amount, 31,650 gal of apple cider was produced, with the average farm producing 2,434 gal. Only about one-third of the growers reported that they had purchased apples for cider production in the past. About 27% reported producing cider for other growers.

Most growers surveyed were implementing IPM principles, understood the importance of disease forecasting, water quality, worker cleanliness, proper use and rates of pesticides and pesticide application equipment, and orchard cleanup. The survey showed, however, that more could be done in soil, foliar, and water (pH) testing, pheromone trapping, and degree-day monitoring of pests to improve pesticide application timing. Over half the growers surveyed reported at least some confusion about using pesticides so that the chance of pesticide resistance development would be reduced.

Protecting fruit from microbial contamination was a major part of the survey. Growers appear to have a solid understanding of how to prevent microbial contamination of fruits. They reported knowledge of the importance of cleaning storage and processing equipment, not using damaged or dropped fruit for cider production, and chilling cider after production.

Practices that need to used more widely by growers include:

- apple sanitization prior to cider production when pasteurization is not used.
- coding of juice containers with lot numbers to aid in the event of future recall.
- cider pasteurization and microbial testing.
- use of expiration dates on containers.
- education of field workers to minimize microbial contamination during harvest.

Pasteurization is expected to increase rapidly due to the Kentucky Department of Agriculture helping apple growers purchase equipment through cost sharing.

The following cider production data were reported:

- 18% of producers have added preservatives to their cider.
- 18% use an expiration date on their containers.
- 18% have pasteurized their cider at least once.
- 11% have performed microbial testing of their cider.
- 39% have coded containers with lot numbers.
- 84% sell cider directly to the consumer.
- 89% clean and sanitize equipment daily.
- 93% refrigerate cider immediately following production.
- 89% store cider in a refrigerator or freezer until sale.
- 33% have purchased apples for cider production at one time or another.

When asked about key insect, disease, and production problems, answers varied. The top three answers for each of these categories in descending order, were:

- Insects: (1) scale, (2) codling moth and mites —tied for second, and (3) aphids.
- Diseases: (1) apple scab, (2) sooty blotch, and (3) cedar apple rust.
- Production problems: (1) weather, (2) labor, and (3) pruning, time, pollination, insect pests, and thinning—all tied for third place.

The number of pesticide applications/crop varied greatly. Fungicide/bactericide applications varied the most, with a high of 20 applications and a low of one application. The average was nine. This trend also was shown in insecticide and to a lesser extent, herbicide application numbers. Insecticide applications averaged eight/crop, with a high of 16 applications and a low of two. There were fewer herbicide applications overall, with an average of two applications/crop, a high of 11, and a low of none.

Conclusion

The information gleaned from this survey is being used to help design educational programs and materials for Kentucky apple growers, cider producers, and consumers. Based on the survey, certain areas need attention, including:

- cider pasteurization.
- worker education.
- using available means to time pesticide applications more effectively (pheromone trapping, degree-day forecasting, etc.).
- benefits of container coding.
- apple sanitization practices.
- pesticide resistance management.

It is possible that education and implementation of at least some these procedures will reduce the number of sprays by growers who responded in the survey that they had made the most pesticide applications.

Eastern Kentucky Blueberry Cultivar Trial

R. Terry Jones, William Turner, and John C. Snyder, Department of Horticulture
David C. Ditsch, Department of Agronomy

Blueberries are native to Kentucky. While limited commercial acreage has been established in Kentucky, blueberries have an excellent potential for local sales and U-pick operations. Recent research into the health benefits of small fruits like blueberries may help further boost sales.

Materials and Methods

Two blueberry plantings were established in the fall (October) of 1996 at the University of Kentucky Robinson Station at Quicksand and the Laurel Fork Demonstration Site in the southeastern corner of Breathitt County. Growth, yield, and survival of various blueberry cultivars were compared between a normal silt loam site (Robinson Station) and a disturbed mine site (Laurel Fork). The plantings consisted of eight to 12 rows of various cultivars in a randomized complete block design. Plants were 4 ft apart in raised beds 14 ft apart. Drip irrigation with point source emitters (2 gph/plant) was installed shortly after planting. Plants were fertilized beginning in the spring of 1997. One application of 5 lb/100 ft of 5-20-20 followed by a side-dressing of 2 lb ammonia sulfate/100 ft of row at bloom was applied each year. Netting was used at both sites to prevent loss due to birds. The Laurel Fork site is also at a higher elevation, and apple tree bloom stages at this site are seven to 10 days later than similar cultivars at Quicksand.

Results

Sixteen cultivars at Quicksand and 13 cultivars at Laurel Fork were tested, and results are shown in Tables 2 and 3, respectively. At Quicksand, Briggitta, Reka, Bluejay, and Bluegold were the highest yielding cultivars. Bluejay and Bluegold were not significantly different from Bluecrop, Duke, or Sierra. Toro had the largest berry size, which was not significantly different from Blueray, Ozarkblue, Briggita, Spartan, Patriot, or Bluecrop. Duke was the earliest maturing blueberry, with 70% of its fruit picked during the first two harvests.

At Laurel Fork, Reka was the highest yielding blueberry. Reka had 54% more fruit than the second highest yielding blueberry cultivar at this site (Bluegold). Bluegold, Patriot, Duke, Nelson, Bluecrop, Bluejay, and Sierra all had yields that were not significantly different from each other. Nelson had the largest berries at Laurel Fork, followed by Duke, Blueray, Toro, Briggitta, Bluecrop, Patriot, Sierra, and Bluegold. These were not significantly different from Nelson or each other. Duke was again the earliest maturing blueberry cultivar, with 81% of its fruit harvested during the first two pickings. In trials at Princeton, Duke was also the earliest maturing cultivar tested.

In general, the blueberry yields were higher on the undisturbed soil site at Quicksand, and the plants at Quicksand were slightly larger than those on the mine spoils. Reka seemed to have high yields and vigorous growth (growth data not shown) at both sites. For some reason Briggitta, the highest yielding cultivar at Quicksand, did not do as well at Laurel Fork. These data represent only the first harvest response of the various cultivars after three-and-a-half years of growth. Additional harvests and observations will be needed to determine which cultivars are the best performing over time in Kentucky.

For additional blueberry information and trial results, see also:

— Strang, John, R. Terry Jones and G. R. Brown. 1989. *Growing Highbush Blueberries in Kentucky.* University of Kentucky College of Agriculture Cooperative Extension Service (publication HO-60).

— Wolfe, Dwight and Gerald Brown. 1998. Blueberry Cultivar Trial. *Fruit and Vegetable Crop Research Report: 1998.* (publication PR-410: 17).

— Wolfe, Dwight and Gerald Brown. 1999. Blueberry Cultivar Trial. *1999 Fruit and Vegetable Crops Research Report. (*publication PR-410:17).

Table 1. 1996 Laurel Fork and Quicksand Blueberry Soil Test Results.

Location	pH	Buf-pH	P	K	Ca	Mg	Zn
			------------ lb/A				------------
Laurel Fork Mine Site[1]	5.9	7.2	46	206	1057	541	10.7
Quicksand	5.7	6.5	14	173	1497	126	5.1

[1] Mine soil pH adjusted with granular sulfur at 2.5 lb/100 sq ft in late summer 1996 two months prior to planting. Both sites received 2.5 cubic ft of Canadian peat/50 sq ft of bed area prior to raised bed formation. Additional peat of 0.13 cubic ft was placed in each planting hole at the time of planting. Granular elemental sulfur 0.75 lb/100 sq ft was applied to the beds at Quicksand.

Table 2. Yield and quality of blueberry cultivars at Quicksand, KY, 2000.

Cultivar[1]	Fruit Yield (oz)/Bush[2]	Berry Size (oz)/Berry[2]	Visual Size Rating[3]	Taste[4]	Appearance[5]	% Total Fruit First Two Harvests[6]
Briggitta	53.6 A	0.06 ABCD	L	T	A	0
Reka	51.7 A	0.04 EF	SM	ST	A	15
Bluejay	45.1 AB	0.05 CDE	ML	ST	A+	13
Bluegold	39.9 ABC	0.05 CDE	L	SB	A	1
Bluecrop	31.9 BCD	0.06 ABCD	VL	ST	A	14
Duke	29.6 BCDE	0.05 CDE	L	S	A+	70
Sierra	28.9 BCDE	0.05 DE	ML	ST	A	13
Ornablue	28.1 CDE	0.02 F	S	B	A-	0
Toro	25.3 CDEF	0.07 A	VL	ST	A+	23
Ozarkblue	24.8 CDEF	0.06 ABC	L	ST	A	13
Blueray	22.2 DEFG	0.07 AB	VL	B	A	10
O'Neal	14.7 EFG	0.06 BCD	L	S	A+	56
Nelson	14.2 EFG	0.06 BCD	L	ST	A	1
Patriot	13.9 EFG	0.06 ABCD	L	T	A	33
Jersey	10.1 FG	0.05 DE	ML	ST	A	<1
Spartan	7.7 G	0.06 ABCD	L	S	A	49
LSD (P=0.05)	*16.4*	*0.014*				

[1] In descending order of yield.
[2] Numbers followed by the same letter are not significantly different.
[3] S=small, M=medium, L=large, VL=very large.
[4] Taste: S=sweet, T=tart, B=bland.
[5] Appearance: A- =below average, A=average, A+ =above average
[6] Harvest dates 5/31, 6/6.

Table 3. Yield and quality of blueberry cultivars at Laurel Fork Mine Site, 2000.

Cultivar[1]	Fruit Yield (oz) /Bush[2]	Berry Size (oz) /Fruit[2]	Visual Size Rating[3]	Taste[4]	Appearance[5]	% Total Fruit First Two Harvests[6]
Reka	44.2 A	0.04 CD	M	ST	A+	45.7
Bluegold	28.8 B	0.05 ABC	ML	ST	A+	24.2
Patriot	25.6 BC	0.05 ABC	ML	T	A	38.3
Duke	21.6 BCD	0.06 A	VL	S	A+	81.3
Nelson	20.2 BCD	0.06 A	VL	T	A	19.2
Bluecrop	19.6 BCD	0.05 AB	L	ST	A	30.4
Bluejay	19.4 BCD	0.04 BC	M	SB	A	43.7
Sierra	17.0 BCD	0.05 ABC	ML	SB	A	8.0
Toro	15.9 CD	0.06 AB	VL	S	A+	24.7
Briggitta	15.5 CD	0.06 AB	VL	ST	A	3.2
Ornablue	14.9 CD	0.03 D	S	S	A	36.3
Blueray	13.2 DE	0.06 AB	VL	S	A	22.4
O'Neal	2.5 E	0.04 BC	M	B	A	77.2
LSD (P=0.05)	*12.0*	*0.01*				--

[1] In descending order of yield.
[2] Numbers followed by the same letter are not significantly different.
[3] Rated as to size visually. S=small, M=medium, L=large, VL=very large.
[4] Taste: S=sweet, T=tart, B=bland.
[5] Appearance: A=below average, A=average, A+ =above average.
[6] Harvest dates 6/2, 6/7.

Western Kentucky Blueberry Cultivar Trial

Dwight Wolfe and Gerald R. Brown, Department of Horticulture

Introduction

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

Materials and Methods

A blueberry cultivar trial was established in the spring of 1993 at the UK College of Agriculture Research and Education Center in Princeton. The planting consists of eight cultivars spaced 4 ft apart in rows spaced 14 ft apart. The pH was reduced from above 6 to 5.4 with elemental sulfur prior to planting. The planting is mulched yearly with sawdust and is trickle irrigated using 1 gph vortex emitters. The planting is netted during the last week of May, and fruit is harvested from the first week of June through the first week of July.

Results and Discussion

Cumulative yields from 1995 through 2000, the 2000 yield, and average percent fruit ripe by the end of the first and third weeks of June 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, with 68% of Duke's fruit ripening during the first week of June this year. Sunrise also ripened early, with 58% of its fruit ripening during the first week of June. Nelson was the latest ripening cultivar again this year, with a third of its fruit being picked during the first week of July 2000.

These results should be useful to growers in selecting a blueberry cultivar with respect to yield and time of harvest. Avoiding labor peaks and harvest times conflicting with the production and/or harvest of other crops may have to be weighed against the highest yielding cultivar.

Other factors important to cultivar selection are discussed in other publications (1,2).

Literature Cited

1. John Strang, Terry R. Jones and G. R. Brown, 1989. *Growing Highbush Blueberries in Kentucky*. University of Kentucky College of Agriculture Cooperative Extension Service (publication HO-60).

2. Dwight Wolfe and Gerald R. Brown. 1999. Blueberry Cultivar Trial. *Kentucky Fruit Facts.* 1-99:2.

Table 1. Yields of blueberry cultivars in Western Kentucky.[1]

	Yield (lb/bush)		Avg % Ripe Fruit at End of Week in June 2000	
Cultivar[2]	**Cumulative**	**2000**	**1st**	**3rd**
Duke	43.9	11.4	68	100
Sierra	42.6	13.8	0	86
Nelson	37.9	15.7	0	35
Toro	37.4	14.4	0	83
Blue Gold	36.0	11.3	17	87
Bluecrop	35.9	11.2	0	78
Sunrise	25.4	7.6	58	100
Patriot	21.6	5.4	35	93
LSD (P=0.05)	*5.8*	*3.8*	--	--

[1] The planting was established in April 1993. Plant spacing is 4 ft between bushes in rows 14 ft apart. There are three bushes of each cultivar in each replication.

[2] In descending order of cumulative yield (1995-2000).

Bell and Specialty Pepper Evaluations for Bacterial Spot Resistance, Yield, and Quality

Brent Rowell, Terry Jones, Darrell Slone, John Snyder, April Satanek, and Janet Pfeiffer, Department of Horticulture and William Nesmith, Department of Plant Pathology

Introduction

After completing a three-year (1995-97) evaluation of bell pepper cultivars under induced bacterial spot (*Xanthomonas campestris* pv. *vesicatoria* or *Xcv*) and bacterial spot-free environments, we began trials again in 2000 to compare new cultivars with previously recommended cultivars that were either highly resistant ('Boynton Bell') and/or that had attractive fruits ('X3R Wizard'). While spot resistant pepper cultivars with the *Bs2* gene (resistance to *Xcv* races 1, 2, and 3) gained widespread acceptance in the state, a number of new resistant cultivars had been released since 1997. In addition to bells, we also wanted to learn more about a large number of hot and specialty peppers, some of which also carry the *Bs2* gene. Out-of-state buyers expressed a strong interest in sourcing hot and specialty peppers from Kentucky in 2000. Other than jalapeno varieties, we knew little about the performance or adaptation of these other pepper types in the state.

Materials and Methods

Duplicate trials were planted at the UK Horticultural Crops Research Station in Lexington (LEX) and at an isolated location in eastern Kentucky at the Robinson Station in Quicksand (QSND). Seventeen bell pepper cultivars were seeded in the greenhouse at LEX on 17 March, 2000 and 49 hot and speciality cultivars were seeded on 16 March, 2000. Seedlings were grown in 72-cell plastic trays and transplanted to the field on 16 and 17 May in LEX and on 24 May at QSND for bell and specialty peppers, respectively. Each LEX trial received 70 lb/A of N prior to planting supplemented by an additional 64 lb N/A fertigated in 7 to 10 lb increments at weekly or biweekly intervals throughout the season (134 lb N/A = season total). Each trial at QSND received a total of 70 lb N/A fertigated in 15 lb N/A increments at weekly intervals during the growing season.

Plots at both locations consisted of 16 plants in double rows with four replications in a randomized complete block design for bells and in single plots for hot and specialty peppers (see RACE trial guidelines on page 9). All were planted on raised beds with black plastic mulch and drip irrigation. Plants of all cultivars were spaced 12 inches apart in the row with 15 inches between the two rows on each bed. Beds were 6 ft apart from center to center. A tank mix of maneb+fixed copper was applied weekly for bacterial spot control at Lexington.

No preventive treatments were applied at QSND in order to encourage the development of a natural bacterial spot epidemic. Susceptible jalapeno pepper cultivars were planted as guard rows on both sides of the bell and hot/specialty pepper fields at QSND. In contrast to previous trials at QSND, we did not inoculate with *Xcv* and relied on natural epidemic development. Prior to a pumpkin planting in 1999, the field where both bell and specialty trials were located at QSND had been in sod for at least 30 years; peppers had not been grown at that station since 1997. Plots at both locations were treated with either Pounce or Orthene for European corn borer and aphid control.

Twelve new bell cultivars with the *Bs2* gene (Table 2) were compared with resistant controls 'Boynton Bell' and 'X3R Wizard' and with a susceptible control, 'King Arthur'. Other bell pepper cultivars included in the trial were 'Vivaldi,' an early long-fruited cultivar claiming multiple virus resistance, and 'Consul,' a cultivar also claiming multiple virus resistance. Mature green fruits were harvested five times in LEX and three times at QSND. Fruits of 'Vivaldi,' however, were allowed to remain in the field longer and were only picked at the red mature stage.

Marketable fruits were graded and weighed according to size class (U.S. No. 1 extra large, large, medium). We also weighed misshapen fruits, which could be marketed to the food service industry as "choppers." Yields in each size class were multiplied by their respective wholesale market prices to determine gross returns (income) for each cultivar. The income variable has been a good indicator of a cultivar's overall performance, taking into account yields of the different size classes and their price differentials.

Hot and specialty peppers included a group of 16 jalapeno cultivars of which three had the *Bs2* resistance gene ('Sayula,' SAX 7603, 'X3R Ixtapa') and others claiming multiple virus resistance (Table 3). These were compared with 'Mitla,' which was the best performer in previous jalapeno trials. Other pepper types included were four serrano cultivars, three anaheim cultivars, five poblano/ancho cultivars, five Italian/cubanelle cultivars, seven hot banana/wax cultivars, five sweet banana/wax cultivars, and three miscellaneous types (Tables 5 and 6). Two of the banana pepper cultivars had *Bs2* for bacterial spot resistance ('X3R Hot Spot,' 'Pageant').

Fruit appearance ratings. All fruits of each cultivar from all four replications from the fourth harvest (10 Aug) at LEX were laid out in the field for careful examination and quality rating. Overall appearance ratings took several factors into account including, in order of importance: overall attractiveness, shape, smoothness, degree of "flattening" (bell cultivars only), color, and uniformity of shape.

Plant support requirements. Some of the hot and specialty pepper cultivars required staking and tying in these trials, which used close spacings, double rows, and plastic mulch with drip irrigation. All specialty cultivars at LEX were inspected at maximum fruit load to determine if staking and tying were needed; those requiring support are indicated in Tables 5 and 6. Tomato stakes (shorter stakes could also have been used) were driven into the ground at the four corners of individual plots; plants were "fenced in" by running a string (tomato twine) around these four stakes. A single stringing was adequate for some cultivars, but others required two or three successive stringings.

Disease assessment. Disease reaction was measured by visual estimates of the percentage of leaves exhibiting bacterial spot or bacterial spot-like lesions (percent BLS) and by rating the plants for the extent of leaf drop (on a 0 to 5 scale, 0 = no defoliation to 5 = total defoliation). All plots at QSND were assessed twice during the growing season. Percentage assessments (percent BLS) were used to calculate the area under the disease progress curve (AUDPC) for each entry. The AUDPC compares the extent of disease development among the different cultivars and is a good measure of overall disease resistance. A lower AUDPC value indicates a greater degree of resistance than a higher value.

Race determinations. To determine which *Xcv* races were present in our trials at the end of the season, symptomatic leaf samples were collected from 'X3R Ironsides,' 'Boynton Bell,' 'Lexington,' and 'King Arthur' at QSND. A composite sample of all the bell cultivars in the QSND trial was also collected. These samples and samples from specialty cultivars 'X3R Ixtapa' and 'Grande' were collected on 30 Sept (36 days after the final harvest). Samples were also collected from the affected specialty cultivars at LEX on 4 Oct (28 days after the final harvest). Samples were sent to Dr. David Ritchie, Department of Plant Pathology, North Carolina State University, for race determinations. Isolates were inoculated onto leaves of differential cultivars consisting of 'Early Calwonder' and three near-isogenic lines carrying *Bs1*, *Bs2*, or *Bs3*. Dr. Ritchie's lab also conducted tests to determine whether these isolates were resistant to copper and streptomycin.

Results and Discussion

As in previous years, we wanted to encourage disease and evaluate resistance at QSND while keeping the LEX trial free of bacterial spot. A uniform and severe natural spot epidemic developed in both bell and specialty trials at QSND after over 12 inches of rain occurred during the period from 12 June to 12 July; the disease was first observed in the specialty trial. In spite of a consistent spray program at LEX, bacterial spot occurred in 17 of the 49 hot and specialty cultivars planted there. The disease, however, did not spread in the LEX trial beyond the individual cultivar plots that were initially infected as indicated in Tables 3 and 5 (i.e., bacterial spot did not spread to the cultivars shown in Table 6). No symptoms occurred in the adjacent bell pepper trial, where cultivars were evaluated for yield and quality.

Bell cultivars. Total marketable yields, income, and fruit quality characteristics for bell cultivars grown without bacterial spot are shown in Table 1; relative incomes are shown in Figure 1. Most of the cultivars grown under bacterial spot-free conditions were high yielding, with 12 that were not significantly different from the top yielding cultivar RPP 6088 (32 tons/A).

