Consumer Attitudes for Asian Vegetables in Direct Markets

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Summary. **Because the demand for Asian vegetables is rapidly increasing in the United States, these crops may provide local market growers new revenue opportunities with high returns per acre. However, consumer attitudes and purchasing habits regarding Asian vegetable crops are poorly understood. Therefore, consumers were surveyed in two direct-market venues (on-farm and farmers market) to measure their familiarity and preferences for Asian vegetables. Attributes that may influence buying decisions such as purchase frequency, consumption behavior, and knowledge of preparation and use were measured. Respondents were generally not familiar with fresh Asian vegetables. Although greater than 80% consumed less than 5 lb per year and less than once per month, the consumers surveyed expressed a strong interest to learn more about these vegetables. Consumers purchased Asian vegetables most often at supermarkets (29.4%) and restaurants (28.1%), and much less at local direct markets (12.5%). Results also indicated that Asians as well as consumers with higher income levels were most likely to consume these vegetables. Thirty-eight percent of consumers strongly indicated that the availability of recipes for various Asian vegetables at direct markets would increase the likelihood for purchase; thus, the opportunity exists to add these vegetables to local production and marketing systems, if recipes were made available at the point-of-purchase.**

Asian vegetables are a diverse group of minor specialty crops that are widely grown throughout Asia. The demand for Asian vegetables is rapidly increasing in the United States (Bachmann, 2002; Ernst and Woods, 2005; Gordon, 2005; Greene, 1992; Lamberts, 1992; Morr, 1989; University of Kentucky, 2006) because of several factors, including burgeoning ethnic diversity in the population, increasing popularity of Asian cuisines, more emphasis on healthy foods, desire for more variety in the diet, and increasing familiarity with their culinary uses. About 35 years ago, Yamaguchi (1973) indicated that most fresh Asian vegetables sales in the United States were made to restaurants or retail outlets catering to customers of Asiatic origin; and, although Asians continue to be the ethnic group most likely to purchase these vegetables today (Gordon, 2005; Govindasamy et al., 2006), Asian foods are becoming an integral part of the American diet. Furthermore, regardless of ethnicity, Asian foods represent one of the fastest-growing cuisines in the United States (Uhl, 1999). Thus, Asian vegetables may offer vegetable growers new revenue opportunities with high returns per acre (Ernst and Woods, 2005; Jia et al., 1996; Salt, 2003; Welbaum, 1995).

Consumer attitudes and the purchasing habits of Asian vegetable crops are generally poorly understood; and, in the past, consumer surveys have aided the development of new, unusual, or unique horticultural crop marketing opportunities (Brumfield and Adelaja, 1991; Frank et al., 2001; Gold et al., 2004; Govindasamy et al., 2006, Kelley et al., 2001). Local or direct marketing of horticultural food crops is rapidly expanding in the Midwest as many consumers desire high-quality, fresh produce and want to support local farmers (Velasquez et al., 2005). Therefore, a survey was conducted in two direct-market venues to determine key attributes that influence Asian vegetable purchase decisions, including consumption habits and knowledge of preparation and use.

Materials and methods

A questionnaire was developed to measure the impact of consumer attitudes, preferences, and demographics on Asian vegetable consumption. All questions contained in the survey had categorical answers. Five questions measured respondents' demographics, including age, education level, ethnic group, household income level, and gender. An additional 15 questions measured consumer knowledge, preferences, and purchasing habits concerning locally grown Asian vegetables. The questions probed the distance consumers were willing to travel for Asian vegetable purchase, annual consumption, frequency of consumption, interest in learning more about these vegetables, normal purchase venue, as well as interest in expanding purchasing habits to include Asian vegetables. Fourteen Asian vegetables were evaluated in the survey: asian eggplant (*Solanum melongena*), bitter gourd (*Momordica charantia*), chinese kale (*Brassica oleracea* var. *alboglabra*), chinese mustard (*Brassica juncea*), chinese okra (*Luffa acutangula*), chinese winter squash (*Cucurbita moschata*), chinese winter melon (*Benincasa hispida*), daikon radish (*Raphanus sativus* Longipinnatus group), japanese snake gourd (*Trichosanthes cucumerina* var. *anguinea*), kabocha squash (*Cucurbita maxima*), napa cabbage (*Brassica rapa* var. *pekinensis*), pak choi (*B. rapa* var. *chinensis*), winged bean (*Psophocarpus tetragonolobus*), and yardlong bean (*Vigna unguiculata* ssp. *sesquipedalis*).

