2003 Fruit and Vegetable Crops Research Report

Edited by John Snyder and Chris Smigell

Faculty, Staff, Student, and Grower Cooperators

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Grants from the Agricultural Development Board through the Kentucky Horticulture Council have allowed an expansion of the field research and demonstration program to meet the informational and educational needs of our growing vegetable and fruit industries.

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Important note to readers
The majority of research reports in this volume do not include treatments with experimental pesticides. It should be understood that any experimental pesticide must first be labeled for the crop in question before it can be used by growers, regardless of how it might have been used in research trials. The most recent product label is the final authority concerning application rates, precautions, harvest intervals, and other relevant information. Contact your county's Cooperative Extension Service if you need assistance in interpreting pesticide labels.

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Diagnostic Laboratory

Fruit and Vegetable Program Overview

Dewayne Ingram, Chair, Department of Horticulture

Teams of faculty, staff, and students from several departments in the UK College of Agriculture conduct multidisciplinary research and Cooperative Extension activities to benefit Kentucky's fruit and vegetable industries. These teams are pleased to provide this 2003 Research Report for your information and use. The research areas on which we have concentrated reflect stated industry needs, expertise available at UK, and the nature of research programs in neighboring states and around the world generating information applicable to Kentucky. If you have questions and/or suggestions about a particular research project, please do not hesitate to contact us.

We gratefully acknowledge the support of the Kentucky Horticulture Council's (KHC) grant that was made possible through Master Tobacco Settlement Funds and the Agricultural Development Board. These funds, along with U.S. Department of Agriculture funds through the New Crop Opportunities Center, have allowed us to significantly expand our field research and Extension programs. The Agricultural Development Board has recently funded a second KHC grant to continue and expand our research and extension efforts in fruits and vegetables. We will continue support for the Extension Associates working with vegetable and fruit crops throughout the state for two more years. In addition, we will hire an Extension Associate to work with vegetable and fruit crop producers/marketers in southeastern Kentucky. Please note in this report information generated from our Extension on-farm demonstrations and trials.

In addition to reporting research and Extension activities and accomplishments, we use this Research Report to update you on the UK undergraduate and graduate degree programs. Program highlights are listed below.

Undergraduate Program Highlights

The department offers areas of emphasis in Horticultural Enterprise Management and Horticultural Science within a Plant and Soil Science Bachelor of Science degree. Following are a few highlights of our undergraduate program in 2002-2003.

The Plant and Soil Science degree program had nearly 100 students in the fall semester of 2003, of which almost one-half are horticulture students and another one-third are turfgrass students. Eighteen horticulture students graduated in 2003.

We believe that a significant portion of an undergraduate education in horticulture must come outside the classroom. In addition to the local activities of the Horticulture Club and field trips during course laboratories, students have excellent off-campus learning experiences. Here are the highlights of such opportunities in 2003.

- A 14-day study tour of Great Britain and Ireland was led by Drs. McNiel, Geneve, and Dunwell involving nine students.
- Eight Horticulture students competed in the 2003 Associated Landscape Contractors of America (ALCA) Career Day competition at Hinds Community College (Mississippi) in March (Drs. Robert McNiel and Mark Williams, faculty advisors).
- Students accompanied faculty to regional/national/international meetings, including the American Society for Horticultural Science Annual Conference, the Annual Kentucky Fruit and Vegetable Winter Meeting, the Kentucky Landscape Industries Conference and Trade Show, the Southern Nursery Association Trade Show, and the Green Industry Conference.

Graduate Program Highlights

The demand for graduates with M.S. or Ph.D. degrees in Horticulture, Entomology, Plant Pathology, Agricultural Economics, and Agricultural Engineering is high. Our M.S. graduates are being employed in the industry, Cooperative Extension Service, secondary and postsecondary education, and governmental agencies. Last year, there were seven graduate students in these degree programs conducting research directly related to the Kentucky vegetable and fruit industries. Graduate students are active participants in the UK vegetable and fruit production/marketing systems research program and contribute significantly to our ability to address problems and opportunities important to Kentucky.

Getting the Most Out of Research Reports

Brent Rowell, Department of Horticulture

The *2003 Fruit and Vegetable Crops Research Report* includes results of more than 40 field research trials that were conducted in 16 counties in Kentucky (see map, p. 6). In addition to these locations, cooperators for packaging research were located in Bourbon, Powell, and Metcalfe counties, and producers statewide were surveyed about their marketing intentions. Research was conducted by faculty and staff from several departments within the University of Kentucky College of Agriculture, including Horticulture, Entomology, Plant Pathology, and Agricultural Economics. This report also includes collaborative research projects conducted with faculty and staff at Kentucky State University and Berea College. 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* (Extension Publication ID-36).