Yields, income, and disease resistance parameters are shown for the same cultivars grown at QSND in Table 2 and in Figure 2 (incomes). There were a number of statistically significant and economically important differences in yields among the same cultivars under heavy disease pressure at QSND where marketable yields ranged from 3 to 19 tons/A (Table 2). By July 12, susceptible cultivars 'King Arthur' and 'Vivaldi' had 80% or more of the plants with symptoms.

The highest yielding (most resistant) group at this location included 'X3R Ironsides,' HMX 9646, 'X3R Chalice' (PS 214596), 'X3R Aristotle' (PS 7273823), and 'X3R Red Knight.' 'Boynton Bell,' one of the highest yielding and consistently most resistant cultivars in previous trials, fell into an intermediate group for yields and resistance that included 'Crusader' (RPP 6110), 'Lexington,' ACX 209, 'Defiance' (XP 12292), 'Legionnaire' (RPP 6089-VP), and RPP 6088 (Table 2).

As expected, susceptible cultivars 'King Arthur,' 'Consul,' and 'Vivaldi' were among the lowest yielding with the most disease in the QSND trial. As in previous trials, 'X3R Wizard' proved to be quite susceptible and low yielding under heavy disease pressure. 'Bennington' (EX 2670168) also appeared to be somewhat susceptible and was low yielding under these conditions. Fruit quality characteristics for bell cultivars are shown in Table 1. 'Bennington' and ACX 209 received the highest fruit appearance ratings, equal to ratings for 'X3R Wizard.' 'Bennington' fruits were as dark green or even darker than fruits of 'X3R Wizard.' Many other cultivars received acceptable appearance ratings, but 'Crusader' and 'Lexington' were rated lower than the others; 'Lexington' fruit quality, however, would have been rated much higher at an earlier harvest date.

Cultivars that were in the highest yielding groups under both epidemic and disease-free conditions and also had acceptable or better fruit quality ratings included 'X3R Aristotle,' 'X3R Ironsides,' 'X3R Chalice,' and 'X3R Red Knight.' The only possible disadvantage to 'X3R Ironsides' was its light-colored fruits, similar in color to those of 'King Arthur,' HMX 9646, and RPP 6088. Although 'X3R Chalice' is yellow at full maturity, it was possible to harvest this cultivar as a mature green bell.

The susceptible cultivar 'Consul' was high yielding with acceptable quality under spot-free conditions. The susceptible elongate cultivar 'Vivaldi' was early maturing and had higher yields than is indicated by the data in Table 1. We had decided this cultivar might be more appropriate for a colored market and therefore waited until full red maturity before harvesting. There were more culls associated with fruit rots as a result of this decision, and a significant number of green fruits remained on the plants after the final trial harvest on 30 Aug.

Jalapenos. Yields and fruit characteristics of the 17 jalapeno pepper cultivars grown in single plot RACE trials at LEX and QSND are shown in Tables 3 and 4, respectively. Three of these cultivars carried the *Bs2* gene. Although we intended to keep the LEX trial free of bacterial spot, symptoms of the disease developed on a number of cultivars (Table 3). In spite of the disease at LEX, most jalapeno cultivars had extremely high marketable yields, ranging from 24 to 42 tons/A with several cultivars exceeding 'Mitla' (Table 3). Among these, RPP 7042-VP (similar to 'Grande') had the most attractive fruits, followed by 'Ballpark.'

Cultivars without the *Bs2* gene that were exposed to severe disease pressure at QSND had low yields (1.5 to 5 tons/A, Table 4). Bacterial spot symptoms and defoliation were low on all three resistant cultivars; yields of 'X3R Ixtapa' and SAX 7603 were relatively high under these conditions, but yields of the third resistant cultivar ('Sayula') were quite low in spite of its resistance.

Serranos. Marketable yields for the four serrano cultivars at LEX ranged from 12 to 24 tons/A, with 'Tuxtlas' having the highest yield and most attractive fruits in spite of bacterial spot infection (Table 5). Under severe disease pressure at QSND, 'Tampico Fiesta' and 'Serrano Chili' appeared to show some tolerance to bacterial spot in spite of the absence of any single gene resistance (Table 7).

Anaheims. Yields of the three anaheim cultivars ranged from 25 to 32 tons/A at LEX; 'Mexiheim' was the highest yielding, and 'Garden Salsa' had smaller but more attractive fruits (Table 5). 'Mexiheim' was also highest yielding at QSND under heavy disease pressure although yields were low; all anaheim cultivars appeared to be susceptible to bacterial spot.

Poblano/anchos. Yields at LEX ranged from 12 to 29 tons/A; where 'Ancho Villa' was the highest yielding with the largest and most attractive fruits (Table 5); fruits of this cultivar, however, were four-lobed, which could be a disadvantage in some markets. All poblano/ancho cultivars were extremely susceptible to bacterial spot (Table 7).

Italian/cubanelles. Yields for the five Italian/cubanelle or frying peppers ranged from 23 to 39 tons/A at LEX (Table 5). ACX 500 had the highest yield (39 tons/A), and 'Aruba' (34 tons/A) had the largest fruit size. 'Corno di Toro' had the most attractive fruits, although they were medium green in color instead of the usual light green or greenish yellow. All of these cultivars appeared to be quite susceptible to bacterial spot with the possible exception of 'Aruba,' which had less disease and yielded 5 tons/A (vs. 0 to 1.7 tons for the other cultivars) under heavy disease pressure at QSND (Table 7).

Hot banana/wax. Seven hot banana or hot wax type peppers were tested, including one with the *Bs2* gene ('X3R Hot Spot,' Table 6). Fruit size and type differed considerably among cultivars in this group; the large-fruited and thick-walled 'Romanian Hot Hybrid' had the highest marketable yield at LEX (38 tons/A). 'X3R Hot Spot' had the highest appearance rating among the long-fruited cultivars (Table 6); this resistant cultivar also had the highest yields under heavy disease pressure at QSND with much less disease and defoliation than the other cultivars in this group (Table 7).

Sweet banana/wax. The five sweet banana or sweet wax cultivars included one with the *Bs2* gene ('Pageant'); yields at LEX ranged from 25 to 41 tons/A (Table 6) with 'Pageant' the highest yielding followed by 'Gypsy.' The popular cultivar 'Banana Supreme' yielded 30 tons/A.

Yields for all cultivars were much lower at QSND where they were exposed to a severe bacterial spot epidemic (Table 7). All cultivars, including 'Pageant,' were affected by bacterial spot; 'Pageant' appeared to be segregating for resistance or was perhaps a mixture of susceptible and resistant plants, with 12 out of 16 plants appearing to be susceptible. 'Market Sweet,' a susceptible cultivar, had about the same level of disease as 'Pageant.'

Miscellaneous. One habanero cultivar, one home garden hot pepper ('Super Chili'), and a large-fruited cayenne type hot pepper ('Mesilla') were included in the trials; yields were high at LEX but much reduced by severe bacterial spot pressure at QSND (Tables 6 and 7, respectively). Although yields were reduced at QSND, the habanero cultivar had only 22% of its leaves with symptoms and little defoliation in spite of not having any single gene bacterial spot resistance (Table 7).

Xcv *races and other pathogens.* Preliminary results have indicated that both *Xcv* races 3 and 6 were present at the end of the season in the QSND bell trial and that at least race 6 was present in the QSND hot/specialty trial. Race 6, for which resistant cultivars are not yet available, was found associated with some of the cultivars appearing to be the most resistant in the trials ('X3R Ironsides' and jalapeno 'X3R Ixtapa') but only race 3 was isolated from lesions on 'Boynton Bell,' 'Lexington,' and 'King Arthur' samples. In addition to *Xcv*, the fungal pathogen *Cercospora* was also present on some samples ('Boynton Bell,' 'Lexington,' and possibly others). In addition, an unidentified pathogen caused raised or edema-like lesions on several cultivars in the QSND trial.

All of the *Xcv* isolates from the QSND trials were sensitive to both copper and streptomycin, indicating that using these materials according to their labels can be effective in controlling bacterial spot under certain conditions.

Pepper types, cultivars, and bacterial spot risk. Kentucky pepper growers experienced periodic devastating bacterial spot epidemics prior to the widespread planting of resistant cultivars after 1995. Interest is increasing in Kentucky and other states in growing hot and specialty pepper cultivars, many of which do not carry any major resistance genes. While there is a significant risk of bacterial spot epidemics associated with the production of some of these cultivars, others can be grown with less likelihood of disaster (Table 8), especially with a sound spray regimen. Our recommendation remains that growers use resistant cultivars whenever possible in conjunction with copper+maneb preventive spray programs. Further research may help determine if and to what extent these sprays can be reduced with resistant cultivars.

Acknowledgments

The authors would especially like to thank Dave Lowry, Kay Oakley, and Larry Blansford for their hard work and generous assistance with these trials. We also appreciate the help of Dr. David Ritchie, Department of Plant Pathology, North Carolina State University, for conducting RACE determinations on our samples collected from selected cultivars with bacterial spot.

Figure 1. Gross dollar returns (incomes)/A for bell pepper varieties under bacterial spot-free conditions in Lexington, KY.

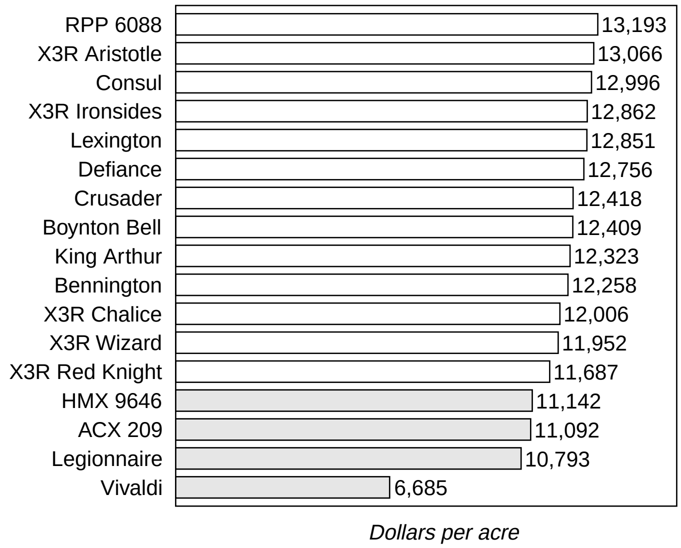


Figure 2. Gross dollar returns (incomes)/A for bell pepper varieties exposed to a severe bacterial spot epidemic at Quicksand, KY.

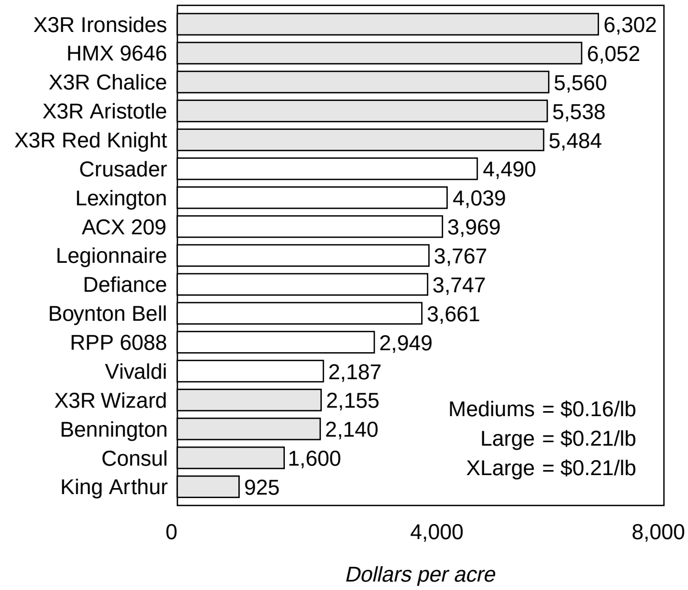


Table 1. Yields, gross returns, and appearance of bell pepper cultivars under bacterial spot-free conditions in Lexington, KY. (Yield and returns data are means of four replications.)

Cultivar	Seed source	Total Mkt Yield[z] (tons/A)	% XL +Large[y]	Income[x] ($/A)	Shape Unif.[w]	Overall Appear.[v]	No. Lobes[u]	Avg Wall Thick.(in)[t]	Fruit Color
RPP 6088	RG	32.1	40	13,193	2	5	3&4	.29	light green
Consul	HM	32.0	34	12,996	3	6	3&4	.30	med. green
X3R Aristotle	PS	31.5	46	13,065	3	6	4	.34	med. green
X3R Ironsides	PS	30.9	38	12,862	4	6	4	.31	light green
Defiance	AS	30.9	58	12,757	3	5	3&4	.32	med. green
Lexington	AS	30.7	51	12,851	2	4	3&4	.31	med.-dk. green
Crusader	RG	30.6	40	12,418	2	4	3&4	.28	med.-dk. green
King Arthur	PS	30.6	46	12,323	2	5	4	.28	light green
Boynton Bell	HM	30.0	46	12,409	3	6	3&4	.28	med.-dk. green
Bennington	AS	29.4	56	12,258	3	7	4	.31	dk. green
X3R Chalice	PS	29.2	37	12,006	3	5	4	.30	med. green[s]
X3R Wizard	PS	28.7	46	11,952	4	7	4	.34	med.-dk. green
X3R Red Knight	PS	28.6	42	11,687	3	5	4	.29	med.-dk. green
HMX 9646	HM	26.7	48	11,142	2	5	3&4	.29	light green
ACX 209	AC	26.7	43	11,092	4	7	3&4	.28	med. green
Legionnaire	RG	26.0	40	10,793	3	6	4	.29	med. green
Vivaldi	VL	16.1	42	6,685	3	6	4	.31	picked red
Waller-Duncan LSD (P<0.05)		*4.5*	*15*	*1,933*					

z Total marketable yield included yields of U.S. Fancy and No. 1 fruits of medium (>2.5 inches diameter) size and larger plus misshapen but sound fruit which could be sold as 'choppers' to food service buyers.
y Percentage of total yield that was extra large (>3.5 inches diameter) and large (>3 inches diameter but ≤3.5 inches diameter).
x Income = gross returns/A; average 2000 season local wholesale prices were multiplied by yields from different size/grade categories: $0.21/lb for extra-large and large, $0.16/lb for mediums, and $0.13/lb for 'choppers,' that is, misshapen fruits.
w Average visual uniformity of fruit shape where 1=least uniform, 5=completely uniform.
v Visual fruit appearance rating where 1=worst, 9=best, taking into account overall attractiveness, shape, smoothness, degree of flattening, color, and shape uniformity; all fruits from all four replications observed at the fourth harvest (10 Aug).
u 3&4 = about half and half three- and four-lobed; 4 = mostly four-lobed.
t Average wall thickness from five 'typical' fruits from one harvest.
s Yellow at maturity.

Table 2. Yields, gross returns, and disease resistance of bell pepper cultivars exposed to a severe bacterial spot epidemic, Quicksand, KY.
(Data are means of four replications.)

Cultivar	Seed Source	Resistance Gene(s)	Total Mkt Yield[z] (tons/A)	Income $/A)[y]	%BLS[x]	Defoln.[w]	AUDPC[v]
X3R Ironsides	PS	Bs2	19.3	6,303	8	0.6	300 a
HMX 9646	HM	Bs2	18.4	6,053	12	0.8	509 a
X3R Chalice	PS	Bs2	16.9	5,560	11	0.4	280 a
X3R Aristotle	PS	Bs2	16.9	5,538	8	0.5	271 a
X3R Red Knight	PS	Bs2	16.7	5,484	13	0.5	444 a
Crusader	RG	Bs2	13.5	4,491	60	1.9	2676 d
Lexington	AS	Bs2	12.4	4,039	40	2.0	1210 c
ACX 209	AC	Bs2	12.2	3,969	13	0.9	577 ab
Defiance	AS	Bs2	11.7	3,747	54	2.6	2349 d
Legionnaire	RG	Bs2	11.5	3,769	23	1.3	1078 bc
Boynton Bell	HM	Bs2, Bs1	11.4	3,661	30	1.3	1206 c
RPP 6088	RG	Bs2	9.0	2,949	56	2.4	2447 d
Vivaldi	VL	--	6.6	2,187	79	3.6	3326 e
Bennington	AS	Bs2	6.5	2,140	63	3.3	2752 d
X3R Wizard	PS	Bs2	6.5	2,155	71	3.4	3298 e
Consul	HM	--	4.9	1,600	82	3.7	3578 e
King Arthur	PS	Bs1	2.9	925	81	4.0	3634 e
Waller-Duncan LSD (P<0.05)	*4.6*			*1,510*	*10*	*0.6*	*505*

[z] Total marketable yield included yields of U.S. Fancy and No. 1 fruits of medium (>2.5 inches diameter) size and larger plus misshapen but sound fruit that could be sold as ‘choppers’ to food service buyers.
[y] Income = gross returns/A; average 2000 season local wholesale prices were multiplied by yields from different size/grade categories: $0.21/lb for extra-large and large, $0.16/lb for mediums, and $0.13/lb for ‘choppers,’ that is, misshapen fruits.
[x] %BLS = average percentage of leaves with bacterial spot or bacterial spot-like symptoms; from two assessments.
[w] Average visual defoliation ratings where 0 = no defoliation, 5 = complete defoliation; from two assessments.
[v] AUDPC = area under the disease progress curve; lower values indicate a greater degree of resistance; means followed by the same letter are not significantly different (P<0.05).

Table 3. Yield and fruit characteristics from single plots of jalapeno pepper cultivars, Lexington, KY, 2000.

Cultivar (resistance gene)	Seed Source	Mkt Yield (tons/A)	Bac. Spot[z]	Fruit Characteristics: Average[y] Ln (in)	Diam (in)	Wt (g)	Wall Thick (in)[x]	Appear. Rating[w]	Color[v]	Comments
Hybrid No. 7	RU	42.0	1	3.3	1.4	33	0.20	6	mg	Tapered; some fruits pointed.
Grande	PS	38.3		3.5	1.3	33	0.20	6	mg	Somewhat tapered; some curved and pointed.
X3R Ixtapa (Bs2)	PS	38.0		3.1	1.2	28	0.18	6	dg	About 15% w/ purpling (anthocyanin).
RPP 7042-VP	RG	37.1		3.5	1.1	26	0.17	8	mg	Slight taper, blunt; longer than most.
Pecos	RG	36.0	2	3.3	1.2	31	0.19	5	mg	Many curved fruits.; tapered and some pointed.
Ballpark	PS	34.7	1	3.9	1.1	30	0.18	7	dg	Longest; no taper, blunt.
Coyame	PS	34.3		3.2	1.2	31	0.19	6	dg	Blunt ends.
Mitla	PS	34.3		2.9	1.2	26	0.21	6	mg	Somewhat tapered, blunt.
Dulce	PS	33.2	1	3.3	1.2	26	0.19	6	vdg	Slight taper, mostly blunt, uniform.
Sayula (Bs2)	PS	33.1		3.3	1.1	24	0.17	6	mg	Slight taper; mostly blunt, some pointed.
SAX 7603 (Bs2)	SK/SW	32.7		3.3	1.3	30	0.18	6	m-dg	Somewhat tapered; blunt.
Tula	PS	31.9	3	3.4	1.3	36	0.20	7	dg	Some pointed and tapered fruits.
Perfecto	HN/AS	31.5		3.3	1.3	28	0.19	6	mg	Tapered; some pointed and curved.
Sierra Fuego	H	31.0	2	2.7	1.2	24	0.17	5	m-dg	Shorter than most; slight taper, blunt.
Delicias	PS	29.0	3	2.8	1.1	26	0.18	7	dg	Very slight taper; blunt.
Summer Heat 5000	AC	26.8		3.1	1.2	27	0.20	6	dg	Slight taper; blunt.
Tam Jalapeno No. 1	RG/PS	24.4		2.8	1.1	19	0.18	6	mg	Very little taper and blunt.

[z] Bacterial spot symptoms were observed in some plots and may have affected yields of those cultivars: 1 = plots with mild infection, 2 = plots with mild to moderate infections, 3 = plots that had moderate to severe infections. A blank in this column indicates that no symptoms were observed; blanks or numbers do not imply resistance or tolerance.
[y] Average of a sample of 10 fruits (length and width); average fruit weight = marketable yields divided by number of fruits (entire season).
[x] Average wall thickness of five 'typical' fruits from one harvest.
[w] Visual fruit appearance ratings where 1 = worst, 9 = best, taking into account overall attractiveness, shape, color, and uniformity.
[v] Lg = light green; mg = medium green; dg = dark green; vdg = very dark green.

Table 4. Disease tolerance and yields from single plots of jalapeno pepper cultivars under severe bacterial spot epidemic conditions, Quicksand, KY, 2000.

