

Consumer and Professional Chef Perceptions of Three Edible-flower Species

Kathleen M. Kelley¹, Bridget K. Behe², and John A. Biernbaum³

Department of Horticulture, Michigan State University, East Lansing, MI 48824-1325

Kenneth L. Poff³

Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1325

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Abstract. Two surveys were conducted to assess consumer and professional chefs' perceptions of three edible-flower species. Our objectives were to determine opinions, preferences, and uses of *Viola tricolor* L. 'Helen Mount' (viola), *Borago officinalis* L. (borage), and *Tropaeolum majus* L. 'Jewel Mix' (nasturtium). Flowers were grown using certifiable organic methods and chosen to reflect a variety of flower tastes, textures, and appearances. We quantified three attributes (taste, fragrance, and visual appeal) with a total of seven semantic, differential scales adapted from a scaling authority. The attributes were rated as: visual—"appealing", "desirable," and "very interested in tasting"; fragrance—"appealing" and "pleasant"; and taste—"tasty" and "desirable". Garden Day participants were self-selected to evaluate and taste flowers from a consumer perspective. When asked to rate the three species on visual appeal and desire, no less than 76% of consumers awarded all flowers an acceptable rating. We found similar results when consumers answered questions regarding the taste of two of the three species. Results from this study support our hypothesis that customers would rate edible flower attributes highly and would be likely to purchase and serve the three species tested. Members of the Michigan Chefs de Cuisine Association participated in a similar survey. At least 66% of these chefs rated the three visual attributes and two fragrance attributes of viola and nasturtium acceptable. Chefs' ratings of the fragrance of borage as "appealing" and "pleasant" were higher than those of consumers, but the ratings were still low, 21% and 25%, respectively. Unlike consumers, chefs' ratings of the taste of viola as "appealing" and "desirable" were low (29% and 36%, respectively). We found some minor differences in ratings when groups were compared, using demographic variables as a basis for segmentation, indicating a homogenous marketing strategy may be employed.

The popularity of edible flowers has increased since the late 1980s, as evidenced by upscale restaurants where edible flowers garnish meals. Such flowers are featured in popular articles, and are also the subjects of cookbooks (Barash, 1993; Belsinger, 1991; McVicar, 1997). The list of edible flowers is extensive, with over 55 known genera repre-

sented (Badertscher and Newman, 1996; Barash, 1993; Belsinger, 1991; McVicar, 1997). Flowers can be used in salads, to garnish soups and entrees, as ingredients in main dishes, sprinkled on desserts, frozen in ice cubes and floated in drinks (Barash, 1998a, b).

Not only do edible flowers add excitement to food presentations, they also have nutritional benefits. The vitamin content of viola on a weight basis is higher than that of oranges [*Citrus sinensis* (L.) Osbeck], and viola also has a higher concentration of beta-carotene (Kosztolnyik, 1996). Because most flowers are >95% water, the nutrient value appears to be nonsignificant. Flowers, however, are nearly calorie-free (Evans, 1993), a real advantage to health- and weight-conscious consumers. Visual, taste, and nutritional appeal enhance the potential marketability of edible flowers.

Consumers, including professional chefs, may find some edible flowers more appealing than others, and research can facilitate efforts to determine which edible flowers deserve further investigation. With better consumer information, growers, wholesalers, and retail-

ers can selectively target consumer groups with more effective marketing strategies. Consumer information is lacking, although a few articles include suggestions as to which flowers are edible and indicate that growers are producing flowers for both restaurants and consumers (Evans, 1993; Greenhouse Business, 1998; Whitman, 1991).

As edible flowers become more popular, defining the preferences of consumers and chefs will become more important to producers and marketers. Our objectives were to determine: 1) which characteristics appeal to consumers and chefs; and 2) how similar the preferences of these two groups are, which may dictate separate or similar marketing strategies. Edible flowers can be grown using certified organic methods. Since production method is a consideration for the grower and retailer, we also wanted to determine if production method had an effect on edible flower desirability by chefs, consumers, or both.