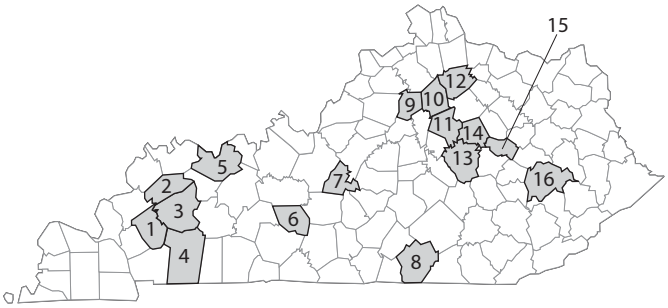
The main purpose of variety evaluation is to provide growers with practical information to assist them in selecting the most suitable variety for a given location or market. Here are some guidelines for interpreting the results of fruit and vegetable variety trials:

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 feet. 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 best not 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 top sellers.



1. Caldwell
2. Webster
3. Hopkins
4. Christian
5. Daviess
6. Edmonson
7. Larue
8. Wayne
9. Franklin
10. Scott
11. Fayette
12. Harrison
13. Madison
14. Clark
15. Powell
16. Breathitt

Climatic conditions obviously differ considerably from one season to the next, and it follows that some varieties perform well one year and 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 and let 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 9).

Making Sense of Statistics

Most trial results 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.

In most reports, we list the results in tables with varieties ranked from highest to lowest yielding (see Table A). 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 Table A cited above, variety 'X3R Aristotle' yielded 25 tons per acre and 'Boynton Bell' yielded 21.7 tons per acre. Since the difference in their yields (25 - 21.7 = 3.3 tons per acre) is less than the LSD value of 5.2 tons per acre, there was no real difference between these two yields. The difference between 'X3R Aristotle' and 'X3R Wizard' (25 - 18 = 7), however, is greater than the LSD, indicating that the difference between the yields of these two varieties is real.

Table A. Yields, gross returns, and appearance of bell pepper cultivars under bacterial spot-free conditions in Lexington, Kentucky; yield and returns data are means of four replications.

Cultivar	Seed Source	Tot. Mkt. Yield[1] (tons/A)	% XL +Large[2]	Income[3] ($/acre)	Shape Unif.[4]	Overall Appear.[5]	No. Lobes[6]	Fruit Color	Comments
X3R Aristotle	S	25.0	89	10,180	4	7	3	dk green	most fruits longer than wide
King Arthur	S	22.5	88	9,079	3	5	4	light-med green	deep blossom-end cavities
4 Star	RG	22.2	86	9,111	3.5	6	4	light-med green	
Boynton Bell	HM	21.7	92	9,003	3	5	3	med-dk green	~15% of fruits 2-lobed (pointed)
Corvette	S	20.6	88	8,407	3	6	3&4	med-dk green	~10% elongated (2-lobed)
X3R Red Knight	S	20.5	90	8,428	3	5	4	med-dk green	
SP 6112	SW	20.2	78	8,087	4	6	3	med green	
Conquest	HM	20.0	85	8,021	2	5	3&4	light-med green	deep stem-end cavities, many misshapes
Orion	EZ	20.0	93	8,219	4	6	4	med-dk green	
Lexington	S	19.8	87	8,022	3.5	6	3	dk green	
PR99Y-3	PR	19.5	87	7,947	3	5	3&4	med green	many misshapen fruits
Defiance	S	18.7	87	7,568	4	7	3&4	dk green	
X3R Ironsides	S	18.4	92	7,585	4	6	3	med green	~5% w/deep stem-end cavities
X3R Wizard	S	18.0	92	7,447	3	6	3&4	dk green	
RPP 9430	RG	17.3	89	7,029	3	6	4	med-dk green	~10% of fruits elongated
ACX 209	AC	17.2	89	7,035	3.5	6	3	med green	
Waller-Duncan LSD (P<0.05)		5.2	7	2,133					

[1] Total marketable yield included yields of U.S. Fancy and No. 1 fruits of medium (greater than 2.5 in. diameter) size and larger plus misshapen but sound fruit that could be sold as "choppers" to foodservice buyers.
[2] Percentage of total yield that was extra-large (greater than 3.5 in. diameter) and large (between 3 and 3.5 in. diameter).
[3] Income = gross returns per acre; 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," i.e., misshapen fruits.
[4] Average visual uniformity of fruit shape where 1 = least uniform, 5 = completely uniform.
[5] 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 second harvest (July 19).
[6] 3&4 = about half and half 3- and 4-lobed; 3 = mostly 3-lobed; 4 = mostly 4-lobed.