Cultivar (resistance gene)	Seed Source	%BLS[z]	Defoln.[y]	Mkt Yield (tons/A)
X3R Ixtapa (Bs2)	PS	2.5	0.0	9.7
SAX 7603 (Bs2)	SK/SW	22	1.0	6.9
Hybrid No. 7	RU	85	4.0	5.1
RPP 7042-VP	RG	62	3.5	5.0
Grande	PS	82	3.5	3.9
Sierra Fuego	H	80	4.0	3.1
Coyame	PS	82	4.0	3.0
Ballpark	PS	75	3.2	2.7
Sayula (Bs2)	PS	10	0.5	2.5
Pecos	RG	75	3.2	2.5
Dulce	PS	67	3.5	2.3
Summer Heat 5000	AC	85	4.0	2.2
Delicias	PS	80	4.5	2.0
Mitla	PS	80	4.0	1.9
Perfecto	HN/AS	80	3.5	1.7
Tam Jalapeno No. 1	RG/PS	80	3.5	1.7
Tula	PS	87	4.5	1.5

[z] %BLS = average percentage of leaves with bacterial spot or bacterial spot-like symptoms; data are averages from two assessment dates.
[y] Visual leaf drop (defoliation) ratings where 0 = no defoliation and 5 = complete defoliation; averages from two assessment dates.

Table 5. Yield and fruit characteristics from single plots of specialty pepper cultivars at Lexington, KY, 2000.

				Fruit Characteristics							
				Average[y]							
type Cultivar	Seed Source	Mkt Yield (tons/A)	Bac. Spot[z]	Ln (in)	Diam (in)	Wt (g)	Wall Thick. (in)[x]	Appear. Rating[w]	Color[v]	Plant Support[u]	Comments
serrano											
Tuxlas	PS	24.4	2	3.4	0.8	11	0.12	8	mg-dg	ben.	Very nice; long and thick.
Tampico Fiesta	HN/AS	20.2		3.0	0.5	8	0.10	7	mg-dg	ben.	Long, not as thick as Tuxtlas.
Serrano Chili	PS	18.0		2.2	0.5	6	0.11	6	mg	ben.	Short (longer than S. Tampiqueno).
Serrano Tampiqueno	RU	12.7		2.0	0.5	4	0.10	5	mg-dg	ben.	Short and stubby.
Anaheim											
Mexiheim	SW	32.1	3	6.2	1.6	48	0.15	6	mg	req'd.	More crescent shapes than other 2 Anaheims.
Anaheim TMR 23	PS	30.9		6.2	1.6	45	0.16	7	mg	req'd.	
Garden Salsa	PS	25.2	1	5.7	1.3	37	0.13	8	mg-dg	req'd.	Very nice, uniform.
poblano/ancho											
Ancho Villa	RG	28.9	2	4.4	2.7	95	0.19	8	mg	req'd.	Very nice; mostly 4-lobed.
Ancho Ranchero	RG	26.5		3.5	2.5	89	0.17	5	dg & lg	req'd.	2 distinct types; cultivar mix?
Ancho San Martin	SW	24.5		3.8	2.4	77	0.15	7	dg	req'd.	2 and 3-lobed.
Ancho 101	RU	20.3	2	3.7	2.6	61	0.17	4	vdg	req'd.	Small; 30-50% 2-lobed.
Ancho Gigantia	RU	12.5	3	3.3	2.5	44	0.15	4	vdg	req'd.	Small; mostly 3-lobed.
Italian/cubanelle											
ACX 500	AC	39.0	1	6.5	2.4	74	0.15	6	lg	ben.	
Aruba	RG	34.1	1	6.0	2.5	101	0.17	6	lg	ben.	
Biscayne	RU	30.6		5.6	2.1	84	0.15	5	gy	ben.	Many crescent-shaped.
Corno Di Toro	RU	27.7	2	5.7	2	74	0.18	8	mg	ben.	Very nice; Anaheim color.
Giant Aconcagua	RU	22.6	1	5.6	2.4	86	0.15	5	gy	ben.	

[z] Bacterial spot symptoms were observed in some plots and may have affected yields of those cultivars: 1 = plots with mild infection, 2 = plots with mild to moderate infections, 3 = plots that had moderate to severe infections. A blank in this column indicates that no symptoms were observed; blanks or numbers do not imply resistance or tolerance.
[y] Average of a sample of 10 fruits (length and width); average fruit weight based on marketable yields divided by number of fruits (entire season).
[x] Average wall thickness of five "typical" fruits.
[w] Visual fruit appearance ratings where 1 = worst, 9 = best, taking into account overall attractiveness, shape, color, and uniformity.
[v] Lg = light green; mg = medium green; dg = dark green; vdg = very dark green; gy = greenish yellow; py = pale yellow; ly = lemon yellow.
[u] Staking with one or more strings may be required using double rows on plastic with drip as indicated by: req'd. = cultivars requiring staking/support; ben. = cultivars that may benefit from staking.

Table 6. Yield and fruit characteristics from single plots of specialty pepper cultivars at Lexington, KY, 2000.

			Fruit Characteristics							
			Average[z]							
type Cultivar	Seed Source	Mkt Yield (tons/A)	Ln (in)	Diam (in)	Wt (g)	Wall Thick. (in)[y]	Appear. Rating[x]	Color[w]	Plant Support[v]	Comments
hot banana/wax										
Romanian Hot Hybrid	RU	38.3	5.5	2.8	94	0.25	6	lg-py	ben.	Very large; pointed pimento shape.
Hungarian Heat	RU	36.5	7.0	1.6	39	0.12	4	gy	poss.	Mostly C-shaped and misshapen.
Hungarian Yellow Wax	RU	33.8	4.3	1.3	34	0.13	6	py-ly	ben.	Large, blunt, pimiento shaped; uniform.
X3R Hot Spot (Bs2)	PS	33.5	5.7	1.4	46	0.17	7	gy	poss.	Somewhat curved.
Inferno	PS	32.5	7.0	1.6	59	0.16	6	gy	poss.	
Santa Fe Grande	PS	27.7	2.8	1.4	21	0.12	7	py	poss.	Jalapeño size and shape; uniform.
ACX 400	AC	26.2	5.1	1.4	28	0.13	5	py	poss.	Many C-shaped and misshapen.
sweet banana/wax										
Pageant (Bs2)	RG	41.2	6.4	1.8	61	0.18	6	py-ly	poss.	Nice, thick, some apostrophe-shaped.
Gypsy	RU	35.6	4.7	2.2	79	0.19	7	py	poss.	Orange at maturity.
Market Sweet	RU	30.4	6.3	1.8	58	0.19	6	py	poss.	Nice, thick.
Banana Supreme	RU	30.4	6.0	1.6	59	0.15	6	gy-ly	ben.	Nice, some C-shaped.
Sweet Banana	RU	25.5	4.8	1.5	40	0.15	4	gy-py	poss.	Many C-shaped and misshapen.
miscellaneous										
Super Chili	RU	10.2	2.3	6.2	4					Numerous small fruits difficult to pick!
Mesilla	PS	16.0	7.7	1.2	44				ben.	Very long, thick cayenne type.
Habanero	HL	10.9	2.0	1.3	10				ben.	Uniform and high yielding; orange at maturity.

[z] Average from a sample of 10 fruits (length and width); average fruit weight based on marketable yields divided by number of fruits (entire season).
[y] Average wall thickness of five “typical” fruits.
[x] Visual fruit appearance ratings where 1 = worst, 9 = best, taking into account overall attractiveness, shape, color, and uniformity.
[w] Lg = light green; mg = medium green; dg = dark green; vdg = very dark green; gy = greenish yellow; py = pale yellow; ly = lemon yellow.
[v] Staking with one or more strings may be required using double rows on plastic with drip as indicated by: req’d. = cultivars requiring staking/support; ben. = cultivars that may benefit from staking; poss. = cultivars that possibly need staking under windy conditions or with heavy fruit loads.

Table 7. Disease tolerance and yields from single plots of specialty pepper cultivars under severe bacterial spot epidemic conditions, Quicksand, KY, 2000.

type Cultivar (resistance gene)	Seed Source	% BLS[z]	Defoln.[y]	Mkt Yield (tons/A)
serrano				
Tampico Fiesta	HN/AS	10	1.0	2.6
Serrano Chili	PS	3	0.0	2.1
Tuxtlas	PS	60	3.5	0.9
Serrano Tampiqueno	RU	45	2.0	0.4
Anaheim				
Mexiheim	SW	72	3.5	2.8
Garden Salsa	PS	75	4.0	1.5
Anaheim TMR 23	PS	80	4.0	0.2
poblano/ancho				
Ancho San Martin	PS	62	3.0	1.6
Ancho Villa	RG	67	3.5	1.0
Ancho 101	RU	85	5.0	0.2
Ancho Gigantia	RU	72	5.0	0.1
Ancho Ranchero	RU	80	4.0	0.0
Italian/cubanelle				
Aruba	RG	40	2.7	5.1
Corno Di Toro	RU	77	4.0	1.7
Biscayne	RU	67	3.5	0.8
ACX 500	AC	72	4.0	0.7
Giant Aconcagua	RU	75	4.0	0.1
hot banana/wax				
X3R Hot Spot (Bs2)	PS	17	1.0	6.7
Romanian Hot Hybrid	RU	52	3.0	6.4
Hungarian Yellow Wax	RU	40	2.5	4.8
ACX 400	AC	42	2.5	4.0
Hungarian Heat	RU	65	3.5	3.4
Inferno	PS	80	4.0	2.1
Santa Fe Grande	PS	50	2.5	1.7
sweet banana/wax				
Market Sweet	RU	67	3.5	6.1
Pageant (Bs2)	RG	62	3.5	5.4
Gypsy	RU	72	3.0	4.6
Sweet Banana	RU	65	4.0	2.5
Banana Supreme	RU	75	4.0	2.4
miscellaneous				
Habanero	HL	22	1.0	2.9
Super Chili	RU	25	2.0	2.8
Mesilla	HM	62	3.5	1.7

[z] %BLS = average percentage of leaves with bacterial spot or bacterial spot-like symptoms; data are averages from two assessment dates.

[y] Visual leaf drop (defoliation) ratings where 0 = no defoliation and 5 = complete defoliation; averages from two assessment dates.

Sweet Corn Cultivar Evaluation in Eastern Kentucky

Terry Jones, William Turner, and John Strang, Robinson Station, Quicksand, KY

Methods

Forty supersweet (sh_2) sweet corn cultivars were planted by hand on 6/1/00. Plots consisted of a 20-ft row of each cultivar replicated four times in a randomized block design. Rows were spaced 3 ft apart, and 100 seeds were planted in each 20-ft row. Four days after planting, 12 pt of Dual II Magnum 7.6E was applied preemergence to control weeds. Because soil moisture levels were low, shortly after planting drip irrigation was installed on 6/12. Stands were rated for germination, vigor, and uniformity on 6/26. Each replication received fertigated applications (6/23, 7/09, 7/18) of ammonium nitrate for a total of 300 lb/A (100 pounds actual nitrogen). Initial soil test results for the plot are shown below; only nitrogen fertilizer was applied to the trial.

2000 Sweet Corn Cultivar Trial Soil Test Results

	---------------------- (lb/A) ----------------------				
pH	P	K	Ca	Mg	Zn
7.4	126	286	5,835	259	16.3

The first fertigated side dressing (50 lb N/A) occurred when plants were approximately 12 inches tall, the second and third applications (25 lb N/A) each when plants were about 24 to 36 inches tall. Supplemental drip irrigation was applied as needed. Pounce or Thiodan was applied during silking for insect control.

Results

This was a good year to evaluate sweet corn cultivars for their ability to tolerate wet soils (lodging) and to pollinate and fill ears under wet weather conditions. Quicksand was among the wettest locations in the state. From 6/1 to mid-August, Quicksand received over 15 inches of rain, primarily during just a few major rain events.

The 2000 sweet corn crop was one of the poorer looking plots ever grown at Quicksand. Excessive soil moisture caused stunting or lodging problems for some supersweet cultivars (Table 1). Viruses, Southern Corn Leaf Rust, and Southern Corn Leaf Blight were also problems for some cultivars. Humid weather conditions may have also led to a greater than normal number of barren stalks or poorly pollinated ears. Despite the weather, a number of supersweet cultivars performed well (Tables 1, 2, 3, and 4).

Flagship II, Bandit, Morning Star, Saturn, Rustler, and Suregold were rated as the six top yielding, best quality yellow sweet corn cultivars (Table 4). Zenith and Attribute also produced nice ears; however, their ratings were slightly lower when compared to the top six cultivars. Suregold suffered more lodging problems than the other seven yellow cultivars mentioned.

Candy Corner, BSS 0977 VP, and BSS 9536 VP were the three best bicolor sweet corns. Candy Corner was an excellent corn and was among the highest rated cultivars in this year's trial (Table 4). No problem with husk coverage was seen.

Ice Queen and White Saturn were the best white cultivars, giving commercially acceptable yields of attractive, high quality ears (Table 4). For some reason many white and bicolor cultivars did not perform well. Fifteen of the worst 16 performing cultivars were either white or bicolor.

TABLE 1. Plant characteristics of supersweet sweet corn cultivars, Quicksand, KY, 2000.

Cultivar	Seed Source	Days to Harvest[1]	Plant Stand[2]	Plant Uniformity[3]	Lodging[4]	Plant Comments
Odyssey BC	SW, S	73	48.8	3.1	1.4	Healthy plants.
Double Dots BC	JS	70	48.7	3.2	2.2	Rust and virus, lodged badly.
Fantasy BC	JS	70	53.0	2.9	1.0	Dwarfed plants, virus, no marketable ears.
Fortune Y	SW	69	79.5	4.0	3.4	Severe lodging, barren stalks.
GS277A BC	ST	69	63.5	3.5	1.8	Small plants, barren stalks.
GS275A BC	ST	71	71.5	4.5	3.5	Severely lodged, badly diseased rust, virus.
Majesty BC	HR, ST	71	51.0	2.2	1.7	Small plants, discolored cob, poor ear fill.
Crystal Cream W	ST	69	72.3	4.4	2.2	Small plants and ears, barren stalks.
FMX 413 W	ST	69	33.5	1.5	1.5	Weak, small plants.
Snow Storm W	ST	70	68.3	3.8	1.5	Small plants many barren stalks.
GS178A	ST	72	75.8	4.3	1.0	Rust and virus, barren stalks.
White Saturn W	SW	70	71.3	4.3	1.0	Healthy plants.
Sugar Burst W	SW	70	51.0	2.9	1.3	Medium plants, virus, barren stalks.
Envy Y	SW	73	69.3	3.9	2.1	Healthy plants, some lodging.
Saturn Y	SW	69	72.3	4.3	1.0	Healthy plants.
Bicolor Saturn BC	SW	70	56.0	3.0	1.0	Healthy plants, some barren stalks.
Flagship II Y	SW	74	79.2	4.3	1.0	Healthy plants.
White Majesty W	SW	72	66.0	3.3	2.4	Virus and rust, plants stunted and lodged.
Attribute Y	NV	75	72.5	4.3	1.3	Healthy plants.
Prime Plus Y	RG, NV	73	73.3	3.9	1.1	Healthy plants, no lodging.
GSS 3587 VP Y	RG, NV	71	70.5	4.3	1.3	Healthy plants.
BSS 0977 VP BC	RG, NV	75	78.8	4.5	1.3	Some small barren plants.
GSS 0978 VP Y	RG, NV	70	48.5	2.3	1.0	Healthy plants.
Impulse Y	RG, NV	68	78.5	4.1	1.0	Small unhealthy plant, some barren stalks.
WSS-1921 VP W	RG, NV	75	57.3	3.6	1.4	Some small barren plants, virus.
Windham W	RG, NV	73	51.8	3.1	2.3	Badly lodged but healthy plants.
BSS 6284 BC	RG, NV	70	67.8	4.0	1.0	Healthy plants, no lodging.
Vail VP W	RG, NV	70	68.3	3.4	3.0	Badly lodged, barren stalks, virus.
BSS 9536 VP BC	RG	70	67.8	4.0	1.0	Healthy plants, no lodging.
Big Time VP BC	RG, NV	72	78.5	3.8	1.3	Healthy plants, a few barren stalks, poor husk coverage.
Millennium W	SW	73	58.0	3.1	4.5	Poor pollination, brittle stalks, badly lodged.
Candy Corner BC	HM	69	79.3	4.5	1.2	Healthy plants.
Twin Star BC	HM	75	43.5	3.0	3.0	Healthy plants but brittle stalks.
Zenith Y	HM	74	67.5	3.4	1.9	Healthy looking plants.
Suregold Y	HM	74	71.3	3.9	2.5	Big healthy plants but more lodging than wanted, long ear shank.
Amazingly Sweet BC	HM	73	57.5	3.5	3.5	Virus and rust. Badly lodged.
Bandit Y	HM	70	74.3	4.8	1.6	Healthy plants.
Morning Star Y	HM	72	70.3	4.5	1.0	Healthy plants a lot of two-eared stalks.
Rustler Y	HM	71	65.7	3.6	1.0	Big healthy plants, no lodging.
Ice Queen W	HR, HM	70	68.8	4.0	1.8	Healthy plants.

[1] Actual days to harvest from June 1, planting date under Quicksand 2000 growing conditions.
[2] Plant stand is percent emergence based on planting 100 seeds.
[3] Plant uniformity 1 = poor, 5 = excellent.
[4] Plant lodging 1 = no lodging; 5 = 100% lodging.
Note: Y=yellow; W=white; BC=bicolor.

Table 2. Plant characteristics and yield/A of supersweet sweet corn cultivars, Quicksand, KY, 2000.

Cultivar	Seed Source	Height to First Ear (in)	Yield Ears (20 ft row)	Yield (dozen ears/A)	Husk Coverage[1]
Odyssey BC	SW, S	31.5	20.0	1,210	8.9
Double Dots BC	JO	26.3	20.7	1,252	9.3
Fantasy BC	JO	-	-	0	-
Fortune Y	SW	29.0	24.3	1,470	9.1
GS277A BC	ST	25.8	18.0	1,089	8.1
GS275A BC	ST	-	18.5	1,119	8.0
Majesty BC	H, ST	30.0	16.0	968	8.5
Crystal Cream W	ST	20.3	10.0	605	7.3
FMX 413 W	ST	22.5	11.5	696	7.8
Snow Storm W	ST	29.8	13.0	787	7.0
GS178A	ST	26.0	17.8	1,077	7.4
White Saturn W	SW	26.8	23.3	1,410	9.8
Sugar Burst W	SW	21.0	13.8	834.9	8.3
Envy Y	SW	32.3	20.0	1,210	9.6
Saturn Y	SW	25.3	29.5	1,785	9.6
Bicolor Saturn BC	SW	28.3	18.3	1,107	9.5
Flagship II Y	SW	35.0	30.0	1,815	10
White Majesty W	SW	24.0	20.0	1,210	8.4
Attribute Y	NV	28.3	23.5	1,422	8.9
Prime Plus Y	RG/NV	26.3	23.5	1,422	8.5
GSS 3587 VP Y	RG/NV	24.8	25.3	1,530	8.5
BSS 0977 VP BC	RG/NV	26.3	25.3	1,531	9.0
GSS 0978 VP Y	RG/NV	25.8	19.0	1,150	9.0
Impulse Y	RG/NV	31.5	24.8	1,500	8.9
WSS-1921 VP W	RG/NV	27.0	20.8	1,258	8.4
Windham W	RG/NV	24.5	23.0	1,392	9.0
BSS 6284 BC	RG/NV	23.0	24.0	1,452	9.0
Vail VP W	RG/NV	24.3	8.2	499	7.3
BSS 9536 VP BC	RG/NV	25.3	25.8	1,561	9.3
Big Time VP BC	RG/NV	30.0	15.8	956	7.2
Millennium W	SW	23.5	23.8	1,440	9.3
Candy Corner BC	HM	28.7	39.0	2,360	10.0
Twin Star BC	HM	28.3	19.3	1,168	10.0
Zenith Y	HM	25.6	23.5	1,422	9.0
Suregold Y	HM	31.0	37.8	2,287	9.3
Amazingly Sweet BC	HM	26.0	04.8	895	8.5
Bandit Y	HM	32.3	36.0	2,178	10.0
Morning Star Y	HM	32.3	41.0	2,481	10.0
Rustler Y	HM	31.3	32.5	1,966	10.0
Ice Queen W	HM	35.3	36.8	2,226	10.0

[1] Husk Coverage: 1 = poor, 10 = excellent.
Note: Y=yellow; W=white; BC=Bicolor.

Table 3. Ear characteristics of supersweet corn cultivars, Quicksand, KY, 2000.