Materials and Methods

General. Flowers of viola (*Viola tricolor* L. 'Helen Mount'), borage (*Borago officinalis* L.), and nasturtium (*Tropaeolum majus* L. 'Jewel Mix') were grown in a greenhouse at a constant 20 °C, in Strong-Lite Universal Mix (Strong-Lite, Pinebluff, Ark.), and fertilized every other week with fish emulsion (400 mg·L⁻¹, 4N–0.4P–0.8K; Northeast Organics, Manchester-by-the Sea, Mass.), Michigan State Univ. special (500 mg·L⁻¹, 19N–1.8P–19K; Greencare, Chicago), or dried blood (12N–0P–0K; Dragon Corporation, Roanoke, Va.). Plants were not treated with pesticides. Commercially raised predators and parasites, including aphid parasite (*Aphidius colemani* Viereck), fungus gnat predatory mite [*Hypoaspis miles* (Berlese)], and thrips predatory mite [*Amblyseius cucumeris* (Oudemans)], were released in the greenhouse to help control aphid and mite populations. Flowers were harvested the mornings of the surveys and stored in a 5 °C cooler several hours until needed. They were rinsed with distilled water 2 h before the tasting to remove any visible debris. Rinsed flowers were placed in labeled, 50-mL paper cups. Order of tasting was randomized among participants. One nasturtium (910 mg), three borage (290 mg each), or three viola flowers (80 mg each) were used per cup.

Two surveys were administered, one of consumers who were attending a statewide annual event, the second of chefs at a monthly professional chef's association meeting in a large metropolitan area. A 43-item consumer-directed questionnaire and a 38-item chef-directed questionnaire were developed to assess perceptions of visual, taste, and fragrance attributes of three edible-flower species. The survey instruments consisted of either twelve preference items for each of the three species plus either seven (consumer-directed) or five (professional chef-directed) demographic questions. We selected three questions for visual evaluation and two questions for fragrance evaluation and adapted two questions for taste from an authority on measurement

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¹Graduate Student.

²Associate Professor. To whom requests for reprints should be addressed. E-mail address: behe@msu.edu

³Professor.

scales for various product attributes (Bruner and Hensel, 1996). We quantified the attributes with a total of seven, seven-point, semantic differential scales in the reference. We asked both groups of participants if, from a visual perspective, the flowers were “appealing” and “desirable,” and if the participants were “very interested in tasting” the flowers after seeing them; if, after smelling the flowers, participants found them “appealing” and “pleasant”; and if the participants, after tasting the flowers, considered them to be “tasty” and “desirable.” We also asked how likely consumers were to grow or to purchase a particular species and how likely they would be to use them in entrees. Professional chefs were asked if they were more likely to purchase the flower if it were grown using certified organic methods, whether they would purchase the flower if it had 10% insect damage, and if they would identify and describe the flavor and fragrance of the flower using their own words. Demographic questions for consumers included age, gender, education, family status, household size, and income. Professional chefs were asked questions including gender, meals served each week, price of least expensive entree, years as a chef, and if they were certified. The order in which participants evaluated the three species was randomized. Results were tested for significance using logistic regression and chi-square with Fisher’s exact test (SAS Institute, 1998). The experiment was approved by the Institutional Review Board for Protection of Human Subjects at Michigan State Univ. prior to implementation.

Consumer-directed survey. Forty-one participants were self-selected from 287 registrants who attended Garden Days at Michigan State Univ. on 7 Aug. 1998. During this popular annual event, participants who are highly involved in gardening pay a fee to attend a variety of activities, such as garden walks and seminars on flower paper making, and herb use and production. Minors (under age 18), pregnant women, and those with severe food allergies were self-excluded from our study. Volunteers reflected a diverse sample, including, but not limited to, college students, em-

ployed persons, retirees, athletes, and gardeners. When participants entered the room, and after they signed a waiver, they were given three cups, each containing a flower species and a survey form. The survey took ≈20 min to complete.

Participants ranged in age from 19 to 72 years, 66% were female, 55% had graduated from college, and 72% of the participants had a 1997 household income that ranged from \$20,000 to \$79,999. Fifty-three percent of the participants had no dependents, and 41% had more than two people in their household. Participants were asked to identify themselves by zip code. Of the 37 who responded, 46% lived within 32 km, the remainder from 33 to 258 km from the survey site.

Participant responses using the seven-point Likert scale were divided into three categories: not acceptable (composite of responses rated either 1, 2, or 3); neutral (response of 4); and acceptable (composite response of either 5, 6, or 7). We assumed that if at least 30% of the responses for any item were acceptable, a substantial market segment was pleased with that flower attribute.