Consumers were surveyed at two fresh fruit and vegetable direct-market venues in Belleville, Illinois: Braeutigam Orchards on-farm market and the Old Town Farmers Market. These

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Units

To convert U.S. to SI, multiply by	U.S unit	SI unit	To convert SI to U.S., multiply by
0.4536	lb	kg	2.2046
1.6093	mile(s)	km	0.6214

markets were chosen for several reasons: 1) proximity to the St. Louis metro area (within 20 miles); 2) a previously observed wide-range of ethnic and other demographic characters for customers at these two venues; 3) customers at local markets were thought to be more receptive to new or alternative vegetable products than those in supermarkets; and, 4) easy access into both of these markets to conduct survey. Belleville, IL, is a rapidly developing area with a diverse demographic population (U.S. Census Bureau, 2000). The written survey instrument was completed by willing consumers as they entered each market venue during busy Saturday mornings in Sept. 2003 and 2004. Saturday was chosen to maximize the number of possible consumer respondents for one day, and once 40 usable surveys were obtained at a venue, consumer solicitation to complete the survey instrument was stopped. Forty surveys were obtained to achieve slightly more than the minimum sample size (n = 30) needed for analysis (R. Beck, personal communication).

A total of 160 surveys were used in the analysis (40 surveys × 2 locations × 2 years). Data were analyzed with descriptive analysis, correlations, and multiple linear regression. Pearson correlation coefficients were calculated to identify the strength of relationships among different variables (e.g., consumer demographics, shopping behavior, and general attitudes with Asian vegetable familiarity). Multiple linear regression analysis using ordinary least squares estimation was performed to determine the influence of various types of demographic (gender, education, income, etc.) and attitudinal variables (Asian vegetable knowledge, preferences, and purchasing habits) on familiarity of Asian vegetables. The dependent variable in this multiple regression analysis was developed using consumers' responses to a set of questions asking whether they have ever tried or regularly consume 14 different Asian vegetables. Respondents were given three options for each vegetable (0 = never tried, 1 = have tried, 2 = consume regularly), with the scores summed across the 14 Asian vegetables evaluated. The resulting score was a composite index of Asian vegetable consumption behaviors, with the index score ranging from 0 to 42. A score of 0 indicates that the respondent never tried any of the Asian vegetables, and a score of 42 represents regular consumption of all 14 Asian vegetables evaluated.

Results

The two direct-market venues in which surveys were obtained did not differ ($P > 0.05$) for most variables evaluated (data not presented). Furthermore, the data were combined over the 2 years and two venues, as no interactions ($P > 0.05$) were observed between years and venues for all variables evaluated.

Demographics of respondents. There were more women respondents (59%) than men (41%). Respondents tended to be young adults 20 to 34 years old (34%), followed by those 35 to 50 years (25%), 51 to 65 years (21%), <20 years (13%), and >65 years (7%). The ethnicity of most respondents were Caucasian (80%) followed by African American (14%), Hispanic (3%), and Asian (3%). Most participants were well educated (49% Bachelors and 14% Masters or PhD degrees), and the remaining 37% had at least a high school education. The annual income level of most participants fell in the ranges <$20,000 (29%) and $30,000 to 49,999 (31%). The other respondents reported incomes ranging from $50,000 to $75,000 (18%) or $20,000 to $29,999 (14%), with few >$75,000 (8%).