Cultivar	Tip[1]Fill	Commercial Acceptability[2]	Taste[3]	Ear Color[4]	Ear Comments
Odyssey BC	9.5	3.5	3.9	BC	Nice ears, a few with tassels on tip.
Double Dots BC	8.5	1.5	3,0	BC	Poorly filled ears, unacceptable.
Fantasy BC	-	1.0	-	BC	No acceptable ears, virus?
Fortune Y	8.6	2.5	3.5	Y	
S277A BC	8.4	1.5	3.0	BC	Poor ear appearance.
GS275A BC	8.7	1.5	4.0	BC	Poor quality ears.
Majesty BC	8.9	1.0	3.3	BC	Poor ears, cob discolored.
Crystal Cream W	9.2	1.5	2.7	W	Small poor/fair ears.
FMX 413 W	8.8	2.0	4.0	W	Fair ears.
Snow Storm W	8.5	1.5	3.25	W	Poor ears, many too small to harvest.
GS178A	8.4	1.5	3.8	Y	Poor ears.
White Saturn W	9.5	4.0	2.9	W	Nice ears.
Sugar Burst W	7.3	1.5	2.8	W	Poor ears.
Envy Y	9.0	3.8	2.7	Y	Nice ears.
Saturn Y	9.6	4.5	3.1	Y	Excellent ears.
Bicolor Saturn BC	9.7	3.5	4.0	BC	Nice ears, more barren stalks—hurt yield?
Flagship II Y	9.8	4.8	3.5	SW	Beautiful ears.
White Majesty W	8.8	2.5	3.5	W	Fairly nice ears.
Attribute Y	10.0	3.5	3.6	Y	Nice looking ears.
Prime Plus Y	9.0	3.5	3.7	Y	Nice looking ears.
GSS 3587 VP Y	9.5	3.3	3.5	Y	Nice looking ears, a little bird damage because of husk.
BSS 0977 VP BC	9.8	3.0	3.8	BC	Nice ears but a lot of barren or small eared stalks.
GSS 0978 VP Y	10.0	3.5	3.8	Y	Attractive/nice ears.
Impulse Y	7.9	1.5	4.0	Y	Poor looking ears, small barren stalks.
WSS-1921 VP W	9.0	2.0	3.2	W	Virus infected, poor looking ears.
Windham W	9.0	3.0	4.0	W	Nice looking ears.
BSS 6284 BC	8.2	2.5	3.3	BC	Fairly nice ears.
Vail VP W	8.6	1.0	3.8	W	Poor stubby ears, barren stalks.
BSS 9536 VP BC	9.3	3.8	2.5	BC	Pretty ears.
Big Time VP BC	9.0	3.5	3.3	BC	Pretty ears but bird damage because of poor husk coverage.
Millennium W	7.9	2.0	4.0	W	Poor pollination resulted in poor ears.
Candy Corner BC	9.5	4.5	3.5	BC	Beautiful ears.
Twin Star BC	9.3	3.8	3.7	BC	Pretty ears, a little pollination problem in one rep.
Zenith Y	10.0	4.0	4.0	Y	Pretty ears, a few tassels on ear tips.
Suregold Y	9.5	3.5	4.0	Y	Pretty ears, a little bird damage, long shank.
Amazingly Sweet BC	8.6	2.5	4.0	BC	Fair ears, virus reduced yield.
Bandit Y	10.0	4.5	3.0	Y	Beautiful ears.
Morning Star Y	9.5	4.5	3.3	Y	Beautiful ears, often two/plant.
Rustler Y	9.3	4.5	4.0	Y	Beautiful ears.
Ice Queen W	9.8	4.5	3.3	W	Beautiful ears.

[1] Number of ears out of 10 that had good tip fill.
[2] Commercial acceptability: 1=poor: 5=excellent.
[3] Taste: 1=starchy; 5=very sweet.
[4] Y=yellow; W=white; BC=bicolor.

Table 4. Plant characteristics and yield components used to rank supersweet sweet corn cultivars, Quicksand, KY, 2000.

Cultivar	Plant Stand[1]	Husk[5] Coverage[2]	Tip[3] Fill[5]	Commercial[5] Acceptability[4]	Yield (dozen ears/A)	Points Scored by This Cultivar[6]	Rank of Sweet Corn Based on Points
Flagship II Y	79.3	10	9.8	4.8	1,815	3,434	1
Candy Corner BC	79.3	10.0	9.5	4.5	2,360	3,429	2
Bandit Y	74.3	10.0	10	4.5	2,178	3,411	3
Morning Star Y	70.3	10.0	9.5	4.5	2,481	3,351	4
Ice Queen W	68.8	10.0	9.8	4.5	2,226	3,341	5
Saturn Y	72.3	9.6	9.6	4.5	1,785	3,271	6
Rustler Y	65.8	10.0	9.3	4.5	1,966	3,234	7
White Saturn W	71.3	9.8	9.5	4.0	1,410	3,184	8
Suregold Y	71.3	9.3	9.5	3.5	2,287	3,172	9
BSS 0977 VP BC	78.8	9.0	9.8	3.0	1,531	3,121	10
Zenith Y	67.5	9.0	10.0	4.0	1,422	3,117	11
Attribute Y	72.5	8.9	10.0	3.5	1,422	3,107	12
BSS 9536 VP BC	67.8	9.3	9.3	3.8	1,561	3,074	13
Envy Y	69.3	9.6	9.0	3.8	1,210	3,054	14
GSS 3587 VP Y	70.5	8.5	9.5	3.3	1,530	2,988	15
Prime Plus Y	73.3	8.5	9.0	3.5	1,422	2,975	16
Fortune Y	79.5	9.1	8.6	2.5	1,470	2,962	17
Bicolor Saturn BC	56.0	9.5	9.7	3.5	1,107	2,941	18
Twin Star BC	43.5	10.0	9.3	3.8	1,168	2,862	19
GSS 0978 VP Y	48.5	9.0	10.0	3.5	1,150	2,850	20
Big Time VP BC	78.5	7.2	9.0	3.5	956	2,846	21
Odyssey BC	48.8	8.9	9.5	3.5	1,210	2,799	22
BSS 6284 BC	67.8	9.0	8.2	2.5	1,452	2,793	23
Impulse Y	78.5	8.9	7.9	1.5	1,500	2,765	24
Windham W	51.8	9.0	9.0	3.0	1,392	2,757	25
White Majesty W	66.0	8.4	8.8	2.5	1,210	2,751	26
GS275A BC	71.5	8.0	8.7	1.5	1,119	2,647	27
Millennium W	58.0	9.3	7.9	2.0	1,440	2,644	28
WSS-1921 VP W	57.3	8.4	9.0	2.0	1,258	2,639	29
Amazingly Sweet BC	57.5	8.5	8.6	2.5	895	2,625	30
GS178A	75.8	7.4	8.4	1.5	1,077	2,596	31
Crystal Cream W	72.3	7.3	9.2	1.5	605	2,583	32
GS277A BC	63.5	8.1	8.4	1.5	1,089	2,544	33
Double Dots BC	48.7	9.3	8.5	1.5	1,252	2,542	34
Snow Storm W	68.3	7.0	8.5	1.5	787	2,462	35
Majesty BC	51.0	8.5	8.9	1.0	968	2,447	36
Vail VP W	68.3	7.3	8.6	1.0	499	2,423	37
Sugar Burst W	51.0	8.3	7.3	1.5	834.9	2,303	38
FMX 413 W	33.5	7.8	8.8	2.0	696	2,264	39
Fantasy BC	53.0	--	--	1.0	0	0	40

[1] Plant stand is percent emergence based on planting 100 seeds.
[2] Husk Coverage: 1=poor, 10=excellent.
[3] Number of ears out of 10 that had good tip fill.
[4] Commercial acceptability: 1=poor: 5=excellent.
[5] Based on 10 ears of corn.
[6] Points obtained (Rank) = (10 x Stand) + (100 x Husk Coverage) + (100 x Tip Fill) + (100 x Commercial Acceptability) + (yield/10).
Note: Y=yellow; W=white; BC=bicolor.

Sweet Corn Evaluation in Central Kentucky

John Strang, April Satanek, Terry Jones, Kay Oakley, Dave Lowry, Darrell Slone, and John Snyder, Department of Horticulture

Supersweet (sh_2) corn varieties were evaluated at the University of Kentucky Horticulture Research Farm in Lexington, Kentucky.

Methods

Forty-one supersweet corn varieties were planted by hand on May 17, 2000. 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 inches apart on June 16.

Prior to planting, 100 lb of actual N/A was applied as ammonium nitrate and tilled in. Plants were side-dressed with 50 lb of actual N/A as ammonium nitrate.

Bicep at the rate of 1.8 qt/A was applied on May 30 for weed control. Pounce, Thiodan, Asana, and Warrior were used for insect control.

Results

Morning Star, Zenith, Suregold, Atribute, GSS 0978 VP, and Flagship II were the best performing yellow varieties.

WSS-1921 VP, Ice Queen, and White Majesty were the best performing white varieties.

BSS 0977 VP, Twin Star, GS275A Gourmet Sweet Brand, and GS277A Gourmet Sweet Brand were the best bicolor varieties. GS275A Gourmet Sweet Brand was rated as being the best tasting bicolor variety.

Millennium, a white variety, was judged to have outstanding ear characteristics and eating quality, but it did not yield well in this trial.

Short tassels on the ear tips of many varieties occurred this season with relatively high frequency

Table 1. Plant characteristics and yield of supersweet corn cultivars, Lexington, KY, 2000.

Cultivar	Seed Source	Days to Maturity	Plant Stand[2] (%)	Height to First Harvested Ear (in)	Ease of Ear Harvest[3] (1-5)	Yield (dozen ears/A)
Candy Corner	HM	73	90	24	3.8	2,424
BSS 0977 VP	RG, NV	79	92	23	3.9	2,398
Morning Star	HR	83	85	25	4.1	2,373
Zenith	HR, HM	81	80	27	2.5	2,295
Suregold	HM	83	78	28	3.3	2,282
WSS-1921 VP	RG, NV	82	82	26	3.8	2,113
Bandit	HM	80	87	30	3.5	2,100
Atribute (GSS0966)	NV	78	76	25	3.6	2,074
Ice Queen	H, HM	77	92	23	3.9	2,035
Rustler	HM	84	83	24	4.0	2,022
Twin Star	HM	84	72	27	3.8	2,010
White Majesty	SW	78	89	24	3.8	2,010
Big Time VP	RG, NV	79	88	25	3.5	1,997
GSS 0978 VP	RG, NV	77	96	26	4.6	1,945
GS275A[1]	ST	76	86	25	4.5	1,932
GS277A[1]	ST	75	89	23	2.5	1,919
Flagship	SW	84	85	28	2.8	1,880
Windham	RG, NV	79	79	24	2.5	1,880
Crystal Cream	ST	74	77	24	4.5	1,828
Vail VP	RG, NV	78	89	25	3.1	1,815
Prime Plus	RG, NV	78	91	21	4.0	1,776
Indian Summer	ST	79	66	31	4.4	1,776
Amazingly Sweet	HM	80	82	25	3.9	1,737
Bicolor Saturn	SW	75	90	23	2.5	1,711
BSS 9536 VP	RG, NV	77	87	23	5.0	1,711
GS178A[1]	ST	76	89	24	3.3	1,672
Saturn	SW	75	91	21	3.3	1,672
Majesty	HR, ST	78	72	28	4.4	1,672
Envy	SW	81	77	28	3.3	1,646
Snow Storm	ST	82	95	30	3.6	1,621
FMX 413	ST	77	83	24	1.8	1,621
BSS-6284	RG, NV	72	89	16	4.0	1,621
White Saturn	SW	75	92	24	29	1,621
GSS 3587 VP	RG, NV	77	82	20	4.3	1,582
Sugarburst	SW	75	71	19	4.5	1,504
Fortune	SW, ST	76	98	24	4.4	1,465
Impulse	RG, NV	75	87	20	4.1	1,465
Millennium	SW	82	76	22	4.9	1,413
Odyssey	SW, ST	80	80	29	4.3	1,387
Double Dots	JS	79	70	28	4.1	1,335
Fantasy	JS	75	81	12	2.4	1,335
Waller-Duncan LSD (P=0.05)						*300*

[1] Gourmet Sweet Brand.
[2] Plant stand is percent emergence based on planting 100 seeds.
[3] Ease of harvest: 1 = hard; 5 = easy.

Table 2. Ear characteristics of supersweet corn, Lexington, KY, 2000.

Cultivar	Husk Coverage[2] (1-10)	Ear Length (in)	Ear Width (in)	Tip Fill[3] (1-10)	Kernel Color[4]	Row Straightness[5] (1-10)
Candy Corner	7.5	7.9	1.9	8.5	BC	7.8
BSS 0977 VP	9.0	7.2	1.8	10	BC	8.0
Morning Star	9.0	7.5	1.8	10	Y	8.8
Zenith	9.3	7.4	1.7	10	Y	7.3
Suregold	9.0	7.7	1.7	9.8	Y	9.3
WSS-1921 VP	7.8	7.7	1.8	9	W	8.5
Bandit	8.8	7.3	1.8	10	Y	6.3
Atribute (GSS0966)	9.5	7.3	1.8	10	Y	8.8
Ice Queen	7.8	8.2	1.8	10	W	8.0
Rustler	7.0	7.7	1.9	9.8	Y	9.5
Twin Star	10.0	7.6	1.9	9.8	BC	5.5
White Majesty	9.8	8.0	1.8	8.8	W	8.5
Big Time VP	7.5	7.5	1.7	9.8	BC	9.0
GSS 0978 VP	9.8	7.2	1.9	10	Y	9.5
GS275A[1]	8.5	7.8	1.8	9.8	BC	8.5
GS277A[1]	8.0	7.3	1.9	10	BC	8.5
Flagship II	9.8	7.4	1.9	9.8	Y	8.3
Windham	9.5	7.6	1.8	10	W	8.0
Crystal Cream	7.0	7.4	1.8	10	W	8.0
Vail VP	8.0	7.5	1.9	9.5	W	8.5
Prime Plus	8.3	7.6	1.7	9.8	Y	8.0
Indian Summer	8.8	7.6	1.9	7.5	BC/purple	7.3
Amazingly Sweet	5.0	8.0	2.0	9.5	BC	6.5
Bicolor Saturn	10	7.7	1.8	10	BC	8.0
BSS 9536 VP	4.5	8.0	1.8	9.8	BC	6.5
GS178A[1]	9.3	7.8	1.8	9.8	Y	8.0
Saturn	9.5	7.5	1.8	10	Y	9.5
Majesty	9.0	8.0	1.9	9.8	BC	8.8
Envy	9.8	7.9	1.8	10	Y	8.8
Snow Storm	7.3	7.6	1.8	9.8	W	9.3
FMX 413	6.5	7.9	1.9	8.3	W	9.5
BSS-6284	6.3	8.1	1.9	3.3	W	7.0
White Saturn	9.8	7.5	1.8	10	W	7.8
GSS 3587 VP	7.5	7.5	1.8	10	Y	8.3
Sugarburst	5.5	7.9	1.9	4.3	W	8.5
Fortune	7.8	7.9	1.7	9.0	Y	8.3
Impulse	10	7.7	1.7	7.3	Y	8.0
Millennium	9.3	8.3	1.9	7.0	W	9.0
Odyssey	7.8	7.7	1.9	10	BC	9.5
Double Dots	9.3	8.2	1.8	5.3	BC	9.5
Fantasy	4.5	7.4	1.8	4.5	BC	6.5

[1] Gourmet Sweet Brand.
[2] Number of ears out of 10 that had tight husk coverage over the ear tip.
[3] Number of ears out of 10 that had good tip fill.
[4] Y = yellow; W = white; BC = bicolor.
[5] Number of ears out of 10 that had straight rows of kernels.

Table 3. Ear quality characteristics of supersweet corn varieties, Lexington, KY, 2000.

	Cooked Corn			
Cultivar	**Pericarp Tenderness[2] (1-4)**	**Kernel Tenderness[3] (1-4)**	**Sweetness [4] (1-4)**	**Comments**
Candy Corner	2.0	2.0	3.3	Attractive shuck and ear; shuck is not tight.
BSS 0977 VP	3.0	2.5	3.5	Attractive husk and ear; very short tassels in ears.
Morning Star	2.5	2.5	3.0	Nice ears; small tassels in ears.
Zenith	3.5	3.0	3.5	Attractive husk and ear, tassels in ears.
Suregold	3.0	2.5	3.5	Atractive husk and ear; few short tassels in ears.
WSS-1921 VP	2.5	2.0	3.0	Attractive light green husk and ear, long flags, some butt end blanking.
Bandit	3.5	2.0	3.0	Attractive ear; small tassels in ears.
Atribute (GSS0966)	3.5	2.5	3.6	Attractive husk and ear, small tassels in ear.
Ice Queen	3.5	3.0	3.0	Attractive husk.
Rustler	1.5	2.0	2.5	Attractive ear and husk.
Twin Star	2.0	2.2	3.3	Attractive husk, easy harvest, very tight shuck, short tassels in tips.
White Majesty	2.5	2.0	3.0	Attractive husk and ear, very tight shuck coverage.
Big Time VP	2.0	2.5	3.5	Attractive husk and ear, shucks easily, deep kernel
GSS0978 VP	2.0	2.0	3.5	Attractive husk and ear, slight smut.
GS275A[1]	3.0	3.5	4.0	Tight husks, tassels in ears, excellent corn taste, small kernels.
GS277A[1]	3.0	3.0	3.5	Attractive ear; small tassels in ears.
Flagship II	2.5	2.0	3.0	Attractive husk and ear, tight husk coverage, some tassels in ears, long flags.
Windham	3.5	3.5	2.5	Tight shuck coverage, long flags, snaps off base easily.
Crystal Cream	3.5	2.5	3.5	Attractive ears.
Vail VP	2.0	2.5	3.0	Attractive husk and ear: short tassels in tips.
Prime Plus	2.5	2.5	3.3	Attractive ears.
Indian Summer	2.5	3.0	3.2	Husk unattractive; thick and spongy; husk hard to snap off base; less mature ears do not have purple kernels.
Amazingly Sweet	3.0	3.0	3.3	Attractive husk and ear; tassels in tips; shuck cover not tight; worm/sap beetle problems.
Bicolor Saturn	2.0	2.0	3.0	Attractive husk and ear; some tassels in ears; very tight shucks deep kernels.
BSS 9536 VP	2.0	2.5	3.5	
GS 178A[1]	2.0	3.0	3.5	Attractive ears; long flags; tassels in tips; excellent flavor; small kernels.
Saturn	2.0	2.5	3.0	Attractive ear; nice golden yellow kernels; tight husk; tassels in tips.
Majesty	2.0	2.5	3.1	Attractive, tight husk.
Envy	2.0	2.5	3.0	Attractive ear and husk; very tight husks.
Snow Storm	2.5	3.0	3.0	Attractive ear; sap beetle damage.
FMX 413	3.5	2.5	3.0	Attractive ear; husk separates easily from base; slight smut.
BSS-6284	2.0	2.5	2.5	Long flags; dark green husks.
White Saturn	2.5	3.0	3.0	Tassels in tips; tight shuck.
GSS 3587 VP	1.5	1.5	3.0	Attractive husk and ear; long flags; short tassels in ears.
Sugarburst	2.5	2.0	4.0	Attractive husk and ear; short flags.
Fortune	2.0	2.5	3.0	Attractive husk and ear; slight butt end blanking; short tassels in ears.
Impulse	1.5	1.0	2.5	Attractive ear; long flags; slight smut; a lot of rust; few with tassels in ears.
Millennium	3.5	3.0	3.5	Attractive ear; husk light colored; deep kernels; nice, tight shuck.
Odyssey	2.5	3.5	3.5	Attractive ear and husk.
Double Dots	2.5	3.5	3.0	Attractive ear and husk.
Fantasy	2.0	3.0	3.5	Good corn flavor; slight smut.

[1] Gourmet Sweet Brand.
[2] 1 = tough; 4 = tender.
[3] 1 = crisp; 4 = creamy and tender.
[4] 1 = starchy; 4 = very sweet; ratings are based on one microwaved ear.

Sweet Corn Cultivar Evaluation for Northwestern Kentucky

Thomas J. Brass, County Extension Agent for Horticulture and Charles Mulligan, Host Farmer
Kentucky Cooperative Extension Service, Henderson County, Henderson, KY

Introduction

Sweet corn production in northwestern Kentucky has seen a steady increase over the past few years. While a new marketing cooperative in the area has provided a wholesale market for sweet corn, the majority of small producers still grow sweet corn for local markets and rely on sugary-enhanced (se) varieties. The objective of this study was to evaluate 22 sugary enhanced sweet corn cultivars and the standard cultivar Silver Queen (su). These varieties were evaluated for their suitability for direct markets by observing plant, ear, yield, and taste characteristics.

Materials and Methods

The trial field was established on a Loring silty clay soil type. The plot was separated into three blocks based on sweet corn color to prevent cross pollination. In late April, the plot was disked, and 250 lb/A of 15-15-15, 220 lb/A of 34-0-0 (NH_4NO_3), and 2 tons/A of agricultural limestone was broadcast and incorporated. The plot was planted on May 8 and consisted of rows 20 ft long and 3 ft apart with 50 seeds planted/row for a desired final stand of 30 plants/row. Germination was good for all varieties, and plants were manually thinned to 30 plants/row. Experimental design was a randomized complete block with four replications.

Bicep 6L herbicide (atrazine + metolachlor :1.2 + 1.5 lb ai/A, respectively), was applied following planting. Ammonium nitrate was side-dressed at 100 lb/A when respective treatments reached 8 inches in height. Permethrin (Pounce 3.2EC) was used at 0.2 lb ai/A for insect control starting at the row tassel stage and followed by three more applications during ear development. Observations recorded included plant height and diameter, ear height above ground, ear length and diameter, shuck cover, tip fill, and yield by marketable number and weight. An informal taste test was performed by recording the opinions of at least 15 patrons per variety at the local farmers' market.