Professional chef-directed survey. Twenty-six member-chefs of the Michigan Chefs de Cuisine Association participated in a survey at the Detroit Athletic Club in Detroit, on 8 Mar. 1999. Pregnant or potentially allergic members were self-excluded from the study. The chefs signed a waiver, and were given three cups, each containing a flower species and a survey form. These participants took <20 min per person to complete the survey. Chefs who participated in the survey answered demographic questions. Six of the chefs were women, 20 were men. About half of them served 500 or fewer meals each week. The highest number of meals that a chef reported serving in 1 week was 35,000. Half the chefs that participated also served entrees that cost \$8 or less, were certified chefs, and had been chefs for 11 years or more; five had been chefs for 20 years. Of those who were certified, six were Certified Executive Chefs. Chefs rated the flower attributes on the same 1–7 scale that consumers used. Their responses were also divided into

the same three categories: not acceptable, neutral, and acceptable.

Results and Discussion

Consumer-directed survey. For all three species, at least 74% of participants rated visual characteristics (appeal, desire, and interest in tasting) acceptable (Table 1). Participants rated visual appeal and desirability of viola higher than those of borage or nasturtium.

The majority of consumer participants rated all three species acceptable for both taste attributes. For viola and borage, ratings for taste appeal and desire were lower than ratings for visual characteristics. Of all three species, nasturtium was rated highest for appealing taste (80%), but lowest for interest in tasting after visual examination (74%), visual desire (76%), and visual appeal (74%).

Few participants (8%) rated the fragrance of borage as pleasing. A much higher percentage rated viola (68%) and nasturtium (54%) as having acceptable fragrance. Verbal comments indicated that participants either did not detect or did not approve of the odor of the borage flower. More responses for borage were neutral (80% and 81% for an appealing fragrance and pleasing fragrance, respectively), than acceptable. Thus, borage fragrance may not be a germane issue.

Each species was also evaluated for potential use. At least 68% of participants rated viola acceptable for use as a garnish or in a salad, and 85% would purchase it if available. Similar responses were observed for nasturtium, but only 25% of participants would use it in a salad. Borage received ratings of at least 48% for potential uses, with 65% of the participants finding it acceptable for serving to guests.

We investigated differences in mean ratings by gender, education, income, marital status, and household size (Table 2). The mean ratings of the higher income (≥\$40,000) group were consistently higher on 14 items across the three species tested. They had a higher mean perception of the visual desirability of viola, and were more likely to purchase this flower. They rated borage higher than the

Table 1. Consumer and professional chef ratings of attributes of three species of edible flowers. Percentage of responses with a composite acceptable rating (5, 6, or 7).

Ratings of species by consumers				Ratings of species by professional chefs			
Attribute	Viola	Borage	Nasturtium	Attribute	Viola	Borage	Nasturtium
	<i>Visual</i>				<i>Visual</i>		
Appealing	98 b ^z	82 a	78 a	Appealing	92 b ^z	54 a	96 b
Desirable	97 b	81 a	76 a	Desirable	87 b	50 a	92 b
Interested in tasting	90 a	81 a	74 a	Interested in tasting	86 b	46 a	72 b
	<i>Fragrance</i>				<i>Fragrance</i>		
Appealing	65 b	8 a	55 b	Appealing	66 b	21 a	87 b
Pleasing	71 b	8 a	54 b	Pleasing	76 b	25 a	79 b
	<i>Taste</i>				<i>Taste</i>		
Appealing	68 a	67 a	80 a	Appealing	29 a	63 ab	72 b
Desirable	68 a	57 a	64 a	Desirable	36 a	48 ab	74 b
	<i>Use</i>				<i>Use</i>		
Garnish	73 b	50 a	55 ab	Salad	42 a	40 a	65 a
Salad	68 b	48 ab	25 a	Would purchase this flower	39 a	38 a	64 b
Would purchase this flower	85 b	62 a	58 a	Would purchase because organic	54 a	46 a	62 a
Would grow myself	70 b	55 a	48 a	Would purchase with 10% insect damage	8 a	4 a	4 a
Would serve to others	80 b	65 a	58 a				

^zMean separation within rows and groups surveyed (consumer and professional chef) by logistic regression, $P \leq 0.05$.

other two species in visual appeal, interest in tasting, pleasant fragrance, desirable to taste, use as a garnish and in a salad, and purchasing and serving. They were also more interested in tasting the nasturtium flower, found that it had a pleasant fragrance and desirable taste, and were more likely to use it in a salad.

Married participants rated 15 items consistently higher than did single participants; these included visual desire of viola, visual appeal of borage, interest in tasting borage, use of borage in a salad, and purchase of borage, as well as nearly all attributes of nasturtium.