Familiarity. Most participants had never tried most of the fourteen Asian vegetables listed in the survey (Table 1). Over 80% of the participants had not tried nine different crops: bitter gourd, chinese mustard, chinese okra, chinese winter squash, chinese winter melon, japanese snake gourd, kabocha squash, winged bean, and yardlong bean. A low percentage of consumers (17.5%–25.6%) had tried three crops: chinese kale, daikon radish, and pak choi. However, 50.0% and 45.6% of respondents had tried napa cabbage and asian eggplant, respectively. Less than 10% of respondents regularly consumed any of the crops listed. Four crops were consumed regularly by 5% to 10% of respondents: napa cabbage (7.5%), chinese kale (5.0%), chinese mustard (5.6%), and asian eggplant (9.4%).

A strong majority of participants (83.0%) consumed less than 5 lb of Asian vegetables on an annual basis, including 27% who did not consume any (data not presented). A small proportion of respondents annually consumed 5 to 10 lb (8%), 10 to 20 lb (3%), and greater than 20 lb (6%). Furthermore, the frequency of Asian vegetable consumption was relatively low. Most participants (81.9%) consumed these vegetables less than one time per month. Only 5.6% consumed Asian vegetables several times

Table 1. Asian vegetable consumption behaviors for customers surveyed in Illinois direct market venues.[z]

	Proportion of respondents (%)		
Asian vegetable	Not tried	Have tried	Consume regularly
Asian eggplant	45.0	45.6	9.4
Bitter gourd	90.6	7.5	1.9
Chinese kale	75.6	19.4	5.0
Chinese mustard	81.9	12.5	5.6
Chinese okra	82.5	16.2	1.3
Chinese winter squash	88.8	10.6	0.6
Chinese winter melon	88.8	10.0	1.2
Daikon radish	78.1	17.5	4.4
Japanese snake gourd	93.1	6.3	0.6
Kabocha squash	91.9	6.3	1.8
Napa cabbage	42.5	50.0	7.5
Pak choi	71.9	25.6	2.5
Winged bean	89.4	8.8	1.8
Yard-long bean	85.7	10.0	4.3
Mean of all vegetables	79.0	17.6	3.4

[z]Data (n = 160) are means of 40 surveys at two direct market venues over 2 years.

per week, 6.3% once per week, and 5.6% once every 2 to 3 weeks. Although consumption habits were generally low, respondents expressed a strong desire to learn about Asian vegetables (mean = 7.1 of 10, where 10 = highest interest).

PURCHASING HABITS. Respondents typically purchased Asian vegetables most often at supermarkets (29.4%) and restaurants (28.1%), with less than half as many purchasing them at direct markets (12.5%), and 30% did not normally purchase these crops (data not presented). When asked "What would persuade you to purchase fresh Asian vegetables?," respondents indicated access to new recipes (38%), more effective advertising (16%), availability of Asian vegetables (13%), and access to nutritional information (9%).

Most participants (89.4%) were willing to drive only relatively short distances (<15 miles) to purchase fresh Asian vegetables (data not presented). They were equally divided among those willing to drive <4 miles (30%) or 4 to 10 miles (30%) or 10 to 15 miles (29.4%). Just 10.6% of respondents were willing to drive >15 miles.

CORRELATION ANALYSIS. Consumer familiarity of each Asian vegetable evaluated was correlated with total consumption and frequency of consumption across all Asian vegetables ($0.27 \geq r \leq 0.66$, $P \leq 0.01$; Table 2). Napa cabbage ($r = 0.60$, $P \leq 0.0001$ and $r = 0.57$, $P \leq 0.0001$) and asian eggplant ($r = 0.66$, $P \leq 0.0001$ and $r = 0.51$, $P \leq 0.0001$) provided the highest correlations with total consumption and frequency of consumption, respectively, for all Asian vegetables evaluated. The number(s) of people in the household and the income level of household were correlated with less than half of the Asian vegetable crops studied. Respondent consumption and willingness to learn more about chinese winter squash were noticeably less strongly correlated compared with other Asian vegetables evaluated. The consumption of japanese snake gourd was much more strongly correlated with driving distance than any other vegetable.