Results and Discussion

White corn. The performance of white sweet corn varieties is summarized in Table 1. Ear length and weight increased as relative days to maturity increased. Late-maturing varieties Silver Queen, Argent, and Silver King had the greatest plant height, and midmaturing varieties Imaculata, Avalanche, and Frosty tended to be the shortest. Both plant and ear diameters had a wide divergence in size that were not correlated with other variables measured. The early variety 96H263 and late variety Argent had the largest plant diameters, and Silver Princess had the smallest plant diameter and the largest ear diameter. The variety with the smallest ear diameter was Imaculata. A wide separation in ear height occurred between varieties. Ear height was greatest for the later maturing varieties Silver Queen, Silver King, and Argent. Midmaturity varieties Avalanche and Frosty had the shortest ear height.

Shuck cover length varied among cultivars. Silver Princess and Silver King had the longest shuck covers, and Silver Queen had the smallest. Tip fill was complete for the late-maturing varieties as well as the early variety Silver Princess. Avalanche had the least kernel fill compared to other varieties. Having the highest number of marketable ears for late, mid, and early maturing varieties, as well as for all varieties tested, were Silver King, Imaculata, and Silver Princess. Seneca Sensation, Frosty, and Argent produced the lowest number of marketable ears. Taste test results indicate a clear preference toward Avalanche, and Seneca Sensation and Argent fared low in palatability. All other varieties, except Frosty, were similar in taste results.

Yellow corn. The performance of yellow sweet corn varieties is summarized in Table 2. Ear height, weight, and diameter all increased as days to maturity increased. While not statistically significant, plant height and ear length tended to be greatest for later maturing varieties compared to earlier maturing ones. Kandy Plus produced the tallest corn. Sugar Buns was at least 38% shorter than all other varieties tested. Honey Select, Kandy Plus, and Tender Delight all had ears greater than 8 inches in length; Sugar Buns had the shortest ears. Plant diameter varied considerably among varieties. Kandy Plus had the largest plant diameter; Tender Delight and Gold Nuggets measured the smallest. Bodacious had the longest shuck cover, and all other varieties were statistically similar, having shuck covers between 1.3 and 2.0 inches. No yellow sweet corn variety tested had complete tip fill. Honey Select had the least tip fill; Bodacious' tip fill was nearly complete. All other varieties were statistically similar in tip fill, ranging from 0.2 to 0.7 inches of unfilled tips. The highest number of marketable ears was produced by Honey Select, followed by the variety Tuxedo. Bodacious, Honey Select, and Kandy Plus were rated the best tasting yellow corn varieties.

Bicolor Corn. The performance of bicolor sweet corn varieties is summarized in Table 3. Plant height, ear height, and length increased as relative days to maturity increased. Plant diameter was similar for all varieties except Peaches and Cream, which had the smallest plant diameter of all varieties tested. Mystique had the greatest ear diameter and Serendipity the smallest. The early varieties of Peaches and Cream and Temptation had the longest shuck covers; Parfait had the shortest. Distance of unfilled kernels to tip was smallest for Peaches and Cream, Temptation, and Mystique. The early variety Peaches and Cream and the late variety Delectable had the greatest number of marketable ears. Yield weight was similar for all varieties except Mystique, which had the highest yield weight compared to all other varieties. Peaches and Cream, Temptation, and Delectable all had similar ear weights. All bicolor varieties had taste preferences of 2.7 or higher. Parfait was found to be the best tasting.

Table 1. White sugary-enhanced (se) and Silver Queen sweet corn plant, ear, yield, and taste characteristics in Henderson County KY, 2000.

Cultivar (seed source)	Maturity[Z] (days)	Plant Height[Y] (in)	Plant Diameter[X] (in)	Ear Height[W] (in)	Ear Length (in)	Ear Diameter (in)	Shuck Cover[V] (in)	Tip Fill[U] (in)	Marketable Ears (no./plot)	Avg Wt 5 Ears Husked (lb)	Taste[T] (1-4)
94H263 (SW)	70	64.8 C-E[S]	3.2 A	22.8 C	6.5 E	5.4 E	1.9 C-E	0.1 A-B	25 B-C	2.1 E	3.5 A-B
Seneca Sensation (SW)	73	65.4 C-E	2.6 D	22.3 C-D	7.1 C-D	5.6 C-D	2.6 A-B	0.2 A-B	24 C	2.4 B-C	1.3 D
Silver Princess (RG)	74	66.5 C-D	2.4 D	23.6 B-C	7.2 C-D	6.1 A	2.8 A	0.0 A	28 A	2.1 E	2.9 B-C
Imaculata (RU)	78	62.9 D-E	2.7 B-D	22.4 C-D	6.8 D-E	5.4 E	2.4 A-C	0.2 A-B	28 A	2.2 D-E	3.0 A-C
Avalanche (RU)	78	62.4 D-E	2.9 B	18.2 D	7.7 B	5.8 B-C	1.4 D-E	0.3 B	26 B	2.5 B	3.8 A
Frosty (RU)	80	59.8 E	2.5 D	18.2 D	7.1 C-D	5.5 D-E	2.0 B-D	0.0 A	24 C	2.3 C-D	2.5 C
Silver King (SW)	82	71.5 A-B	2.8 B-C	28.2 A	7.5 B-C	5.7 C-D	2.8 A	0.0 A	29 A	2.8 A	3.2 A-C
Argent (RU)	86	70.7 A-C	3.2 A	27.3 A-B	7.7 B	6.0 A-B	2.2 A	0.0 A	24 C	2.9 A	1.5 D
Silver Queen (WI)	92	73.1 A	2.8 B-C	28.2 A	8.3 A	5.8 B-C	1.3 E	0.0 A	27 B	2.9 A	3.0 A-C
LSD (P = 0.05)		*6.4*	*0.3*	*4.8*	*0.5*	*0.3*	*0.7*	*0.3*	*2.1*	*0.2*	*0.9*

[Z] Relative days to maturity.
[Y] Distance from ground to top leaf at R6 stage of growth for five random samples of each replicate.
[X] Measured 3 inches above ground around plant stalk for three random samples of each replicate.
[W] Distance from ground to bottom of ear for five random samples of each replicate.
[V] Distance husk extends beyond ear tip for three random samples of each replicate.
[U] Distance of unfilled kernels at ear tip for three random samples of each replicate.
[T] Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
[S] Means followed by same letter do not significantly differ (P = 0.05).

Table 2. Yellow sugary-enhanced (se) sweet corn plant, ear, yield, and taste characteristics in Henderson County, KY, 2000.

Cultivar (seed source)	Maturity[Z] (days)	Plant Height[Y] (in)	Plant Diameter[X] (in)	Ear Height[W] (in)	Ear Length (in)	Ear Diameter (in)	Shuck Cover[V] (in)	Tip Fill[U] (in)	Marketable Ears (no./plot)	Avg Wt 5 Ears Husked (lb)	Taste[T] (1-4)
Sugar Buns (RU)	72	46.5 E[S]	3.0 B-C	10.2 D	6.9 C	4.8 C	1.3 B	0.2 A-B	15.2 F	1.7 D	1.8 D
Tuxedo (RU)	72	65.2 C-D	3.0 B-C	19.1 B-C	7.5 B-C	5.8 A-B	1.7 B	0.2 A-B	32.0 B	2.4 C	2.5 C-D
Bodacious (RU)	75	66.4 B-D	3.1 B	20.7 B	7.0 C	5.5 B	3.1 A	0.1 A	20.4 D	2.3 C	3.6 A
Gold Nuggets (RU)	75	64.1 D	2.8 C	17.0 C	7.3 C	6.0 A	1.7 B	0.6 A-B	27.1 C	2.4 C	2.8 B-C
Kandy Plus (RG)	79	70.9 A	3.5 A	26.0 A	8.3 A-B	5.9 A	1.7 B	0.5 A-B	26.4 C	3.0 A-B	3.2 A-C
Honey Select (RG)	79	70.2 A-B	2.9 B-C	25.7 A	8.6 A	6.0 A	2.0 B	0.8 B	35.0 A	2.9 B	3.5 A-B
Tender Delight (RG)	84	70.2 A-B	2.8 C	27.7 A	8.3 A-B	6.1 A	1.3 B	0.3 A-B	18.3 E	3.0 A-B	2.5 C-D
Incredible (RU)	85	69.0 A-C	2.9 B-C	28.3 A	7.6 B-C	6.0 A	1.3 B	0.7 A-B	20.3 D	3.2 A	2.5 -C-D
LSD (P = 0.05)		*11.6*	*0.8*	*10.2*	*2.1*	*1.0*	*2.2*	*0.7*	*2.0*	*0.3*	*0.8*

[Z] Relative days to maturity.
[Y] Distance from ground to top leaf at R6 stage of growth for five random samples of each replicate.
[X] Measured 3 inches above ground around plant stalk for three random samples of each replicate.
[W] Distance from ground to bottom of ear for five random samples of each replicate.
[V] Distance husk extends beyond ear tip for three random samples of each replicate.
[U] Distance of unfilled kernels at ear tip for three random samples of each replicate.
[T] Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
[S] Means followed by same letter do not significantly differ (P = 0.05).

Table 3. Bicolor sugary-enhanced (se) sweet corn plant, ear, yield, and taste characteristics in Henderson County Ky, 2000.

Cultivar (seed source)	Maturity[Z] (Days)	Plant Height[Y] (in)	Plant Diameter[X] (in)	Ear Height[W] (in)	Ear Length (in)	Ear Diameter (in)	Shuck Cover[V] (in)	Tip Fill[U] (in)	Marketable Ears (no./plot)	Avg Wt 5 Ears Husked (lb)	Taste[T] (1-4)
Peaches and Cream (SW)	70	56.9 B[S]	2.3 B	16.3 C	7.4 B	5.4 B-C	2.1 A	0.0 A	27 A	2.3 B	2.7 B
Temptation (RU)	71	61.8 B	2.7 A	21.2 B	7.4 A-B	5.5 A-C	2.4 A	0.2 A-B	17 D	2.3 B	2.7 B
Mystique (RU)	75	62.6 B	2.8 A	23.1 B	7.7 A-B	5.8 A	1.6 A-C	0.2 A-B	20 C	2.6 A	3.4 A-B
Parfait (SW)	76	71.3 A	2.8 A	27.5 A	7.5 A-B	5.4 B-C	0.9 C	0.9 C	22 B-C	2.2 B	3.6 A
Delectable (SW)	82	76.0 A	2.8 A	28.8 A	7.9 A	5.6 A-B	1.9 A-B	0.4 A-B	25 A-B	2.3 B	3.3 A-B
Serendipity (RG)	82	72.8 A	2.8 A	27.5 A	7.8 A-B	5.2 C	1.1 B-C	0.5 B	21 B-C	2.4 B	3.3 A-B
LSD(P = 0.05)		*6.2*	*0.2*	*4.0*	*0.5*	*0.3*	*0.9*	*0.7*	*2.0*	*0.3*	*0.7*

Z Relative days to maturity.
Y Distance from ground to top leaf at R6 stage of growth for five random samples of each replicate.
X Measured 3 inches above ground around plant stalk for three random samples of each replicate.
W Distance from ground to bottom of ear for five random samples of each replicate.
V Distance husk extends beyond ear tip for three random samples of each replicate.
U Distance of unfilled kernels at ear tip for three random samples of each replicate.
T Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
S Means followed by same letter do not significantly differ (P = 0.05).

Sweet Corn Cultivar Evaluation for Ginat Soils in Northwestern Kentucky

Thomas J. Brass, County Extension Agent for Horticulture and Robert F. Mitchell, Host Farmer
Henderson County Cooperative Extension Service, Henderson, KY

Introduction

This study's objective was to determine suitable varieties of sweet corn for use on nonirrigated Ginat soils, a dominant soil series along the Ohio River. Ginat soils are a combination of poorly drained soils that developed in mixed sediment along the Ohio River and are characterized by a shallow root zone and moderately low capacity for holding moisture. The soil profile consists of a plow layer of brown silt loam or silty clay loam that tends to crust at the surface. The subsoil is mottled gray and brown silty clay loam with a fragipan around 28 inches deep. Available water within the root zone becomes a major limiting factor in crop production when irrigation is not provided, and crusting of the surface tends to impede germination. A total of 40 standard (su) and sugary enhanced (se) sweet corn cultivars, grouped by color, were compared for their performance in Ginat soils by evaluating stand, plant, ear, yield, and taste characteristics.

Materials and Methods

The selected plot area was established on a Ginat silt loam soil type near Henderson. The plot was separated into three blocks based on sweet corn color to prevent cross pollination. In late April, the plot was disked, and 300 lb/A of 34-0-0 (NH_4NO_3) was broadcast and incorporated. The plot was planted on May 3 and consisted of rows 20 ft long and 3 ft apart with 50 seeds planted/row for a desired final stand of 30 plants/row. Experimental design was a randomized complete block with three replications. Atrazine + metolachlor (Bicep 6L) at 1.2 + 1.5 lb ai/A, respectively, was applied after planting. Ammonium nitrate was side-dressed at 100 lb/A when treatments reached 8 inches in height. Permethrin (Pounce 3.2EC) was used at 0.2 lb ai/A for insect control starting at the row tassel stage and followed by three more applications during ear development. Observations included plant population, plant height and diameter, ear height above ground, ear length and diameter, shuck cover, tip fill, straight rows of kernels, and yield by marketable number and weight. Three informal taste tests were performed by recording the opinions of 50 to 75 patrons at the local farmers' market. Only averages for taste tests are given.

Results and Discussion

White varieties. The performance of white corn varieties is summarized in Table 1. Plant height and diameter, ear height, length, and weight increased as days to maturity increased. Plant stand was similar for all varieties, with Silverado having the highest. Ear diameter was generally greatest for mid to late maturing varieties, except for the early maturing variety 94H263 and the late maturing variety Silver Queen. The variety 94H263 had a similar or larger ear diameter, and Silver Queen had the smallest ear diameter, when compared with previous varieties mentioned. The shuck coverage was greatest for Spring Snow and Argent.

Shuck cover and tip fill showed no correlation. Silver Queen, Silverado, and 94H263 had complete tip fill. Row straightness was similar for all white varieties. Marketable ears did not differ significantly between cultivars. Silverado had the greatest number of ears. Taste results indicate a slight preference for the early-maturing varieties as well as the late-maturing variety Silver King.

Yellow varieties. Yellow sweet corn variety performance is summarized in Table 2. Plant and ear height increased as days to maturity increased. Plant population varied considerably between varieties. Kandy Korn was greatest. Plant diameter varied considerably among varieties with no distinct pattern. Ear length, although not significant, tended to be longer for later maturing varieties. Kandy King tended to have the longest ears. Ear diameter was the greatest for Kandy Plus and Seneca Horizon. Kandy Kwick, Sugar Buns, Kandy King, and Tuxedo had shuck covers between 1.0 to 1.7 inches. Kandy Korn had a shuck cover of less than 1 inch. All other varieties had a shuck cover greater than 2 inches. Tip Fill was similar for all varieties, except Kandy Korn, which had a distance of unfilled kernels to tip of more than 1 inch. Seneca Horizon, Kandy Kwick, and GH4881 had only a few ears with straight kernel rows. Kandy Korn and GH4881 had the highest number of marketable ears for late-maturing corn. Remaining varieties were similar except for the early-maturing variety Sundance. This variety had the greatest number of marketable ears compared with other early- and midmaturity varieties. Ear weight was highest for Seneca Horizon. Early-maturing varieties, along with Legend and Tuxedo, were lowest in taste ratings. Bodacious, GH4881, and Kandy Korn had high taste ratings—above 3.0.

Bicolor varieties. The performance of bicolor sweet corn varieties is summarized in Table 3. Plant height, ear height, and shuck cover increased as days to maturity increased. A 26% divergence in plant stand was noted among varieties. Cotton Candy had the best stand. Other varieties averaging more than 20 plants were Seneca Dancer, Delectable, Clock Work, Harmony, and Temptation. Plant diameter varied considerably among varieties. The late-maturing variety BiQueen and Ecstase II had the largest and smallest diameter, respectively. Clock Work had the longest ears. Early- and late-maturing varieties tended to have lower ear diameters than midmaturity varieties. Distance of unfilled kernels to tip was less than ½ inch for Temptation, Double Gem, Ambrosia, Clock Work, Jackpot, Seneca Dancer, and BiQueen. Harmony, Parfait, and Delectable were about 1 inch of unfilled kernels. Row straightness was not significantly different for any varieties tested. A wide divergence in marketable ears was present. Ecstase II and Seneca Arrowhead performed well for early varieties. Comparing the two 92-day varieties, Seneca Dancer had more than twice the number of marketable ears than did BiQueen. The average weight of five marketable ears tended to be similar for all varieties, with Seneca Arrowhead, Ambrosia, and Clock Work having the highest. Taste preferences varied considerably: Parfait, Sweet Sal, Ecstase II, and Delectable all had high ratings—of 3.5 or above.

Table 1. Yields and plant characteristics of standard (su) and sugary enhanced (se) white sweet corn varieties grown in Ginat soils, 1999.

Cultivar (seed source)	Maturity[Z] (Days)	Plant Pop. (plants /20 ft)[R]	Plant Height[Y R] (in)	Plant Diam.[R] (in)	Ear Height[W R] (in)	Ear Length[R] (in)	Ear Diam.[R] (in)	Shuck Cover[V R] (in)	Tip Fill[U R] (in)	Row Straightness[T R] (1-10)	Mktable Ears (no./plot)	Avg Wt 5 Ears Husked[R] (lb)	Taste[S] (1-4)
Spring Snow (SW)	66	21.0 A-B	46.0 E	2.3 D	13.2 D	7.6 B	5.6 F	2.8 A	1.3 D	7.0 A	11.0 B	1.1 C	3.5
94H263 (SW)	70	15.7 B	64.5 C-D	3.1 B-C	19.7 B-C	7.6 B	6.8 A-B	2.1 B	0.0 A	8.3 A	15.0 A-B	2.1 A-B	3.2
Sugar Snow (PA)	70	20.3 A-B	49.9 E	2.6 D	14.7 C-D	7.7 B	6.0 E	2.0 B	1.0 C-D	8.3 A	11.7 A-B	1.7 B	3.7
Sugar Snow II (PA)	71	20.7 A-B	49.2 E	2.3 D	14.0 C-D	7.6 B	5.9 E-F	2.3 A-B	0.6 A-C	7.7 A	14.0 A-B	2.1 A-B	3.6
Silver Princess (RG)	74	19.0 B	60.0 D	3.0 C	18.6 B-D	8.6 A	6.6 A-D	1.9 B-C	0.2 A-B	5.0 A	10.3 B	2.1 A-B	3.4
Pristine (JS)	75	20.7 A-B	60.0 D	3.4 A-B	18.1 B-D	7.6 B	6.5 B-D	2.0 B-C	0.5 A-C	7.0 A	14.3 A-B	2.1 A-B	1.4
Brilliance (H)	79	21.7 A-B	63.1 C-D	3.1 B-C	19.4 B-C	8.5 A	6.4 C-D	1.4 C-D	0.7 B-C	5.3 A	15.7 A-B	2.3 A-B	2.6
Silverado (H)	80	27.7 A	64.3 C-D	3.1 B-C	22.0 B	8.6 A	6.6 A-D	1.0 D	0.0 A	7.3 A	21.0 A	2.4 A	2.5
Fantasia ((AS)	80	15.3 B	69.7 B	3.0 C	22.6 B	8.3 A	6.6 A-D	2.0 B-C	0.2 A-B	7.0 A	11.0 B	2.1 A-B	3.0
Silver King (SW)	82	17.0 B	66.9 B-C	3.1 B-C	23.8 B	8.3 A	6.9 A	2.5 A-B	0.3 A-B	7.6 A	15.0 A-B	2.4 A	3.4
Argent (WI)	86	20.3 A-B	69.9 B	3.4 A-B	22.4 B	8.4 A	6.6 A-C	2.8 A	0.6 A-C	5.3 A	18.0 A-B	2.1 A-B	2.8
Silver Queen (WI)	91	17.0 B	76.6 A	3.6 A	34.9 A	8.5 A	6.3 E-D	2.0 B-C	0.0 A	7.0 A	15.3 A-B	2.4 A	2.7
LSD (P = 0.05)		*8.7*	*5.6*	*0.3*	*6.1*	*0.5*	*0.39*	*0.66*	*0.6*	*4.8*	*9.6*	*0.7*	

[Z] Relative days to maturity.
[Y] Distance from ground to top leaf at R6 stage of growth for five random samples of each replicate.
[X] Measured 3 inches above ground around plant stalk for three random samples of each replicate.
[W] Distance from ground to bottom of ear for five random samples of each replicate.
[V] Distance husk extends beyond ear tip for three random samples of each replicate.
[U] Distance of unfilled kernels at ear tip for three random samples of each replicate.
[T] Number of ears out of 10 that had straight rows of kernels.
[S] Only mean values given. Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
[R] Means followed by same letter are not significantly different (P = 0.05).

Table 2. Yields and plant characteristics of standard (su) and sugary enhanced (se) yellow sweet corn varieties grown in Ginat soils, 1999.