Sometimes these calculations have already been made, and statistical comparisons among varieties are indicated by one or more letters (a, b, c, or A, B, C, etc.) listed after the yields in the tables (see Table B). If yields of two varieties are followed by one or more of the same letters, they are considered to be the same (statistically speaking, that is). Yields of two varieties are different if they have no letters in common. In this example, the average muskmelon fruit weight of 'Eclipse' and that of 'Vienna' are both followed by an "a," so they are not different, while values for 'Eclipse' and 'Athena' 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, 'X3R Aristotle', in Table A and subtract the LSD from its yield (25 - 5.2 = 19.8), this means that any variety yielding 19.8 tons per acre or more will not be statistically different from 'X3R Aristotle'. The group of highest yielding varieties in this case will include the 10 varieties from 'X3R Aristotle' down the column through variety 'Lexington'.

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 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.

Table B. Yields and quality of muskmelon cultivars at Quicksand, Kentucky, 2001; data are means of four replications.

Cultivar	Avg. Wt./ Fruit[1] (lb)	Fruit/A[1]	Pounds/A	Rind Thickness (mm)	% Soluble Solids	Comments *(shape and appearance)*
Eclipse	8.8 a	5,601 ab	49,036	7.0	11.5	nice
Odyssey	8.8 a	6,016 ab	53,039	-	9.0	nice, elongated
Vienna	9.0 a	5,083 b	46,230	-	8.6	nice, plts showed MO deficiency
RAL 8793VP	8.7 a	5,601 ab	48,735	-	10.2	nice, good flesh color
Athena	6.4 b	6,846 a	43,440	2.6	8.8	small looking
Minerva	9.7 a	4,771 b	45,349	3.4	13.5	nice, melon chosen by customers first
LSD (P = 0.05)	1.5	1,636	ns			

[1] Means followed by the same letter are not significantly different.

After the group of highest yielding, or in some cases, highest income[1], varieties (see Table 1 cited above) 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. 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 backward 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. See the 2000 and 2001 hot and specialty pepper reports for examples of such trials.

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. 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 among 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 produced, 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

[1] It is often desirable to calculate a gross "income" or gross return variable for vegetable crop varieties that will receive different market prices based on pack-out of different fruit sizes and grades (bell peppers, tomatoes, cucumbers). 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.

that some varieties may perform differently from 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 at **www.ca.uky.edu/agc/pubs/respubs.htm.** Other useful sources of information for commercial vegetable growers can be found by following the links at **www.uky.edu/Agriculture/Horticulture/veglinks.htm**. In addition, results of some pepper and blackberry trials are posted on UK's New Crop Opportunities Center Web site under current research at **www.uky.edu/Ag/NewCrops**.

Auburn University publishes a variety trial report twice a year in cooperation with several other universities. The 2002 reports have been posted in PDF (Acrobat) format at **www.ag.auburn.edu/aaes/information/publications/fruitsnutsvegs.html**.

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 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 from further testing and make recommendations about a group of cultivars that can be put into further trials by growers themselves.

The 2003 Kentucky Produce Marketing Intentions Survey

Matt Ernst and Tim Woods, Department of Agricultural Economics

Introduction

The 2003 Produce Planting and Marketing Intentions Survey was conducted to determine potential planting and marketing changes in Kentucky's produce acreage during the 2003 season. This survey was similar to a 2001/02 survey conducted among Kentucky's produce growers. This report highlights produce marketing practices and trends indicated by the producers surveyed during early spring 2003.

Methodology

The 2003 survey was mailed to 1,065 addresses throughout Kentucky. These addresses had been collected through county Extension offices, produce cooperatives, the Kentucky Department of Agriculture, and farmers' markets. Approximately 7% (73) of the surveys mailed were unusable or indicated respondents at those addresses did not market produce in 2002.

The survey was mailed and a reminder postcard was mailed approximately 10 days later. More than 30% (325) of the addresses returned surveys that contained information useful for analysis.