The age of the consumer, the percentage of shopping that the consumer does for household, education level, the number of consumers in

Table 2. Pearson correlation coefficients relating shopper demographics and behaviors with Asian vegetable familiarity for customers surveyed in Illinois direct market venues.[z]

	Consumer familiarity by Asian vegetable[y]													
Variables[x]	Napa cabbage	Pak choi	Chinese kale	Chinese mustard	Winged bean	Yardlong bean	Daikon radish	Bitter gourd	Chinese w. squash	Chinese w. melon	Japanese s. gourd	Kabocha squash	Chinese okra	Asian eggplant
Total consump.	0.60***	0.52***	0.56***	0.56***	0.54***	0.55***	0.51***	0.52***	0.38***	0.58***	0.51***	0.58***	0.52***	0.66***
Consump. freq.	0.57***	0.47***	0.51***	0.47***	0.46***	0.48***	0.42***	0.45***	0.27**	0.43***	0.39***	0.40***	0.44***	0.51***
Driving dist.	0.22**	0.25**	0.27**	0.31***	0.33***	0.37***	0.21**	0.24**	0.27**	0.37***	0.43***	0.38***	0.31***	0.24***
Learn more	0.28**	0.23**	0.24**	0.27**	0.24**	0.26**	0.18*	0.22**	NS	0.23*	0.21**	0.20**	0.23**	0.37***
Consumer age	0.30**	0.22**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Shop freq.	NS	NS	0.16*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Education	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Shop h/wk	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
No. in household	0.15*	NS	NS	0.17*	0.18*	0.21**	NS	0.19*	NS	NS	NS	NS	NS	NS
Annual income	0.26**	0.24**	0.21**	NS	NS	0.15*	NS	NS	NS	NS	NS	NS	NS	NS

[z]Data (n = 160) are means of 40 surveys at two direct market venues over 2 years.

[y]Survey participants were asked to provide information about their familiarity with Asian vegetables: 0 = never tried the vegetable, 1 = have tried, 2 = consume frequently; chinese w. squash = chinese winter squash, chinese w. melon = chinese winter melon, japanese s. gourd = japanese snake gourd.

[x]Total Consump. = annual Asian vegetable consumption in pounds, Consump. freq = consumption frequency of Asian vegetables, Driving dist. = miles that consumers were willing to drive to purchase Asian vegetables, Learn more = willingness to learn more about Asian vegetables, Consumer age = age (years) of consumer, Shop freq. = percentage of shopping that consumer does for household, Education = Education level, Shop h/wk = hours per week spent grocery shopping, No. in household = number of consumers in household, Annual income = annual income level of household, 1 lb = 2.2046 kg, 1 mile = 1.6093 km.

NS, *, **, ***Nonsignificant or significant at $P \leq 0.05$, 0.01 or 0.0001, respectively.

household, and the time spent grocery shopping per week were not correlated with total consumption habits of the Asian vegetables evaluated in the survey (Table 3). Furthermore, these same consumers did not have high familiarity with Asian vegetables (Table 4).

Total annual Asian vegetable consumption was positively correlated with consumption frequency, driving distance, willingness to learn more about Asian vegetables, and annual income (Table 3). Consumption frequency of Asian vegetables was also positively correlated with driving distance, willingness to learn more about Asian vegetables, consumer age, consumer education level, time spent grocery shopping per week, number in household, and annual income level of household.

Multiple regression analysis of asian vegetable consumption. Driving distance, income level, ethnic group, and willingness to learn more about Asian vegetables were associated with the consumption of these vegetables (Table 4). Respondents that were willing to drive farther for Asian vegetables tended to consume more of them on an annual basis. Also, consumers with higher income levels were more likely to eat Asian vegetables. Asians as an ethnic group were more likely to consume them compared with Caucasians. Furthermore, those consumers willing to learn more about these vegetables tended to consume more of them.

Discussion

There currently exists a great opportunity for growers that sell at local markets to increase revenues from producing alternative Asian vegetable crops by capitalizing on the strong interest consumers expressed in them. Although most participants were not Asian (97% were non-Asian), unfamiliar with most Asian vegetables (80% had never tried two-thirds of the vegetables in the survey), and did not consume them on a regular basis (>80% consumed less than once per month and less than 5 lb per year), most consumers expressed a strong interest to learn more about these vegetables. Thus, there is opportunity to increase consumption of Asian vegetables by educating non-Asian consumers about them.