Cultivar (seed source)	Maturity[Z] (Days)	Plant Pop.[R] (Plants/ 20 ft)	Plant Height[Y R] (in)	Plant Diam.[R] (in)	Ear Height[W R] (in)	Ear Length[R] (in)	Ear Diam.[R] (in)	Shuck Cover[V R] (in)	Tip Fill[U R] (in)	Row Straight-ness[T R] (1-10)	Mktable Ears (no / plot)	Avg Wt 5 Ears Husked[R] (lbs)	Taste[S] (1-4)
Seneca Horizon (WI)	64	15.0 C-E	50.5 F-H	3.0 B-D	15.5 D	8.2 B-E	6.9 A-B	2.1 A-C	0.1 A	5.7 A-B	14.0 B-D	3.7 A	2.3
Kandy Kwick (JS)	65	13.7 D-F	49.2 G-H	2.5 F	11.8 E	7.8 D-E	5.9 D-E	1.6 B-E	0.0 A	5.3 A-B	11.7 B-D	2.3 A-B	2.1
Sundance (H)	69	19.0 B-C	52.9 F-G	2.9 C-D	17.0 D	7.7 D-E	6.1 C-D	2.5 A	0.0 A	8.7 A	16.3 A-C	1.7 B	1.6
Sugar Buns (RU)	72	9.3 E-F	46.5 H	2.6 E-F	14.5 E-D	7.6 E	5.6 E	1.5 C-E	0.2 A	6.0 A	9.7 C-D	2.4 A-B	2.8
Legend (H)	73	16.7 B-D	55.1 E-F	3.3 A-B	17.5 D	7.9 C-E	6.1 C-D	2.4 A	0.0 A	8.3 A	15.0 B-D	3.1 A-B	1.7
Kandy King (RG)	73	18.7 B-C	58.7 D-E	2.9 C-E	17.2 D	8.9 A	6.8 A-B	1.3 D-E	0.0 A	7.0 A	14.3 B-D	2.2 A-B	2.8
Bodacious (RU)	75	22.7 B	62.8 C-D	3.1 A-C	16.2 D	8.3 A-E	6.8 A-B	2.7 A	0.0 A	7.0 A	15.3 B-D	2.2 A-B	3.3
Tuxedo (SW)	79	12.3 D-F	63.6 B-D	2.8 D-E	17.7 D	8.5 A-C	6.5 B-C	1.6 B-D	0.1 A	7.3 A	9.0 D	2.1 A-B	1.6
GH4881 (RG)	79	21.3 B	68.9 B	3.4 A	22.6 C	8.3 A-D	6.5 B-C	2.5 A	0.2 A	2.7 B	17.0 A-B	2.2 A-B	3.0
Kandy Plus (RG)	79	21.7 B	66.2 B-C	3.1 B-D	22.7 C	8.6 A-B	6.9 A	2.2 A-B	0.3 A	7.3 A	13.0 B-D	3.1 A-B	2.9
Kandy Korn (SW)	81	29.0 A	80.0 A	3.4 A	30.9 A	8.7 A-B	6.5 B-C	0.9 E	1.3 B	8.0 A	22.3 A	2.4 A-B	3.0
Tender Delight (RG)	84	8.0 F	64.6 B-C	3.1 A-C	26.1 B	8.2 B-E	6.7 A-B	2.6 A	0.0 A	7.0 A	9.0 D	2.5 A-B	2.8
LSD (P = 0.05)		*6.3*	*6.4*	*0.3*	*3.5*	*0.6*	*0.4*	*0.7*	*0.6*	*3.6*	*7.1*	*1.6*	

Z Relative days to maturity.
Y Distance from ground to top leaf at R6 stage of growth for five random samples of each replicate.
X Measured 3 inches above ground around plant stalk for three random samples of each replicate.
W Distance from ground to bottom of ear for five random samples of each replicate.
V Distance husk extends beyond ear tip for three random samples of each replicate.
U Distance of unfilled kernels at ear tip for three random samples of each replicate.
T Number of ears out of 10 that had straight rows of kernels.
S Only mean values given. Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
R Means followed by same letter are not significantly different (P = 0.05).

Table 3. Yields and plant characteristics of standard (su) and sugary enhanced (se) bicolor sweet corn varieties grown in Ginat soils, 1999.

Cultivar (seed source)	Matur-ity[Z] (days)	Plant Pop.[R] (Plants /20 ft)	Plant Height[YR] (in)	Plant Diam.[X] (in)	Ear Height[WR] (in)	Ear Length[R] (in)	Ear Diam.[R] (in)	Shuck Cover[VR] (in)	Tip Fill[UR] (in)	Row Straight-ness[TR] (1-10)	Mktable Ears (No./plot)	Avg Wt 5 Ears Husked[R] (lb)	Taste[S] (1-4)
Seneca Arrowhead (H)	62	15.3 B-F	48.9 E-F	2.8 B-E	10.9 H	7.8 A-B	5.7 C-D	1.7 B-E	0.8 B-D	5.7 A	13.3 A-F	2.9 A	2.3
Ecstase II (SW)	68	19.3 A-E	44.7 F	2.3 G	11.3 G-H	7.6 A-B	5.6 D	1.3 D-E	0.8 A-D	8.0 A	16.3 A-E	1.6 B	3.6
Athos (JS)	70	14.7 B-F	47.0 E-F	2.8 B-E	11.1 G-H	7.3 B	6.1 B-D	1.6 B-E	0.7 A-D	6.7 A	4.3 F	2.1 A-B	2.1
Cotton Candy (RG)	72	27.0 A	61.1 A-D	2.7 D-F	19.9 C-E	8.0 A-B	6.6 A-B	1.7 B-E	0.5 A-D	8.7 A	18.7 A-B	2.1 A-B	3.4
Temptation (RG)	73	20.0 A-D	61.1 A-D	2.8 C-F	21.5 C-E	8.6 A	6.3 A-D	2.0 A-E	0.1 A-C	8.7 A	21.0 A-B	2.2 A-B	2.2
Harmony (H)	73	23.3 A-B	65.2 A-C	3.2 A-B	28.9 B	7.7 A-B	6.6 A-B	2.1 A-D	1.0 D	7.3 A	16.7 A-D	2.1 A-B	3.1
Double Gem (JS)	75	11.0 E-F	60.9 A-D	2.6 E-F	15.3 E-H	8.1 A-B	7.0 A	1.7 B-E	0.3 A-D	7.3 A	7.3 C-F	2.1 A-B	2.0
Ambrosia (WI)	75	7.7 F	44.4 F	2.4 G-F	11.8 F-H	7.6 A-B	6.0 B-D	1.4 C-E	0.3 A-D	8.7 A	5.3 E-F	2.6 A	2.7
ClockWork (JS)	76	23.0 A-B	66.5 A-B	3.2 A-C	17.7 D-F	8.5 A	7.0 A	1.4 C-E	0.1 A-B	7.7 A	15.7 A-E	2.7 A	1.3
Parfait (RU)	78	11.3 D-F	62.0 A-D	3.0 B-D	20.9 C-E	8.1 A-B	6.6 A-B	1.1 E	1.0 D	7.0 A	6.0 D-F	2.4 A-B	3.9
Delectable (RU)	80	22.0 A-C	64.4 A-C	3.1 B-D	22.2 C-D	8.1 A-B	6.9 A-B	1.8 B-E	0.9 D	7.7 A	12.7 A-F	2.1 A-B	3.5
BC4885 (RG)	82	18.3 A-E	58.4 B-E	2.9 B-E	21.2 C-E	7.8 A-B	6.3 A-D	2.5 A-B	0.8 A-D	6.0 A	13.3 A-F	2.1 A-B	2.8
Jackpot (SW)	82	16.7 B-E	60.3 A-D	2.9 B-E	24.3 B-C	8.4 A-B	6.4 A-D	2.7 A	0.3 A-D	8.0 A	14.7 A-F	2.4 A-B	2.3
Sweet Sal (H)	83	26.3 A	72.4 A	3.2 A-C	28.8 B	7.9 A-B	6.4 A-C	2.1 A-D	0.6 A-D	7.0 A	18.3 A-C	2.1 A-B	3.7
Seneca Dancer (SW)	92	21.0 A-C	52.3 C-F	2.9 B-E	17.2 D-G	7.6 A-B	6.3 A-D	2.8 A	0.0 A	7.3 A	21.7 A	2.2 A-B	1.6
BiQueen (ST)	92	13.3 C-F	73.5 A	3.5 A	34.6 A	8.3 A-B	6.2 A-D	2.3 A-C	0.3 A-D	5.0 A	10.0 B-F	2.1 A-B	1.5
LSD (P = 0.05)		*9.2*	*13.6*	*0.5*	*6.6*	*1.1*	*0.8*	*0.9*	*0.8*	*3.8*	*11.4*	*1.0*	

Z Relative days to maturity.
Y Distance from ground to top leaf at R6 stage of growth for five random samples in each replicate.
X Measured 3 inches above ground around plant stalk for three random samples in each replicate.
W Distance from ground to bottom of ear for five random samples in each replicate.
V Distance husk extends beyond ear tip for three random samples in each replicate.
U Distance of unfilled kernels at ear tip for three random samples in each replicate.
T Number of ears out of 10 that had straight rows of kernels.
S Only averages given. Taste: 1 = Poor; 2 = Good; 3 = Very Good; 4 = Excellent.
R Means followed by same letter are not significantly different (P = 0.05).

Seeded and Seedless Watermelon Cultivar Evaluation

John Strang, April Satanek, Darrell Slone, and John Snyder, Department of Horticulture

In this trial, five seeded and 18 triploid (seedless) varieties of watermelon were grown and evaluated for their performance in Kentucky. The trial was conducted at the University of Kentucky Horticultural Research Farm in Lexington.

Materials and Methods

Seeds were planted in cell packs in the greenhouse on April 21, 2000. Plants were transplanted into a raised black plastic mulched bed using a waterwheel setter on May 26, 2000. Each plot was 20 ft long with six plants planted 4 ft apart within the row. Plots were replicated four times in a randomized complete block design. Rows were spaced 10 ft apart. Plots were drip irrigated based on soil tensiometer readings.

Fifty lb N/A as ammonium nitrate was applied preplant to all replications, and 25 lb of K_2O/A from potassium chloride was applied to two replications as warranted by soil tests. Plots were fertigated with 7.5 lb/A of ammonium nitrate. A foliar application of Epsom salts was applied on August 10, 2000, at a rate of 4 lb/A to remedy an apparent magnesium deficiency. Sprays for disease included fixed copper, Manzate, Bravo, and Quadris. Pounce, Thiodan, Asana, and Capture were applied for insect and mite control. A preemergence application of Curbit was used for weed control between the beds.

Results

The growing season of the year 2000 was mild, with sufficient rainfall and an absence of extremely high temperatures, which tended to spread the melon harvest over a period of four to five weeks. An apparent magnesium deficiency was observed just prior to harvest, and the overall vigor of the plants was noticeably diminished compared to plant vigor in the preceding year's trials. Some plots contained off-type melons, and these fruit were graded as culls.

Triploid watermelons. The best oval, triploid, crimson sweet rind-type melons were Triple Prize, Triple Crown and Triple Star. Triple Prize was the top recommendation in last season's trials also. Tri-X-Brand Shadow, a round, attractive, dark green melon, had the best taste rating. Sterling, Revolution, and Freedom were all excellent large, elongated triploid varieties with allsweet rinds. Revolution, Freedom, and Sterling are early, midseason and late cultivars respectively. Sterling had a number of off-type round melons, which were not noted in last season's trial, but it still had high yields. Of the two yellow seedless watermelons observed, Buttercup was the best performer, with high yields and an attractive yellow flesh color, although it had a slightly lower sugar content than Solid Gold.

Seeded watermelons. The best red elongated allsweet, rind-type seeded watermelons with high yields and attractive fruit were RWM 8036, Sangria, and Royal Majesty. Sangria was rated as having the best taste of the seeded cultivars in this trial.

Table 1. Seeded (S) and seedless (T) watermelon yield, fruit size, and seed germination, Lexington, KY, 2000.

Cultivar	Melon Type	Seed Germ. 5/99 (%)	Seed Source	Days to Harvest	Mkt Melon Wt >10 lb (cwt/A)[1]	No. Mkt Melons/A	Avg Mkt Melon Wt (lb)	No. Melons/A < 10 lb (culls)	Outside Measurements Length (in)	Outside Measurements Width (in)	Rind Thickness (in)
Triple Prize	T	63	SW	85	922 a	5037	18.3	363	11	9	0.9
Buttercup	T	74	DP	85	906 ab	5082	18.9	0	10	10	0.7
Sterling	T	69	SW	92	902 ab	3630	24.7	544	16	10	0.7
RWM 8036	S	-	RG	88	879 a-c	3131	28.0	0	17	9	0.6
Sangria	S	-	SW	87	874 a-c	3857	22.7	181	17	8	0.6
Royal Majesty	S	-	SW	90	859 a-c	4129	20.9	0	16	8	0.7
Revolution	T	59	SU	80-85	814 a-d	4084	19.9	0	15	9	0.7
Royal Flush	S	-	AS	85	812 a-d	3766	21.5	0	16	8	0.7
Triple Crown	T	74	SW	85	806 a-d	4538	17.8	181	12	10	0.6
Tri-X Sunrise	T	-	NV	85	787 a-e	4220	18.6	0	11	10	0.7
Triple Star	T	51	SW	86	781 a-e	4401	17.7	0	11	9	0.7
Fandango	T	63	SR	85	778 a-e	4220	18.4	1452	12	10	0.7
Freedom	T	75	SU	85-90	771 a-f	3948	19.7	0	15	9	0.7
Tri-X Triple Sweet	T	72	NV	85	766 a-f	4265	18.0	544	10	10	0.7
Tri-X 313	T	81	NV	85	751 a-f	4311	17.5	181	12	9	0.7
Genesis	T	40	SR	85	703 a-f	4628	15.4	181	10	9	0.6
Farmer's Wonderful	T	39	JS	85	699 a-f	4674	15.0	544	11	10	0.6
Tri-X Shadow	T	67	NV, RG	88	699 a-f	4492	15.6	0	12	9	0.6
RWM 8073	T	71	RG	88	642 b-f	4038	15.9	181	11	9	0.6
Sapphire	T	54	HL	80	627 c-f	3630	17.2	1452	13	10	0.6
Crimson Sweet	S	-	JS	85	579 d-f	2496	22.8	0	11	10	0.8
Sweet Caroline Improved	T	85	DP	95	526 ef	3131	16.8	181	10	9	0.6
Solid Gold	T	80	SR	80	505 f	2949	17.3	907	11	10	0.5

[1] Numbers followed by the same letter are not significantly different (Waller-Duncan LSD, P=0.05).

Table 2. Seeded and seedless watermelon fruit characteristics, Lexington, KY, 2000.

Cultivar	Hollow Heart[1] (1-2)	Sugar (%)	Flavor[2] (1-5)	Seed No./ fruit	Interior color[3]	Rind Type[4]	Comments
Triple Prize	1.8	11.8	4.1	3	LR	Crimson Sweet	Some dark seed traces, thick rind, some interior discoloration around rind, bright yellow interior, attractive.
Buttercup	2.0	11.4	3.4	0	MBY	Jubilee	Good firm, red flesh; tough rind; some reps w/ round; melons w/ a lot of seeds.
Sterling	1.5	12.4	4.5	4.3	MR	Allsweet	Attractive interior and exterior.
RWM 8036	1.5	10.6	3.7	--	LR	Allsweet	
Sangria	2.0	12.1	4.2	-	MR	Allsweet	Attractive, good interior color.
Royal Majesty	1.5	11.4	3.8	-	LR	Allsweet	
Revolution	1.8	11.7	4.6	4	MR	Dark Allsweet	Attractive exterior, nice, attractive red interior.
Royal Flush	1.8	11.3	3.6	-	LR	Allsweet	
Triple Crown	1.8	11.7	4.2	1.8	DP	Crimson Sweet	Attractive exterior.
Tri-X Sunrise	2.0	12.4	4.5	2.5	DP	Jubilee	Firm flesh, interior discoloration (orange) around rind.
Triple Star	2.0	12.5	4.1	1.5	LR	Dark Crimson Sweet	Attractive interior and exterior, nice flesh.
Fandango	1.8	12.6	4.3	3.5	LR	Crimson Sweet	Tender flesh, attractive interior.
Freedom	1.8	12.3	4.3	4.8	LR	Allsweet	Attractive interior and exterior, nice red color, firm flesh.
Tri-X-Triple Sweet	1.5	11.2	3.8	2.8	LR	Allsweet	Tender flesh.
Tri-X 313	2.0	11.7	4.6	1.5	DP	Crimson Sweet	Firm flesh.
Genesis	2.0	11.9	3.6	4.8	DP	Crimson Sweet	Tender flesh.
Farmer's Wonderful	1.5	12.1	4.4	1.8	LR	Allsweet	Attractive interior, tender flesh.
Tri-X Shadow	2.0	12.8	4.8	3	LR	Black w/stripe	Some dark seed remnants, easy to cut.
RWM 8073	2.0	12.2	4.5	2.8	DP	Royal Sweet	Tender flesh.
Sapphire	1.8	12.9	4.2	0.8	LR	Crimson Sweet	Tender flesh.
Crimson Sweet	1.5	11.1	3.6	-	LR	Crimson Sweet	Tender flesh, a little fibrous.
Sweet Caroline Improved	1.8	12.2	4.4	1.3	DP	Crimson Sweet	Juicy, attractive interior.
Solid Gold	1.8	12.3	3.7	1.8	MBY	Jubilee	Attractive interior and exterior, few w/dark seed traces.

[1] 1 = hollow heart; 2 = no hollow heart.

[2] 1 = poor; 5 = excellent.

[3] LR = light red; MBY = medium bright yellow; MR = medium red; DP = dark pink.

[4] Allsweet = medium green rind w/ dark green, broad mottled stripes; Jubilee = light green rind w/distinct narrow, dark green stripes; Black = solid dark green rind; Crimson Sweet = light green rind w/mottled, dark green stripes; Royal Sweet = light green rind w/wide, mottled, dark green stripes.

Winter Squash Cultivar Evaluation

John Strang, April Satanek, Kay Oakley, Darrell Slone, and John Snyder, Department of Horticulture
Bill Papania, Papania's Wholesale Produce, Lexington, KY

Introduction

In Kentucky, ornamental as well as edible winter squash are in demand. In this trial, 14 butternut, seven kabocha, two spaghetti, and eight miscellaneous winter squash hybrids, including acorn and hubbard, were evaluated for their yield and quality. Acorn squash has the largest share of the winter squash market year-round, while butternut is in somewhat seasonal demand in Kentucky. Kabocha squash is a unique type of *Cucurbita maxima* that has potential in the fresh market as well as the ornamental market. Kabocha squash tend to have a sweet, dry flesh, similar to that of sweet potatoes. A medium to small butternut squash is preferred for the fresh market, and a cultivar that has greater uniformity of this desired size will ultimately have more marketable fruit. The large butternut squash are more suitable for processing or for ornamental purposes.

Materials and Methods

Seeds were planted in cell packs in the greenhouse on May 16 and 17, 2000. Transplants were set in the field on June 5 and 6 on raised, black plastic mulched beds using a waterwheel setter. Each plot was 20 ft long and contained 6 plants spaced 4 ft apart, with 10 ft between rows. Drip irrigation was used to fertigate and to irrigate according to soil tensiometer readings. Seventeen lb/A of N as ammonium nitrate was applied preplant and disked in. Three replications received 25 lb/A of K_2O as potassium chloride as indicated by soil tests. Throughout the growing season plots were fertigated with a total of 17 lb/A of actual N as ammonium nitrate. Thiodan, Pounce, Asana, Capture, and Endosulfan were used as insecticide sprays. Fungicides applied during the season included fixed copper, Manzate, Bravo, Quadris, and Ridomil. A preemergence application of Curbit herbicide was applied after the last tilling.

Results and Discussion

The growing season was mild, with sufficient rainfall and a lack of extreme temperatures. In mid-July, a wilt disease was noted on some plants in two of the replications. The plants wilted badly under hot conditions but recovered during humid, cooler weather. Powdery mildew was observed in the first week of August, and fungicidal sprays were applied. Harvest began for all squash 104 days after setting in the field.

Butternut squash. The highest yielding butternut squash in this trial was RWS 4586, a long, large squash weighing about 8 lb. Ultra is slightly smaller but still too large for fresh market sales. Size is important, and as a result, the larger butternut squash in this trial were not acceptable for fresh market. Nicklow's Delight, Butternut Supreme, Chieftan, and Walthan Butternut were rated as the highest yielding best size for fresh market butternut squash, weighing between 2.3 and 3.4 lb each. Butternut Supreme was rated as having the best taste and had one of the higher aroma ratings. Waltham Butternut was the most uniform of the butternuts, and Ultra was the least, producing fruit with both straight and curved necks. The primary reasons for butternut culls were cracking and small fruit size. All butternut squash were large vining types, and the fruit had a bright orange interior color and a tan exterior. The market for butternut squash is primarily the fall.