Results and Discussion

Demographics (age, experience). Produce, like other farm crops in Kentucky, continues to be grown by an older population. Those responding to the 2003 survey were slightly older overall as compared to the 2002 sample. Since this survey is random and anonymous, this does not necessarily indicate an aging of produce growers in Kentucky. Rather, it signifies that

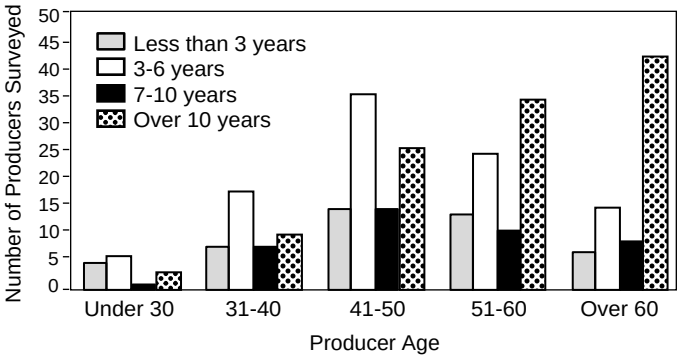
75 to 80% of Kentucky produce growers remain over 40 years old (Table 1).

Table 1. Age of producers surveyed (to nearest percent).

Age Category	2002	2003
Under 31	7%	5%
31-40	17%	14%
41-50	31%	29%
51-60	22%	27%
Over 60	23%	25%

The 2003 survey also indicated Kentucky produce growers are relatively inexperienced in fruit and vegetable production. Nearly half (48%) of those surveyed had been growing produce for six years or less. This is nearly identical to the 49% who indicated they had been growing produce for six years or less in 2002.

Figure 1. 2003 Fruit and vegetable producer experience, by age.



Producers in the 41 to 50 year age category are the most likely to have begun growing produce in the past six years (Figure 1). This demographic indicates good potential for continued growth in Kentucky's produce industry in the near future. Recruiting younger growers into an older grower base continues to be critical to sustain growth in Kentucky's produce industry.

Acreage. Producers surveyed in 2003 represented about 45% (2,600 acres) of commercial fresh vegetable production in Kentucky. The 2003 data reflect a minority of fruit production in the state (500 acres or 17%) due to a lack of responses from larger orchards and from vineyards. A detailed summary of produce acreage reported in the mail survey by individual crop has been published in the 2003 Kentucky Produce Planting Intentions and Outlook (1). Surveying vineyard production was not a goal for this survey; wine grape acreage was surveyed extensively by the Department of Horticulture in December of 2002/03 (2).

The data from Kentucky Produce Marketing and Planting intentions survey are therefore best interpreted as reflecting the marketing intentions of 1) commercial vegetable producers and 2) producers growing smaller acreages of both commercial vegetables and fresh fruit, especially small fruit.

Gross sales. The produce industry continues to be a minor, but growing, sector of Kentucky's agricultural economy. Producers represented in this survey indicated that they sold no less than $3.8 million and no more than $7.7 million worth of produce in 2002. The total sales value of produce grown by respondents to this survey is likely in the $4.5 to $5 million range.

With less than half of the state's total produce acreage represented in this survey, the value of Kentucky's fruit and vegetable production has likely increased substantially over the $10.4 million value reported in the 1997 Ag Census. The release of the 2002 Ag Census data in January 2004, as well as future produce marketing surveys, will be important indicators of the increased value that produce crops contribute to net farm income. Gross sales from produce were likely well over $20 million in 2003.

Producer income. Kentucky produce growers can be placed into two income groups: those who rely on farming for more than half their income and those who do not. Generally, those producers selling less than $10,000 worth of produce annually do not rely on farming for their primary income (Table 2). These smaller producers comprised more than half (58%) of survey respondents. Producers with gross sales over $20,000 are more likely to rely on farm income for more than half their household income (Figure 2).

Figure 2. Gross produce sales by farming as percent of household income, 2002.