We divided participants into two age groups at the median age: 43 years. Participants who were 43 or older rated both fragrance and both taste characteristics of viola higher than did the younger age group. They also rated all of the usage attributes for all species, except for the use of viola as a garnish and in a salad, and purchase of the flower, lower than did their younger counterparts. Aside from the appealing and pleasing fragrance of borage and its appealing taste, the older participants rated all of the other visual, fragrance, and taste attributes of borage and nasturtium lower than did younger participants.

Across all three species tested, only three differences were apparent in mean preference by gender. Males rated the visual appeal of nasturtium lower than did females and indicated that they were less likely to use it as a garnish and grow it.

We found only one difference in mean preference rating when comparing college graduates with nongraduates. College graduates rated use of nasturtium as a garnish higher (5.2) than did noncollege graduates (4.0).

Mean preferences of small households (one person) vs. larger households (two or more persons) differed in only two cases. Respondents from one-person households rated both pleasant and appealing fragrance of viola higher.

Income and marital status were the two variables for which we found greatest differences, and these would be useful in a segmentation scenario. Age, gender, education level, and number of people in the household showed few differences and these variables would not be a good basis for segmenting the market for edible flowers.

Professional chef-directed survey. At least 72% of the chefs rated the visual characteristics

of viola and nasturtium (appeal, desire, and interest in tasting) as acceptable (Table 1). Nasturtium had the highest rating (96%) for visual appeal, but the lowest (72%) for interest in tasting. Borage did not receive a rating higher than 54% for any of the three characteristics.

Nasturtium received the highest ratings for appealing (87%) and pleasing fragrance (79%). In contrast with the results from consumer participants, viola received the second highest ratings in both categories, 66% and 76%. Although chefs rated borage higher in both categories (21% and 25%) than did consumer participants, borage received the lowest ratings among the three species.

For the chef's fragrance ratings, nasturtium received a 72% rating for appealing taste and a 74% rating for desirable taste and the highest ratings in both taste categories. Unlike consumer participants, the chefs rated viola's appealing taste (29%) and desirable taste (36%) lower than borage's (63% and 48%, respectively).

When chefs were asked whether they were likely to use the three species in a salad, 65% reported that they would use nasturtium, 42% that they would use viola, and 40% that they

Table 2. Effects of income, marital status, and age of respondents on mean rating of consumer's acceptability of viola, borage, and nasturtium based on visual, fragrance, taste, and usage attributes.