Kabocha. Of the typical, dark green kabocha squash, Sweet Mama, Delica, and Tastie Delight were some of the best performers. Sweet Mama was the highest yielding cultivar despite 37% culls. The high number of culls in the kabocha squash was due mostly to sunscald, which led to splitting and decay. All Kabocha squash had a dark orange interior and excellent eating quality. The highest yielding squash in this section of the trial was Sweet Meat, which is light grayish green in color; this variety is a hybrid winter squash and not a Kabocha squash. The fruit of this variety is large, averaging 12 lb/fruit. The flesh quality is good, and the cultivar also has ornamental value due to its color and shape; however, many fruit had scarring or warts on them.

Miscellaneous winter squash. The highest yielding winter squash in the entire trial was the Stripetti spaghetti squash. This was an extremely prolific variety, and six plants produced an average of 563 lb of fruit. The fruit were attractive, oblong, and bright yellow with orange stripes at maturity and having an extremely hard exterior. Small Wonder, the other spaghetti squash in this trial, was also productive, attractive and small, making it ideal for small families. When cooked, Small Wonder had a slightly better taste than Stripetti.

Festival, Heart of Gold, and Sweet Dumpling were all small, brightly colored, and attractive. Both Festival and Sweet Dumpling varied considerably in the color patterns between individual squash. In fact, warty gourd-type squash were observed in some replications of Festival and Sweet Dumpling, and these squash were classified as culls in the following tables even though they were quite attractive. Heart of Gold, an acorn squash, had the highest yield, and Sweet Dumpling had the lowest yield but also had the best eating quality of the three.

Of the three dark green acorn squash, Taybelle PM appeared to be the best and had an excellent taste.

Blue Majic, a gray-green hubbard squash, was smaller in size than a typical hubbard and had an attractive exterior.

Table 1. Butternut squash yield and fruit size characteristics, Lexington, KY, 2000.

Cultivar	Seed Source	Days to Harvest [Z]	Yield (cwt/A) [Y]	No. Mkt Fruit/A	Avg Fruit Wt (lb)	Culls (%)	Fruit Length (in)	Fruit Diameter (in)	Uniformity of Size (1-5) [X]	Uniformity of Color (1-5) [W]
RWS 4586	RG	110	409 a	8,576	8.0	3.0	16.9	5.3	3.9	4.6
Ultra	HL, RU	90	332 b	10,209	5.4	5.1	12.6	5.6	1.9	4.8
RWS 4572	RG	100	296 bc	13,250	3.7	5.6	10.2	4.6	3.3	4.6
Nicklow's	JS	105	280 cd	13,703	3.4	1.3	9.3	4.4	3.2	3.8
Avalon	HL	90	274 cd	13,068	3.5	2.1	9.1	4.7	3.9	4.8
Butternut	SW, RU	90	238 de	11,843	3.4	7.5	8.9	4.8	3.3	4.4
Chieftan	RU	90	222 ef	16,017	2.3	0.5	7.8	3.8	3.5	4.7
Waltham	SW	110	221efg	12,251	3.0	1.1	8.6	4.6	4.2	4.6
Zenith	HL, RU	88	203 efg	12,977	2.6	10.6	8.9	4.6	3.0	4.7
Harris'	HR	88	196 efg	12,524	2.6	11.8	9.0	4.4	3.8	4.4
Puritan	SW	110	195 efg	12,569	2.6	1.7	8.4	4.4	3.1	3.9
Early	RU, HR	80	192 efg	12,297	2.6	10.7	8.2	4.3	3.3	4.5
Butterboy	SW	80	184 fg	1,134	2.7	3.5	8.8	4.4	2.8	4.3
Pilgrim	RU	80	171 g	11,253	2.5	1.6	8.5	4.5	3.5	3.8
Waller-Duncan LSD (P=0.05)			*50*	*2,323*	*0.64*					

[Z] As listed in catalogue.
[Y] Means followed by the same letter are not significantly different.
[X] Uniformity of size: 1 = extremely variable, 5 = very uniform.
[W] Uniformity of color: 1 = extremely variable, 5 = all the same color.

Table 2. Butternut squash fruit characteristics, Lexington, KY, 2000.

Cultivar	Flesh Thickness Range[Z]	Cavity Size l x w (in) [Y]	Aroma (1-5) [X]	Taste (1-5) [W]	Comments
RWS 4586	0.6 -3.7	3.8 x 3.4	4.0	3.2	Long, thick neck, ribbed exterior, sweet aroma, exterior w/ slight pinkish tint, large for fresh.
Ultra	0.8 -4.0	3.3 x 3.7	3.4	3.2	Slightly curved, thick neck, exterior w/ slight pinkish tint.
RWS 4572	0.6 -3.5	3.1 x 2.9	3.9	3.0	Medium large size.
Nicklow's	0.7 -3.7	2.9 x 2.8	3.4	3.5	Solid neck, green aroma, some peanut shaped, majority are of fresh market size.
Avalon	0.6 -3.6	2.6 x 3.2	3.7	3.5	Sweet aroma, medium large fruit size.
Butternut	0.6 -3.4	2.8 x 3.1	4.0	4.5	Thick neck, attractive interior, good fresh market size.
Chieftan	0.6 -3.1	1.9 x 2.4	3.6	4.0	Mild aroma, small seed cavity, good fresh market size.
Waltham	0.6 -3.2	2.3 x 3.0	2.9	3.0	Bright orange flesh, good fresh market size.
Zenith	0.6 -3.4	2.8 x 2.7	3.3	3.2	Thick neck, bright orange flesh, some pumpkin shaped, good fresh market size.
Harris	0.7 -2.8	2.3 x 2.8	3.5	3.0	Good fresh market size, culls mainly misshapen fruit.
Puritan	0.6 -3.2	2.4 x 2.8	3.4	4.0	Thick neck, attractive interior, good fresh market size.
Early Butternut	0.6 -3.4	2.1 x 2.7	3.3	3.5	Good fresh market size, interior is bright orange, some off types with very thin necks.
Butterboy	0.6 -3.2	2.3 x 2.8	3.9	3.5	Thick neck, small cavity, attractive interior, good size for fresh market.
Pilgrim	0.6 -3.3	2.0 x 2.8	3.0	3.0	Thick neck, attractive interior.

[Z] Flesh thickness: range in inches of narrowest to widest interior flesh thickness.
[Y] Cavity size: length and width of the seed cavity.
[X] Aroma: 1= very unpleasant, 5 = good, sweet squash aroma.
[W] Taste: 1 = flavorless or undesirable, 5 = sweet, appealing, based on one microwaved squash.

Table 3. Kabocha squash yield and fruit size characteristics, Lexington, KY, 2000.

Cultivar	Seed Source	Days to Harvest [Z]	Yield (cwt/A) [Y]	No. Mkt Fruit/A	Avg Fruit Wt (lb)	Culls (%)	Vine Size [XZ]	Fruit Length (in)	Fruit Diameter (in)	Uniformity of Size (1-5)[W]	Uniformity of Color (1-5)[V]
Sweet Meat	HR	103	291 a	4,084	11.9	1.5	lv	6.3	10.5	3.5	4.7
Sweet Mama	AT, RU, ST, SW	85	195 b	6,534	5.0	37.2	sv	4.7	8.4	3.9	4.0
Delica	RU	90	194 b	7,850	4.1	9.9	lv	4.3	7.5	4.4	3.8
Tastie Delight	SW	110	160 bc	7,442	3.5	8.5	lv	4.3	7.2	4.1	3.5
Honey Delight	JS,RU,ST	90	140 bcd	5,853	4.0	16.1	lv	4.2	7.0	3.8	3.5
Hokkori	JS	95	127 bcd	6,262	3.4	8.7	lv	4.3	7.2	3.5	3.7
Cha-Cha	JS	95	108 cd	5,264	3.4	10.9	lv	4.3	7.1	3.5	4.1
Black Forest	JS	95	77 d	4,401	2.9	83.9	lv	3.2	6.6	3.1	3.6
Waller-Duncan LSD (P=0.05)			*80*	*2,120*	*0.77*						

[Z] As listed in catalogue.
[Y] Means followed by the same letter are not significantly different.
[X] Vine size: lv=large vine, sv=semi-vine, b=bush.
[W] Uniformity of size: 1=extremely variable, 5= very uniform.
[V] Uniformity of color: 1= extremely variable, 5=all the same color.

Table 4. Kabocha squash fruit characteristics, Lexington, KY, 2000.

Cultivar	Exterior Color	Flesh Thickness Range (in)[Z]	Cavity Size l x w (in)[Y]	Aroma (1-5)[X]	Taste (1-5)[W]	Comments
Sweet Meat	Grey-green, flecked dark green	1.0 - 2.2	2.8 x 6.8	3.5	4.5	Large white seeds, strong squash smell, moist, not as fine grained, slightly sweet taste, many w/ scarring and warts.
Sweet Mama	Dark green w/ grey-green stripes	0.9 - 1.6	2.3 x 5.3	4.3	4.5	Slightly lighter green than others, moist consistency, not fine grained, slight squash smell, most culls were sunburned and split.
Delica	Dark green w/ grey-green stripes	0.7 - 1.4	2.4 x 5.2	3.1	4.5	Sweet squash aroma, medium dry, slightly sweet, some seed germinating inside cavity, culls included rot and splits.
Tastie Delight	Dark green w/ grey-green stripes	0.6 - 1.2	2.4 x 5.1	3.1	4.5	Squashy aroma, not real sweet, moist, fine grained, mild sweet flesh.
Honey Delight	Dark green w/ grey-green stripes	0.7 - 1.3	2.4 x 4.8	3.5	4.5	Medium dry, fine grained, slightly sweet, exterior dimpled, many culls w/sunburn.
Hokkori	Dark green w/ grey-green stripes	0.7 - 1.3	2.2 x 5.0	3.5	4.0	Sweet squash smell, dry, fine grained flesh, fairly sweet, exterior dimpled, many culls w/sunburn.
Cha-Cha	Dark green w/ grey-green stripes	0.7 - 1.3	2.1 x 4.7	3.4	4.5	Dry, fine grained, good, sweet flavor, exterior dimpled, some decayed stems.
Black Forest	Black-green w/ grey-green stripes	0.7 - 1.2	2.0 x 4.8	3.3	4.5	Fine grained, faint aroma, dry flesh, exterior dimpled, culls w/sunburn.

[Z] Flesh thickness range: range in inches of narrowest to widest flesh thickness.
[Y] Cavity size: length and width of the seed cavity.
[X] Aroma: 1= unpleasant, 5=pleasant, sweet squash aroma.
[W] Taste:1=bland or unpleasant, 5=excellent, sweet squash taste based on one microwaved squash.

Table 5. Miscellaneous squash yield and fruit size characteristics, Lexington, KY, 2000.

Cultivar	Seed Source[Z]	Days to Harvest	Yield (cwt/A)[Y]	No. Mkt Fruit/A	Avg Fruit Wt (lb)	Culls (%)	Vine Size[X]	Fruit length (in)	Fruit Diameter (in)	Uniformity of Size (1-5)[W]	Uniformity of Color (1-5)[V]
Stripetti	HL	110	614 a	28,087	3.7	0	lv	9.3	5.0	3.9	3.4
Small Wonder	HL	70	348 b	25,410	2.3	1.8	lv	5.5	4.9	4.8	4.5
Blue Majic	RU	100	271 c	6,080	7.4	0	lv	10.4	8.2	3.5	4.8
Heart of Gold	RG	90	222 d	22,370	1.7	0	sv	4.3	4.5	4.5	3.0
Taybelle PM	RU	70	169 e	12,887	2.2	10	b	5.5	5.0	4.3	4.4
Festival	RU	100	140 ef	14,928	1.6	11.2	sv	4.0	4.6	4.5	1.3
Mesa Queen	HL,RU	70	130 ef	12,251	1.8	4.2	sv	5.3	4.5	4.3	4.3
Table Ace	RU	70	120 f	10,845	1.8	6.1	sv	5.7	4.1	4.4	4.7
Sweet Dumpling	RU	100	118 f	17,696	1.1	23.2	sv	3.5	4.2	4.1	1.6
Waller-Duncan LSD (P=0.05)			*42*	*4,120*	*0.47*						

Z As listed in catalogue.
Y Means followed by the same letter are not significantly different.
X Vine size: lv= large vine, sv= semi-vine, b=bush type.
W Uniformity of size: 1=extremely variable, 5=very uniform.
V Uniformity of color: 1= extremely variable, 5= all the same color.

Table 6. Miscellaneous squash fruit characteristics, Lexington, KY, 2000.

Cultivar	Interior Color[Z]	Exterior Color	Flesh Thickness Range (in)[Y]	Cavity size l x w (in)[X]	Aroma (1-5)[W]	Taste (1-5)[V]	Comments
Stripetti	LY	yellow w/ orange stripes, flecked orange	0.7 - 1.2	6.6 x 2.6	3.3	3.0	Spaghetti type, exterior hard, difficult to cut, attractive ornamental, sweet aroma.
Small Wonder	LY	light orange w/ yellow flecks	0.8 - 1.1	3.7 x 2.8	3.4	3.5	Spaghetti type, uniform, sweet squash aroma, slightly crunchy, golden when cooked.
Blue Majic	DO	grey-green w/ green flecks	1.1 - 2.4	6.0 x 5.3	2.5	4.0	Small hubbard, attractive interior, taste is dry, sweet, smooth, fine textured.
Heart of Gold	DY	cream w/ dark green mottled stripes	0.6 - 1.2	2.4 x 3.0	4.4	3.3	Acorn type, attractive exterior, coarse flesh texture, mild aroma.
Taybelle PM	DY	black-green	0.7 - 1.3	3.6 x 2.9	3.3	4.5	Acorn type, mild aroma, orange ground spot, highly ridged exterior.
Festival	DY	cream or yellow w/ dark green or orange mottled stripes	0.5 - 1.0	2.3 x 3.1	4.1	2.5	Extremely variable exterior color, nice as an ornamental.
Mesa Queen	DY	black-green	0.7 - 1.0	3.4 x 2.7	3.8	4.5	Acorn type, attractive.
Table Ace	DY	black-green	0.8 - 1.1	3.5 x 2.4	4.3	4.0	Acorn type, attractive, sweet aroma, smooth flesh, distinct cavity, orange ground spot, a lot of sunburn.
Sweet Dumpling	LY	cream w/ dark green mottled stripes	0.4 - 1.0	1.8 x 3.0	4.4	4.5	Attractive, variable exterior color, some yellow w/ orange mottled stripes.

Z Interior color: LY=light yellow, DO=dark orange, DY=dark yellow.
Y Flesh thickness range: range in inches of smallest to largest flesh thickness.
X Cavity size: length and width of the seed cavity.
W Aroma: 1= unpleasant, 5= sweet squash aroma.
V Taste: 1=flavorless or undesirable, 5= sweet, very appealing, based on one microwaved squash.

Cucumber Beetle Control and Its Impact on Bacterial Wilt in Cantaloupe

Ric Bessin, Department of Entomology; William Nesmith, Department of Plant Pathology; Brent Rowell and John Strang, Department of Horticulture

Introduction

Striped and spotted cucumber beetles can cause serious losses in cucumbers and cantaloupes in Kentucky. While the adults feed mainly on foliage, stems, pollen, and flowers, it is their feeding on melon rinds late in the season that may reduce market quality. Cucumber beetles are a major concern to cantaloupe and cucumber growers because they carry and transmit the bacterium that causes bacterial wilt. This disease can severely limit cucumber and cantaloupe production if it is not managed effectively. While larvae of cucumber beetles feed on roots and stems and can cause some damage, this damage is minimal compared to the potential losses due to bacterial wilt.

Commercial melon producers must particularly control these beetles on young plants. Two species of cucumber beetle, the striped and the spotted, are both effective vectors for bacterial wilt. Until the early 1990s, growers were able to use Furadan 15G at planting to provide systemic control of the beetles and reduce the incidence of the disease. However, that insecticide was disallowed on cucurbits due to environmental issues. Currently, producers rely on foliar insecticides applied at seven-to-10 day intervals to keep beetle numbers to a minimum.

Materials and Methods

A study was conducted at the UK South Farm in Lexington during the summer of 2000 to evaluate the effectiveness of a newly registered systemic insecticide and a foliar insecticide for control of cucumber beetles on cantaloupes and their control of bacterial wilt.

Four-week-old 'Athena' cantaloupe plants were transplanted into raised beds with plastic and trickle irrigation on May 23 using a waterwheel setter. Plants were spaced 2 ft apart in a single row per bed. Each experimental plot consisted of four rows of 10 melon plants each. Between plots, 30 ft of corn was transplanted into the rows to reduce cucumber beetle movement.

The commercially available cucumber beetle treatments examined were an untreated control, Pounce 3.2 EC applied as a foliar spray at the rate of 6 fluid oz/A/application, and Admire 2F applied at the rate of 20 fluid oz as a post-transplant drench. Pounce sprays were applied on May 23 and 30 and June 6, 13, and 20 using a Solo Backpack sprayer. The Admire treatment was applied directly to the soil at the base of the plants in 1/3 oz of water on May 23 immediately after transplanting was completed. The post-transplant drench was selected to minimize exposure of laborers to insecticide residues while trying to maximize rapid uptake of the insecticide and control of cucumber beetles. Admire was intentionally not mixed in with the transplant water because that method of application is prohibited. All application methods used in this study are labeled for commercial use.

Prior to harvest, cucumber beetle numbers were monitored by periodically recording the number of striped and spotted cucumber beetles on five plants in each plot and by use of a yellow sticky card in the corner of each plot. Plants within the plots were examined frequently for incidence of bacterial wilt (based on wilt symptoms and bacterial streaming) throughout the course of the study. However, in the analysis, because cucumber beetles tended to first colonize the outside rows of plots, the inner and outer rows of the plot were analyzed separately and then analyzed together. Data were subjected to analysis of variance, and means were compared using Fisher's Protected LSD.

Results and Discussion

Beetles. During the course of this study, the striped cucumber beetle was far more numerous than the spotted cucumber beetle. Generally, numbers of striped cucumber beetles were high in early June but declined through late July. Yellow sticky card monitoring revealed an initial difference in the number of striped cucumber beetles among treatments. During the first two sampling periods, many more striped cucumber beetles were captured in untreated plots than in the insecticide treated plots. There was no significant difference in the number of cucumber beetles captured on yellow sticky cards in Admire and Pounce-treated plots throughout the study.

Inspection of plants for striped cucumber beetles showed that by the June 12 sampling date, there were significant differences between the untreated control and the insecticide treatments. No significant differences were detected in the numbers of these beetles found on the plants between the two insecticides treatments on each of the sampling dates. Numbers of spotted cucumber beetles on the plants were so low that no differences among treatments were detected. Both insecticide treatments significantly reduced the numbers of squash bugs around the crown of the plants and underneath the plastic on the June 12 and 27 sampling dates.

Bacterial wilt. This farm has a long history of serious bacterial wilt problems. A high level of bacterial wilt incidence was observed in this study, with nearly 60% of the untreated plants infected by the end of the study. Levels of infection were slightly higher in outside rows, as might be expected due to manner in which cucumber beetles colonize plots. When considering only the inner rows or outer rows, the levels of disease between the insecticide treatments and the untreated control were significantly different beginning on July 7 and the differences continued until the end of the study. The incidence of bacterial wilt in Admire and Pounce treatments was not significantly different for any observation period. When considering all rows within each plot together, the insecticide treatments had significantly less bacterial wilt than the untreated control on all observation dates except the first. No differences in disease were detected between the Admire and Pounce treatments. At the end of the study, only about 10% of the plants that had been treated with either of the insecticides had symptoms of bacterial wilt infection.

Yields. Melons were harvested from July 25 through August 13. Significantly higher yields came from the insecticide treatments. The insecticide treatments yielded about three fruits/plant with an approximate total weight of 17.5 lb/plant. The untreated control yielded approximately half the number and weight of fruits than did the insecticide treatments. However, there were no significant differences in either the number or weight of fruit harvested from the Admire and Pounce treatments.

The evidence provided by this single-year study indicates that a single application of the systemic insecticide Admire, when applied at 20 fluid oz/A as a post-transplant drench, provided the same level of cucumber beetle control as five weekly foliar applications of Pounce. This contributed to statistically similar incidences of bacterial wilt and melon yields among the two insecticide treatments, with significantly less bacterial wilt and higher yields in insecticide-treated plots than in control plots.

These data are consistent with our standing recommendations that cucumber beetle control is critical to bacterial wilt control. It must be pointed out that there are other methods of application listed for cucurbits on the Admire label but that those were not evaluated in this test. The levels of cucumber beetle control, bacterial wilt infection, and melon yields using those other methods may not be the same as those obtained with the post-transplanting soil drench method. The authors are planning to repeat this study in 2001.

Table 1. Numbers of striped and spotted cucumber beetles/yellow sticky card.

	Striped Cucumber Beetle			Spotted Cucumber Beetle		
	Admire	Pounce	Control	Admire	Pounce	Control
6/12	13.75 b	5.25 b	127.25 a	1.50	1.75	4.00
6/20	1.50 b	2.25 b	22.50 a	1.25 ab	0.00 b	3.25 a
6/27	4.25	2.00	11.25	1.25	1.25	2.25
7/14	4.00	3.33	6.75	3.75	1.33	1.50
7/18	2.75	1.33	7.33	0.75	0.00	1.00
7/25	1.75	3.75	4.25	0.25	0.50	0.25
7/31	4.50	5.25	3.00	0.25	0.00	0.25

Note: Means within the same species and date followed by the same letter are not significantly different (LSD >0.05).