Table 3. Pearson correlation coefficients measuring the relationships among shopper demographics and behaviors in the Illinois Asian vegetable consumer survey.[z]

Variables[y]	Total consump.	Consump freq.	Driving dist.	Learn more	Consumer age	Shop freq.	Education	Shop h/wk	No. in household	Income/ yr	Familiarity across all veg.
Total consump.	—	0.69***	0.43***	0.40***	NS	NS	NS	NS	NS	0.16*	0.75***
Consump. freq.		—	0.33***	0.40***	0.18*	NS	0.16*	0.17*	0.19*	0.25**	0.64***
Driving dist.			—	0.34***	NS	NS	NS	NS	NS	NS	0.41***
Learn more				—	NS	NS	0.17**	0.24**	NS	NS	0.34***
Consumer age					—	0.24**	0.20**	0.21**	NS	0.43***	NS
Shop freq.						—	0.18**	0.43***	NS	0.22**	NS
Education							—	0.17*	NS	0.25**	NS
Shop h/wk								—	0.31***	NS	NS
No. in household									—	0.18*	0.17*
Annual income										—	0.15*

[z]Data (n = 160) are means of 40 surveys at 2 direct market venues over 2 years.
[y]Total Cosump. = annual consumption of all Asian vegetable consumption in pounds, Consump. freq = consumption frequency of all Asian vegetables, Driving dist. = miles that consumers were willing to drive to purchase Asian vegetables, Learn more = willingness to learn more about Asian vegetables, Consumer age = age (years) of consumer, Shop freq. = percentage of shopping that consumer does for household, Education = Education level, Shop h/wk = hours per week spent grocery shopping, No. in household = number of consumers in household, Annual income = annual income level of household. Information about consumer familiarity with Asian vegetables and Familiarity across all veg. (= summed responses) (0 = never tried, 1 = have tried, 2 = consume frequently) obtained across all 14 Asian vegetables evaluated (napa cabbage, pak choi, chinese kale, chinese mustard, winged bean, yardlong bean, daikon radish, bitter gourd, chinese squash, chinese winter melon, japanese snake gourd, kabocha squash, chinese okra, and asian eggplant), 1 lb = 2.2046 kg, 1 mile = 1.6093 km.
NS, *, **, ***Nonsignificant or significant at $P \leq 0.05$, 0.01 or 0.0001, respectively.

Table 4. Multiple regression parameters describing the influence of respondent demographics and attitudes with Asian vegetable familiarity in Illinois direct markets.[z]

Independent variable[y]	Parameter estimates	Asymptotic t-ratios
Constant	–0.07[NS]	–0.04
Driving distance	0.70**	2.78
Shopping time per week	0.11[NS]	0.44
Willingness to learn	0.30**	2.82
Venue location	–0.48[NS]	–0.92
Year	–0.15[NS]	–0.29
Age	–0.12[NS]	0.46
Education level	–0.22[NS]	0.59
Income level	0.47*	2.16
Gender	–0.34[NS]	–0.63
Ethnic group		
Asian	10.19***	7.50
Caucasian	–1.89*	–2.04
Log – L	–402.85	—
R^2	0.58	—
No. observations	160.00	—

[z]Data (n = 160) are means of 40 surveys at two direct market venues over 2 years. Consumers were asked to provide information about their behavior with respect to Asian vegetables (0 = never consumed, 1 = have consumed, 2 = consume on a regular basis) with the scores summed across the 14 Asian vegetables (napa cabbage, pak-choi, chinese kale, chinese mustard, winged bean, yardlong bean, daikon radish, bitter gourd, chinese winter squash, chinese winter melon, japanese snake gourd, kabocha squash, chinese okra, and asian eggplant). The resulting score was used as a composite index for Asian vegetable consumption behaviors.