Attribute	Income		Status		Age (years)		Gender		Education		No of persons in the household	
	<\$40K	≥\$40K	Single	Married	≤42	≥43	Female	Male	Not a college/tech. grad	College/tech grad	≤1	≥2
<i>Viola</i>												
Visual appealing	6.1	6.9	6.3	6.8	6.8	6.4	6.8	6.4	6.6	6.7	6.7	6.5
Visual desire	5.9	6.6*	6.2	6.5*	6.6	6.2	6.4	6.4	6.2	6.5	6.3	6.4
Interest in tasting	5.8	6.3	5.6	6.5	6.4	5.8	6.0	6.5	6.3	6.0	6.1	6.1
Appealing fragrance	5.2	5.5	5.5	5.3	5.4	5.4	5.6	5.1	5.4	5.4	5.6	5.1*
Pleasing fragrance	5.3	5.7	5.7	5.5	5.6	5.6	5.7	5.4	5.5	5.7	5.8	5.3*
Appealing taste	4.7	4.8	4.9	4.8	4.5	5.2	4.9	4.8	4.9	4.8	4.9	4.8
Desirable taste	4.5	4.7	4.9	4.6	4.7	4.7	4.7	4.6	4.8	4.6	5.0	4.3
Use as a garnish	5.2	5.1	5.5	5.0	4.9	5.4	5.3	4.8	5.3	5.0	4.9	5.6
Use in a salad	4.7	4.9	4.9	4.8	4.7	4.9	5.0	4.5	5.1	4.6	4.5	5.3
Grow this flower	4.6	5.0	5.5	6.0	5.8	5.8	6.0	5.5	5.9	5.7	5.7	6.0
Purchase this flower	5.6	6.0*	4.9	5.1	5.2	4.9	4.8	5.5	4.9	5.2	4.7	5.5
Serve to others	5.1	5.8	5.5	5.5	5.6	5.4	5.4	5.6	5.4	5.6	5.3	5.8
<i>Borage</i>												
Visual appealing	5.0	6.1*	5.1	6.2*	6.4	5.0	5.8	5.5	6.1	5.4	5.8	5.7
Visual desire	4.7	5.6	4.8	5.7	5.8	4.9	5.7	4.8	5.6	5.2	5.4	5.4
Interest in tasting	4.7	6.0*	4.9	6.1*	6.1	4.8	5.6	5.1	5.5	5.4	5.4	5.4
Appealing fragrance	3.5	4.0	3.7	3.9	3.7	3.9	4.0	3.6	3.9	3.8	4.1	3.5
Pleasing fragrance	3.8	3.9*	3.9	3.7	3.7	3.9	4.1	3.3	3.8	3.9	4.0	3.7
Appealing taste	4.9	4.9	4.3	4.8	4.5	4.7	4.6	4.7	4.6	4.6	4.5	4.8
Desirable taste	3.5	4.9*	3.7	4.8	4.3	4.3	4.5	4.0	4.4	4.2	4.2	4.4
Use as a garnish	3.0	4.6*	3.5	4.6	4.3	4.1	4.3	3.9	4.6	3.8	3.9	4.5
Use in a salad	3.2	4.6*	3.5	4.5*	4.3	4.0	4.2	4.0	4.6	3.7	4.0	4.4
Grow this flower	4.2	5.2	4.3	5.1	5.2	4.5	4.9	4.6	4.9	4.7	4.9	4.8
Purchase this flower	4.2	5.3*	4.3	5.3*	4.6	4.1	4.5	4.7	4.5	4.2	4.1	4.6
Serve to others	3.5	5.1*	3.9	5.0	4.8	4.3	4.5	4.8	4.7	4.5	4.4	4.8
<i>Nasturtium</i>												
Visual appeal	5.1	5.8	4.8	6.1*	6.1	5.2	6.1	4.6*	5.9	5.4	5.4	5.9
Visual desire	4.8	6.0	4.8	6.2*	6.3	5.1	6.0	5.1	5.9	5.5	5.6	5.7
Interest in tasting	4.4	6.1*	4.4	6.3*	6.1	4.3*	5.7	5.4	5.6	5.5	5.5	5.6
Appealing fragrance	4.4	5.3	4.9	5.1	5.5	4.5	5.1	4.8	5.1	5.0	5.2	4.8
Pleasing fragrance	4.2	5.2*	4.6	5.1*	5.4	4.4	4.9	4.9	5.1	4.8	5.0	4.8
Appealing taste	4.7	5.5	4.2	5.8*	6.2	4.3*	5.4	5.2	5.1	5.5	5.2	5.5
Desirable taste	3.4	5.3*	3.6	5.4*	6.1	3.0*	4.8	4.5	4.6	4.8	4.7	4.6
Use as a garnish	3.8	4.8	3.5	5.2*	5.2	3.8*	4.9	3.9*	5.2	4.0*	4.2	5.0
Use in a salad	2.5	4.6*	2.7	4.8*	4.8	3.1*	4.1	3.7	4.4	3.6	3.6	4.4
Grow this flower	3.8	5.0	3.8	5.3*	5.5	3.9	4.4	4.1*	5.1	4.3	4.6	4.8
Purchase this flower	3.1	4.5	3.8	5.3*	5.4	3.9*	4.1	4.1	4.5	3.9	3.7	4.8
Serve to others	3.5	5.0	3.5	5.4*	5.7	3.5*	4.2	4.2	4.8	4.4	4.5	4.8

*Mean differences of attributes within categories (income, etc.) significant at $P \leq 0.10$ based on Fisher's exact test (2-tail probability).

would use borage. In contrast, consumers rated viola highest, followed by borage and nasturtium. While chefs were more likely to purchase nasturtium (64%), consumer participants were more likely to purchase viola (85%). Only 39% of the chefs gave viola an acceptable rating.

When chefs were asked if they were more likely to purchase the flower because it was grown organically, the acceptable ratings increased from 39% to 54% for viola and from 38% to 46% for borage. The acceptable rating for nasturtium decreased by 2%.

When chefs were asked if they would purchase the three flowers if they had 10% insect damage, only 8% gave viola an acceptable rating. When asked whether they would purchase a borage flower or a nasturtium flower with 10% damage, only 4% of the chefs, in both instances, indicated that they would.