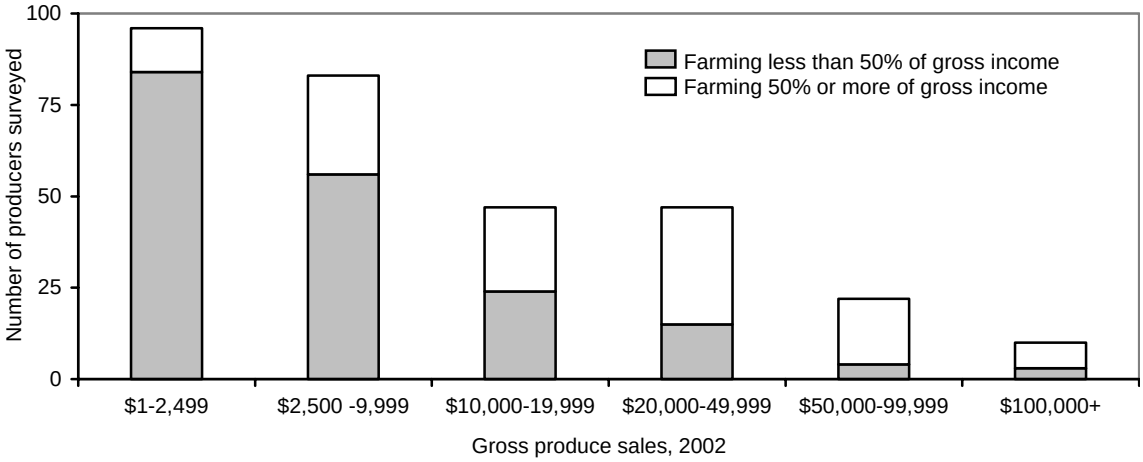


Table 2. Producer characteristics by farming's contribution to household income.

	Total Sample	Respondents by Income: Farming as Majority of Household Income	Respondents by Income: Farming Less Than 50% of Household Income
Do you grow tobacco on your farm?			
Yes	46%	52%	48%
No	54%	33%	67%
Have you participated in a County Agricultural Diversification Program?			
Yes	41%	43%	57%
No	59%	24%	76%
Have you visited a university on-farm demonstration plot in the last three years?			
Yes	33%	35%	65%
No	67%	45%	55%

Producer characteristics by farming's contribution to household income. Several questions on the survey dealt with general characteristics and activities of Kentucky's produce growers. Responses to these questions are grouped by farming as a majority and minority household income source in Table 2.

The total sample of produce growers surveyed was nearly equally divided between those who do and do not grow tobacco on their farms. They were similarly divided between whether or not they received the majority of their household income from farming.

The majority of those producers surveyed who had participated in a County Agricultural Diversification Program reported farming as contributing less than 50% of their household income in 2002. Producers participating in County Agricultural Diversification Programs were slightly more likely (57%) to rely on farming for less than 50% of their household income than those reporting farming as contributing more than 50% of household income (43%).

University on-farm demonstration plots have been widely used to promote commercial horticulture. However, only a third of producers surveyed had visited a demonstration plot in the last three years. The majority of those producers relied on farming for less than half of their household income.

The changing structure of Kentucky agriculture makes it more likely that producers will rely on off-farm income to contribute substantially to household income. This trend is reflected in the answers to survey questions concerning tobacco production and agricultural diversification program participation (Table 2). The producers more likely to visit on-farm demonstrations, however, appear to be more often those who rely on farming for less than half of household income.

The remainder of this report will examine general differences in marketing practices between producers who rely on farming for more than 49% of their household income and those who do not.

Marketing Channels

There were 316 surveys available for analysis of income characteristics by market channel. Several differences were observed between the two income groups (farming as majority of income, farming as minority of income) in the ways that producers marketed produce. This section will focus on characterizing those producers using farmers' markets, cooperatives, and produce auctions.

Farmers' markets. Just under half (47%) of producers surveyed indicated they sold produce at farmers' markets (Table 3). While the majority of producers (73%) using farmers' markets rely on farming for less than 50% of their household income (Table 4), more than a quarter of producers using farmers' markets indicated that farming provided 50% or more of their household income. Due to sheer volume of use, farmers' markets and other direct marketing venues continue as an important market outlet for a diversity of farm types and sizes growing produce in Kentucky.

Cooperatives. Produce marketing cooperatives are a significant wholesale market channel in Kentucky. Producers surveyed were much more likely to use a produce co-op if they

Table 3. Surveyed producers' use of market channels (316 respondents).

Market Channel	Percent of Producers Using
Other direct markets (roadside stands, PYO, on-farm)	55%
Farmers' markets	47%
Direct-to-retail (local grocery, etc.)	28%
Wholesale (non-cooperative)	20%
Cooperative	18%
Direct-to-restaurants	14%
Auction	9%
Other	4%
Community Supported Agriculture	3%
Internet	1%

Table 4. Market channels by farming as percent of income (308 respondents).