[y]Driving distance (1 = 0 miles, 2 = 1–2 miles, 3 = 4–8 miles, 4 = 10–15 miles, 5 = 20–30 miles, and 6 = >30 miles), shopping time per week (1 = < 15 min, 2 = 15–20 min, 3 = 30–60 min, 4 = 60–120 min, and 5 = > 120 min), willingness to learn (1 = no interest to 10 = high interest), venue location in Belleville, IL (0 = Old Town Farmers' Market, 1 = Braeutigam Orchards on-farm market), year (1 = 2003, 0 = 2004), age (1 = < 20 years, 2 = 20–34 years, 3 = 35–50 years, 4 = 51–65 years, 5 = > 65 years), education level (1 = elementary school, 2 = high school, 3 = college, 4 = graduate school), income level (1 = < $20,000, 2 = $20,000–$29,999, 3 = $30,000–$49,999, 4 = $50,000–$75,000, 5 = >$75,000), gender (1 = female, 0 = male), and ethnic group (1 = Asian, 2 = Caucasian, 3 = other), 1 mile = 1.6093 km.

[NS, *, **, ***]Nonsignificant or significant at $P \leq 0.05$, 0.01, or 0.0001, respectively.

Although the Caucasian and Asian populations were 8% higher and 3% less, respectively, at Belleville, IL, compared with the rest of the state, other demographic characters at this location, including age, gender, and number per household, were similar to Illinois (U.S. Census Bureau, 2000). This indicates that the general lack of consumption but strong interest in these vegetables should follow a similar trend at many other Illinois direct-market venues. Although Caucasians have some interest in these vegetables, Asians were more likely to purchase and consume them (Table 4). This indicates that Asian populations should probably be initially targeted to allow practical increase in market supply and diversity of alternative Asian vegetables, as they are the ethnic group most familiar with the preparation and culinary uses of these vegetables (Gordon, 2005). However, growers should probably initially produce chinese cabbage or asian eggplant and initially develop markets for these crops because these were the vegetables with which consumers were most familiar. Expansion to other Asian vegetables could possibly occur at a later time if initial efforts were successful.

Education efforts to promote alternative vegetable consumption should work with existing consumer attitudes and behaviors defined by our survey. Because consumer willingness to learn more about Asian vegetables was highly correlated with their total annual consumption (Table 3), education efforts should probably be concentrated on increasing Asian vegetable consumption for those consumers that tend to purchase the two most popular crops (napa cabbage and asian eggplant). Promotional activities (e.g., recipes at the point-of-purchase) should be developed around these crops and related to one of the most likely previous exposure venues, restaurant dining or supermarkets, as opposed to direct markets. Currently, many western countries are trying to improve citizen health by increasing diet diversity (Cox et al., 1998) and this desire to improve fruit and vegetable intakes has the potential to directly increase purchases of alternative crops such as Asian vegetables.

Almost 30 years ago, Courter et al. (1980) indicated that 94% of Illinois direct-market farms advertised by newspaper, 88% by roadside signs, 70% by radio, and 35% by postcards. However, our results showed lackluster consumer responsiveness to advertising, as well as to product availability and nutritional information, suggesting that nontraditional educational methods may be needed to cultivate consumer interest in Asian vegetables. The general lack of familiarity with these vegetables strongly emphasizes the need for creative product sampling activities to connect with the greatest consumer interest area, preparation, and use of product. Gold et al. (2004) also indicated that educational strategies for alternative crops should focus on the strong consumer desire for new recipes. Indeed, 38% of survey respondents in our study indicated that access to recipes would persuade them to purchase fresh Asian vegetables.

Local producers and marketers may have an advantage in developing alternative Asian vegetable market activity. Consumers have been traditionally drawn to local marketing because they value freshness and quality along with the opportunity to visit the countryside and obtain produce at a reasonable price (Brodt et al., 2006; Gale, 1997; LaTrobe, 2001; Uva, 2002; Velasquez et al., 2005). However, the availability of Asian vegetables at local markets is highly seasonal, which can prove to be problematic for growers because supermarkets can offer the same vegetables over a longer period of time. Consumer familiarity with supermarkets in close proximity to their homes can create conflicts with local marketers because the majority of respondents (60%) were willing to drive no more than 10 miles to purchase fresh Asian vegetable products. This suggests a significant reduction during the last 30 years in the distance that consumers are willing to drive for produce purchases (Courter et al., 1979) and although supermarkets may provide some competition, this may provide an advantage for local, direct marketers located near large populations.

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