Table 2. Numbers of striped and spotted cucumber beetles and squash bugs/5 plants.

	Stripped Cucumber Beetle			Spotted Cucumber Beetle			Squash Bug		
Date	Admire	Pounce	Control	Admire	Pounce	Control	Admire	Pounce	Control
6/5	0.00	0.00	29.00	0.00	0.00	0.00	0.00	0.00	0.00
6/12	0.25 b	0.00 b	39.25 a	0.00	0.00	0.50	0.00 a	0.00 a	3.25 b
6/20	3.75 b	1.50 b	44.50 a	0.00	1.00	1.00	0.00	0.00	0.00
6/27	2.50 b	0.25 b	12.25 a	2.25	1.50	1.75	0.00 b	0.00 b	1.50 a

Note: Means within the same species and date followed by the same letter are not significantly different (LSD >0.05).

Table 3. Percentage incidence of bacterial wilt in 'Athena' melons.

	Inner Rows			Outer Rows			All Rows		
Date	Admire	Pounce	Control	Admire	Pounce	Control	Admire	Pounce	Control
6/20	0.00	0.00	1.25	1.25	0.00	17.50	0.63	0.00	9.38
6/27	0.00	0.00	2.50	1.25	0.00	18.75	0.63 b	0.00 b	10.63 a
7/7	0.00 b	0.00 b	13.75 a	1.25 b	0.00 b	33.75 a	0.63 b	0.00 b	23.75 a
7/18	3.75 b	5.00 b	18.75 a	2.50 b	0.00 b	50.00 a	3.13 b	2.50 b	34.38 a
8/3	5.00 b	6.25 b	33.75 a	3.75 b	3.75 b	50.75 a	4.38 b	5.00 b	46.25 a
8/14	10.00 b	15.00 ab	50.00 a	10.00 b	6.25 b	68.75 a	10.00 b	10.63 b	59.38 a

Note: Means within row configuration and date followed by the same letters are not significantly different (LSD >0.05).

Table 4. Numbers and weight of marketable fruit.

	No. of Fruits			Wt of Fruits		
Treatment	Inner rows	Outer rows	All rows	Inner rows	Outer rows	All rows
Admire	59.3 a	54.8 a	114.0 a	356.2 a	318.5 a	674.6 a
Pounce	64.3 a	61.0 a	125.0 a	373.3 a	363.7 a	737.0 a
Control	34.8 b	25.8 b	60.5 b	194.8 b	140.3 b	335.0 b

Note: Means within columns followed by the same letter are not significantly different (LSD >0.05).

Fresh Sawdust as a Nitrogen Source in Sweet Corn Production

Thomas J. Brass, Henderson County Cooperative Extension Service, Henderson, KY

Introduction

In an effort to recycle and keep potentially valuable materials out of landfills, many organic by-products are being evaluated for use in agricultural production. One such by-product is sawdust generated by sawmills and plywood mills. Disposal fees at many landfills become a liability and, as a result, wood processing mills have begun to explore alternative disposal options.

The problem with typical sawdust compositions is that its high C/N ratio requires the material to go through a decomposition process. The result is that nitrogen immobilization does not occur when applications are made to soil. However, newer techniques in the manufacture of particleboard involve the use of urea formaldehyde as adhering or gluing agent. As a result of this process, plywood glued with urea formaldehyde potentially has a high nitrogen content and low C/N ratio. Favorable compositions would permit direct application to soil without having to worry about nitrogen immobilization. The high nitrogen content of the material could also supply partial or total N requirements to crops.

The objectives of this study were to determine the chemical analysis of a fresh sawdust from plywood having urea formaldehyde as the gluing agent and to study its use as a nitrogen source for sweet corn production.

Materials and Methods

Sawdust elemental and water-soluble ion composition were analyzed by wet digestion at Auburn University's Soil Testing Laboratory, Auburn, Alabama. Results are shown in Table 1. The analysis is similar to those of many rapidly decomposing organic materials (like chicken litter) in total nitrogen content and C/N ratio. Concentrations of salts and heavy metals are well within acceptable ranges for its use as an organic soil amendment in crop production.

The field experiment consisted of three blocks of Rapture sweet corn planted in a Waverly silt loam soil on May 1, June 4, and July 1, 1998. Plots within each block included a total of five treatments: four combinations of fresh sawdust (SD) and ammonium nitrate (NH_4NO_3) and a control.

The five treatments were as follows:
1. Control.
2. 2804 lb/A sawdust.
3. 2103 lb/A sawdust and 66 lb/A NH_4NO_3.
4. 701 lb/A sawdust and 198 lb/A NH_4NO_3.
5. No sawdust and 264 lb/A NH_4NO_3.

Each of these treatments except the control contained a total of 90 lb N /A based on the analysis of the sawdust and ammonium nitrate. Plots consisted of one row, each 20 ft long and 3 ft apart with 50 seeds planted/row for a desired final stand of approximately 23,000 plants/A. Each plot represented an experimental unit. All five treatments were replicated four times and arranged in a randomized complete block design for each of the three blocks.

Prior to planting, ammonium nitrate and sawdust were incorporated 6 inches deep with a standard tractor-mounted tiller. Atrazine plus metolachor (Dual II) at 1.2 + 1.5 lb ai/A, respectively, was applied at two or three days after planting. All treatments were sidedressed with ammonium nitrate at 100 lb/A after the first plot of sweet corn in each block reached the sixth leaf stage.

Chlorophyll content using a Spad-502 Chlorophyll Meter (Minolta Camera Co., Ltd., Japan) was measured on the newest fully expanded leaves that had leaf collars exposed during the reproductive silking (R1) stage of growth, using 10 random samples in each experimental plot. Plant height was also recorded at R1 using five random plants in each experimental plot.

Marketable number of ears and marketable yield were measured following harvest. Data were subjected to an analysis of variance, and regression analysis was used to determine rate response to ammonium nitrate and sawdust treatments.

Results and Discussion

All measurements taken had a similar response to respective treatments. Chlorophyll content in plant leaves (Fig. 1) and final plant height (Fig.2) increased with higher amounts of ammonium nitrate relative to sawdust; however, differences in the control and the sawdust treatment alone were not significant for either measurement.

Table 1. Total elemental content and water-soluble ion composition of fresh sawdust expressed on a dry weight basis.

Ash	C	N	P	K	Ca	Mg	C/N Ratio	pH^Z	EC^Z
% of dry matter			ppm dry matter						mmhos/cm
2.0	47.5	3.2	34	409	1943	137	15	5.75	1.92

Fe	Mn	Zn	B	Mo	Cu	Al	Ba	Co	Cr	Pb	Na
ppm dry matter											
97	16	8	2	< 0.5	< 0.5	27	7	< 0.5	0.5	0.5	32

[Z] pH and EC as measured in 1:10 water extract.

In addition, side-dressing had no effect on the relationship between initial fertility treatment and rate of plant growth. Change in plant height after side-dressing for sweet corn having only ammonium nitrate applied and control plots was 19.6 inches and 20.0 inches, respectively. This could indicate that nitrogen required for microbial activity was not the limiting factor prior to side-dressing in the growth response to sawdust. Adding nitrogen as a side-dressing or preplant incorporated with sawdust did not seem to promote mineralization of the nitrogen present in the sawdust.

Marketable ears (Fig. 3) and yield (Fig. 4) increased with higher ratios of ammonium nitrate, following a predictable pattern in relation to plant height and chlorophyll content. Sweet corn grown in plots with only ammonium nitrate had a total number of marketable ears nearly 2.5 times as large as corn grown in control plots and just over 1.5 times the total yield as those grown in plots with incorporated sawdust. The total number of marketable ears was higher with applied sawdust alone than it was in the control plots.

Conclusions

Sweet corn growth and yield were less in plots grown in sawdust alone or in combination with ammonium nitrate compared to sweet corn grown with only ammonium nitrate. Nevertheless, nitrogen "depression," which occurs when available nitrogen is used by microbes for consumption of organic carbon residuals, did not seem to affect release of mineralized N, which was indicated by the fact that sawdust treatments had a positive effect on plant growth and yield compared to the control treatment.

This study indicates that applying fresh sawdust containing urea formaldehyde should not negatively affect plant growth but that recommended rates of a reliable nitrogen source are still needed for optimal plant production. Further study could help determine decomposition and transformation characteristics and proper age or degree of decomposition needed for nitrogen release of the sawdust during sweet corn production.

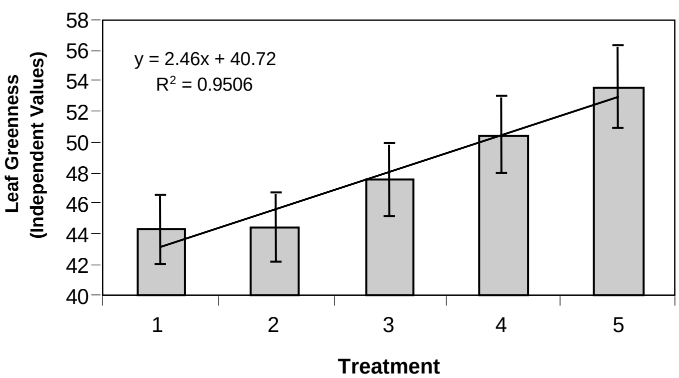


Figure 1. Effect of sawdust and ammonium nitrate treatments on sweet corn leaf greeness using a Spad-502 chlorophyll meter.

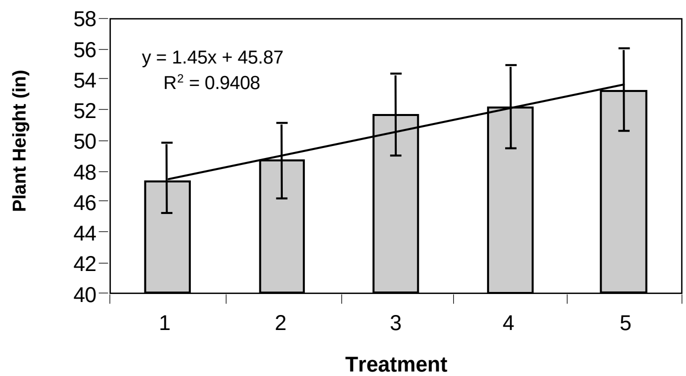


Figure 2. Effect of sawdust and ammonium nitrate treatments on final sweet corn height.

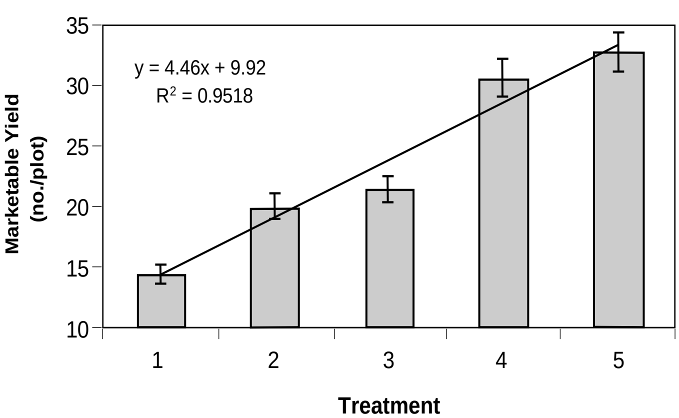


Figure 3. Effect of sawdust and ammonium nitrate treatments on yield of marketable ears.

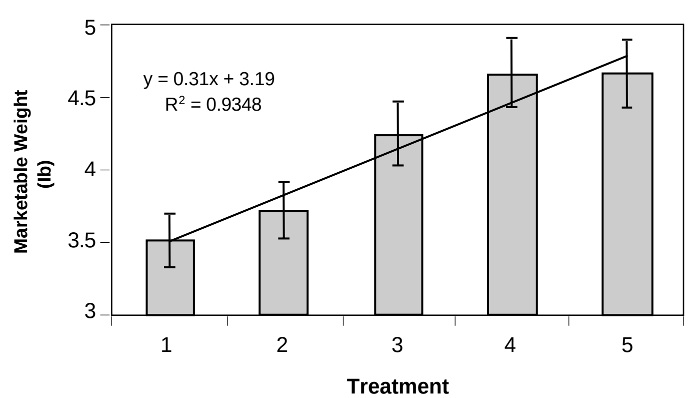


Figure 4. The effect of sawdust and NH_4NO_3 treatments on sweet corn marketable weight.

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

Julie Beale, Paul Bachi, William Nesmith, and John Hartman, Department of Plant Pathology

Introduction

Diagnosis of plant diseases and providing recommendations for their control are the result of UK College of Agriculture research (through the UK Agricultural Experiment Station) and Cooperative Extension Service activities through the Department of Plant Pathology. We maintain two branches of the UK 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 growers are not charged for plant disease diagnosis at UK, the estimated direct annual expenditure to support diagnoses of fruit and vegetable specimens by the laboratory is $15,000, excluding physical plant overhead.

Materials and Methods

Diagnosing fruit and vegetable diseases involves a great deal of research into the possible causes of the problem. Most visual diagnoses include microscopy to determine what plant parts are affected and 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 need culturing and ELISA are common for commercial fruits and vegetables.

The laboratory also has a role in monitoring pathogen resistance to fungicides and bactericides. These exceptional measures are well-spent effort, because fruits and vegetables are high-value crops for Kentucky. Computer-based laboratory records are maintained to provide information for conducting plant disease surveys, identifying new disease outbreaks, and formulating educational programs.

After the hot and dry 1999 growing season and a relatively mild winter, the 2000 season reverted to near-normal precipitation and temperature levels in Kentucky. Above normal temperatures in February and March led to an early and long-lasting fruit crop bloom. Freezes occurred on March 29 and April 9 (20°F in some areas), causing peach, apple, and strawberry crop losses, especially in Central Kentucky. Although soil moisture levels were still deficient from the previous year's drought, above-normal April rainfall and mostly normal spring and early summer rains eased the drought. July was characterized by below-normal temperatures and above-normal rainfall. This trend continued into late summer in Eastern Kentucky, but hot, dry weather returned in western parts of the state.

With mostly normal rainfall, much of the 2000 growing season was favorable for foliar diseases of fruits and vegetables. Drought still influenced plant health, however, because some vascular wilts and canker diseases of perennial or biennial fruits had begun the previous year during times of drought stress.

Results and Discussion

Tree fruit diseases. Early spring rainy weather favored peach leaf curl (*Taphrina deformans*), plum pockets (*T. communis*), apple diseases such as scab (*Venturia inaequalis*), and the cedar rusts (*Gymnosporangium juniperi-virginianae, G. clavipes, G. globosum*). Spring frost caused apple fruits to show russeted equatorial bands later in the season. Showers and mild weather during bloom in some parts of the state were sufficient to initiate primary infections of apple and pear fire blight, although most regions had little fire blight. Throughout the spring and into the summer, seasonal rain and long periods of leaf wetness increased the incidence and severity of peach brown rot (*Monilinia fructicola*), peach scab (*Cladosporium carpophilum*), plum leaf spots (*Blumeriella jaapii, Xanthomonas campestris* pv. *pruni*) apple scab, frogeye leaf spot (*Sphaeropsis malorum)*, sooty blotch (*Peltaster fructicola, Geastrumia polystigmatis, Leptodontium elatius*, and other fungi) and flyspeck (*Zygophiala jamaicensis)*. All of these diseases are aggravated by long periods of leaf wetness. By season's end, susceptible unsprayed apples were nearly defoliated by scab, and fruits were covered in sooty blotch and flyspeck. Bitter rot (*Colletotrichum gloeosporioides*) was found in some apple orchards.

Small fruit diseases. Grape black rot (*Guignardia bidwellii*) and anthracnose (*Elsinoe ampelina*) were prevalent early in the season. Strawberry anthracnose (*Colletotrichum acutatum*), red stele (*Phytophthora fragariae*), and strawberry leaf spot (*Mycosphaerella fragariae*) occurred early in the season. Systemic orange rust (*Gymnoconia nitens*) was devastating to blackberries in some locations. Drought stress in the previous season may have resulted in high levels of anthracnose (*Elsinoe veneta*) and other cane cankers on brambles. Blackberry Septoria leaf spot (*Septoria rubi*) and Verticillium wilt (*Verticillium dahliae*) were also observed. Wet weather and poorly drained soils stimulated root rot (*Phytophthora* spp.) of raspberries.

Vegetable diseases. Tomato Mosaic Virus (TMV) was found in greenhouse tomatoes and Impatiens Necrotic Spot Virus (INSV) was found in tomato transplants. The latter virus likely came from other plants being grown in the same greenhouse; INSV may have developed as a result of vegetable transplants being produced in the same greenhouse with virus-susceptible ornamental plants such as petunia and impatiens.

Cabbage developed wirestem (*Rhizoctonia solani*) disease early in the season, and stem rot (caused by the same fungus) later in the season.

Tomatoes in commercial plantings were infected by several bacterial diseases, including bacterial canker (*Clavibacter michiganensis*), bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*), bacterial speck (*Pseudomonas syringae* pv. *tomato*), bacterial wilt (*Ralstonia solanacearum*), and pith necrosis (*Pseudomonas corrugata*). Fungal diseases such as early blight (*Alternaria solani*), Septoria leaf spot (*Septoria lycopersici*), Fusarium wilt (*Fusarium oxysporum* f.sp. *lycopercici*), buckeye rot (*Phytophthora* spp.), southern stem blight (*Sclerotium rolfsii*), and timber rot (*Sclerotinia sclerotiorum)* took their toll. Viral diseases such as Tomato Spotted Wilt Virus (TSWV), Cucumber Mosaic Virus (CMV), and root knot nematode (*Meloidogyne incognita*) also caused losses. Septoria leaf spot and TSWV were especially common this year.

Peppers developed bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*), fruit anthracnose (*Colletotrichum* spp.), and occasionally southern stem blight (*Sclerotium rolfsii*) and stem rot (*Rhizoctonia solani*).

Pumpkins and other cucurbits are becoming more popular in Kentucky, and their diseases continue to be economically important. A new disease, Phytophthora fruit rot (*Phytophthora capsici*) was widespread. Like many other diseases, incidence of pumpkin fruit rot is associated with a failure to use crop rotation out of other vegetables or tobacco. Fusarium (*Fusarium* spp.) fruit rots were a common problem again this year. Gummy stem blight/black rot (*Mycosphaerella melonis*), Microdochium blight (*Microdochium* sp.), and powdery mildew, (*Sphaerotheca fuliginea* or *Erysiphe cichoracearum*) were found at serious levels. Pumpkin (and squash) was found to be a host to a complex of viruses including Watermelon Mosaic Virus (formerly Watermelon Mosaic Virus 2) and to bacterial diseases including angular leaf spot (*Pseudomonas syringae* pv. *lachrymans*), a bacterial fruit rot (*Xanthomonas cucurbitae*), and bacterial wilt (*Erwinia tracheiphila*), which was also widespread on other cucurbits such as cantaloupe, cucumber, and squash.

Sweet corn rust (*Puccinia graminis*) was widespread, and Stewart's wilt (*Pantoea [Erwinia] stewartii* subsp. *stewartii*) was observed. Asparagus crown rot (*Fusarium* sp.), bean root and stem rot (*Rhizoctonia solani* and *Fusarium solani* f.sp. *phaseoli*), and potato scab (*Streptomyces scabies*) were also frequently observed this year.

The laboratory has been conducting a survey of the viruses infecting commercial vegetables in Kentucky for the past several years. Using ELISA tests, a broad range of virus diseases were found; no new viruses were detected in 2000.

Growers are urged to bring to the attention of their county Extension agent any observations of new outbreaks and disease trends in their fields. We want to be especially watchful of the new spectrum of microbes and diseases that may occur with changes in fungicide use patterns from broad-spectrum protectant fungicides such as Mancozeb and Bravo to new chemicals such as Quadris and Abound. The latter two fungicides present a greater risk of pathogen resistance to the fungicide while reducing risks to human health and the environment. We have observed, for example, increased bacterial diseases in tomatoes and want to know if this is due to how we produce the crops, manage other diseases, or import seeds and transplants.

Because fruits and vegetables are high-value crops, the UK Plant Disease Diagnostic Laboratory should be of great value to commercial growers. However, many growers are not using the 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 about the disease, or, in some cases, it is too late to correctly diagnose the sequence of diseases that may have led to the final outcome. Growers need to keep in touch with their county Extension agents so that appropriate plant specimens are sent to the laboratory in a timely manner. We are urging county Extension agents to stress the need for accurate diagnoses of diseases of high-value crops. Kentucky growers can work with their agents to see that they have the best possible information on fruit and vegetable diseases.

Literature Cited

1. Bachi, P.R., J.W. Beale, J.R. Hartman, D.E. Hershman, W.C. Nesmith, and P.C. Vincelli. 2001. *Plant Diseases in Kentucky—Plant Disease Diagnostic Laboratory Summary, 2000.* 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 Second 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.*

The College of Agriculture is an *Equal Opportunity Organization.*
1-2001, 1,100 copies