Market Channel Used	Number of Observations Providing Income Information	Farming Less Than 50% of Household Income	Farming 50% or More of Household Income
Community Supported Agriculture	8	75%	25%
Farmers' markets	146	73%	27%
Direct-to-restaurants	42	67%	33%
Internet	3	67%	33%
Other direct markets (roadside stands, PYO, on-farm)	170	64%	36%
Direct-to-retail (local grocery, etc.)	82	61%	39%
Other	11	55%	45%
Wholesale (non-cooperative)	56	54%	46%
Cooperative	56	36%	64%
Auction	26	23%	77%

relied on farming for half or more of household income. In addition, 45% of producers using co-ops used it to market all of their produce. This means that, among those surveyed, producers marketing through co-ops were much more likely to only use one market channel, compared to other producers. Co-ops, then, serve as the sole marketing vehicle for the produce grown by many of their members.

Auctions. The only auction currently available to Kentucky produce growers is the Fairview Produce Auction in Christian County (southwest Kentucky). Producers using the auction were most likely to report farming as 50% or more of their household income. Many producers in the Fairview area rely on farming as their sole source of income and the auction remains an important regional wholesale market channel for produce. Total produce sales at the auction have increased from $100,000 in its opening year of 1997 to estimated sales of more than $850,000 in 2003.

Emerging Market Channels: Pick Your Own, Organic

Specific questions were asked concerning interest in Pick Your Own (PYO) marketing and organic production practices. Interest in PYO marketing was particularly strong. Future producer education in Kentucky could focus on market channels that use consumer harvest of product.

Pick Your Own. Producers were asked two questions: 1) whether they currently used PYO to market produce and 2) if they were interested in using PYO in the future. Answers to these questions, grouped by farming as a percent of household income, are reported in Table 5. The percentage of producers interested in using PYO in the future was greater among those deriving less than 50% of their income from farming. Only one of the producers surveyed who was currently using PYO production indicated that he or she would discontinue it in the future. PYO marketing complements many small operations by introducing an agri-tourism angle. Future marketing education efforts for Kentucky produce growers should include specifics on using PYO marketing to generate more profits from produce crops.

Organic production. Only 31 (10%) of those surveyed indicated that they had produced organic fruits and/or vegetables in 2002. These producers grew a total of 62 acres of vegetables and six acres of small fruit, or 2% of the total produce acreage surveyed. Expansion of organic production in Kentucky was anticipated in 2002. Due primarily to changes in the organic certification process, this expansion was not realized statewide.

Respondents indicated modest plans for expanding organic production, a 5% increase to 65 acres of organic vegetables in 2003. This represents approximately one-half to one-third of the state's organic produce acreage. Several producers also planned to expand organic berry acreage (blueberries, blackberries, strawberries). There is clearly market potential in Kentucky's more populated areas for small fruit produced by organic methods. Organic fruit acreage expansion appears to be occurring among producers marketing into population centers.

Some respondents to the survey noted that there are advantages to marketing their products as produced using sustainable methods ("declared organic") rather than as certified organic. It is clear that there are some economic returns that may be captured from fruits and vegetables advertised as produced using sustainable methods, particularly when using direct marketing channels. It remains to be determined exactly how large the market is for such sustainable production in Kentucky. Product differentiation and consumer education will be key for producers who wish to market "sustainability" with their produce crop.

Conclusion

Promotion and further development of alternative market channels continue to be primary issues for expanding Kentucky's produce acreage. Value of produce production will continue to increase with alternative market channel development and expansion. Continued expansion in established wholesale channels (co-ops, auctions, other wholesale) will aid this increase. Expanding higher-profitability market channels, such as PYO marketing and certified organic production, will enhance the value of produce grown in Kentucky.

Future market research and education efforts should embrace producer interest in new market channels. Based on information obtained from this survey, some Extension efforts were focused on PYO marketing education and on consumer research during 2003. Impacts of County Agricultural Diversification Programs, expansion and changes in farmers' markets, and expansion among wholesale market channels within the state are also worthy of future evaluation.

Literature Cited

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2. Christopher Smigell, Shane Bogle, and John Strang. *Kentucky Winegrape Growers Survey December 2002*. University of Kentucky Department of Horticulture, December 2002. http://www.uky.edu/Ag/Horticulture/fallsurvey.pdf.

Table 5. Producer interest in pick-your-own (PYO) marketing (316 respondents).

	Totals (from 316 Respondents)	Farming Less Than 50% of Household Income	Farming More Than 50% of Household Income	No Response
Currently using PYO	47 producers (15%)	27 (57%)	19 (40%)	1 (3%)
Interested in PYO in future	120 producers (38%)	70 (58%)	48 (40%)	2 (2%)