In order to determine differences in mean ratings for viola, borage, and nasturtium, we divided chefs into groups based on gender, average number of meals served weekly, meal cost, professional certification, and years of experience. Ratings varied little with gender, with the exception of appealing fragrance (3.5 for females vs. 5.4 for males) (Table 3). Mean ratings for borage characteristics were similar except for desirable taste, which fe-

males rated higher (5.5 vs. 3.8). Males were more likely to purchase nasturtium (5.3 vs. 3.0).

We found no differences in ratings between professional chefs who served more vs. <900 meals per week.

Chefs employed by restaurants where the least expensive entree cost \$8 or less were more inclined to purchase viola if grown organically than were those working at restaurants where entrees were more expensive (5.4 vs. 3.4). Mean ratings were similar for chefs in both categories for all attributes. We found three differences in mean ratings for nasturtium. Chefs at less expensive restaurants gave higher ratings to visual desirability (6.2 vs. 4.6) and interest in tasting (6.3 vs. 3.3), and were more likely to purchase if plants were grown organically (6.1 vs. 4.7) (Table 3).

Years of employment did not affect ratings for attributes of viola, but several attributes of borage were rated lower by chefs who had worked for 11 or more years (Table 3).

Certification had little effect on ratings for viola and borage, but noncertified chefs rated fragrance of nasturtium both more appealing (5.6 vs. 4.9) and pleasing (5.6 vs. 5.0) than did certified chefs (Table 3). Across all five of

these comparisons, chefs were more similar in their evaluations than were consumers.

Chefs were also asked to describe the fragrance and taste of the flowers, and how they used them. If they did not use them, they were asked if they intended to use them in the future. If the answer was positive, they were also asked how many days they would use them, and how much they would pay for a dozen (data not shown). Most of those who responded described viola as having a floral to perfume scent. Chefs were not able to describe the fragrance of borage, which corresponds with the low acceptance ratings. Chefs described the fragrance of nasturtium as having a floral, perfumed, sweet, spicy, or fruit-like scent. The tastes of viola and borage ranged from undetectable to bland, "vegetable," or, in the case of borage, sweet or clam-like. Most chefs described nasturtium's taste as peppery, cabbage-radish- or citrus-like, or both. Nearly all chefs said they would use all three species in a salad, but less than half would use the flowers as a garnish. Several chefs reported that they would use borage in seafood presentations, and one chef reportedly would use nasturtium in Asian presentations.

Fifteen percent of the chefs used viola in their presentations, eight used borage, and five

Table 3. Effect of gender, number of meals served each week, price of least expensive entree, years as a chef, and certification of respondents on mean ratings of chef acceptability of viola, borage, and nasturtium based on visual, fragrance, taste, and usage attributes.

Attribute	Gender		No. of meals served each week		Price of least expensive entree		Years as a chef		Certification	
	Female	Male	≤500	≥900	≤\$8	≥\$11	≤10	≥11	Yes	No
<i>Viola</i>										
Visual appealing	5.2	6.1	6.5	6.2	6.8	5.9	5.5	6.5	5.8	6.1
Visual desire	4.8	5.4	5.6	6.1	6.7	4.7	5.2	5.8	5.6	5.3
Interest in tasting	4.7	4.6	4.0	5.8	4.9	5.0	4.8	4.7	5.2	4.8
Appealing fragrance	3.5	5.4*	4.5	5.9	4.6	6.0	4.0	5.8	4.7	5.0
Pleasing fragrance	3.5	4.9	3.6	6.0	4.1	5.4	4.2	5.0	4.8	4.8
Appealing taste	2.3	3.8	3.2	3.9	3.0	4.7	3.3	3.6	3.2	3.9
Desirable taste	2.5	3.9	2.9	4.3	3.3	4.0	3.7	3.8	3.7	3.9
Purchase this flower	4.0	3.1	2.6	3.9	2.9	3.6	3.7	3.5	2.6	4.3
Use in a salad	3.8	4.2	4.2	4.6	4.7	3.7	4.2	4.2	3.9	4.6
More likely to purchase if grow organically	4.2	4.3	4.3	4.9	5.4	3.4*	4.5	4.2	3.9	4.7
Purchase with 10% insect damage	2.0	1.8	1.7	1.7	1.7	1.6	2.2	1.6	1.9	1.8
<i>Borage</i>										
Visual appealing	5.8	4.3	4.2	5.0	4.8	4.1	6.2	3.3*	4.5	4.8
Visual desire	5.0	4.0	3.8	4.8	4.2	3.9	5.7	4.3*	4.1	4.8
Interest in tasting	4.5	3.7	4.0	4.0	4.0	4.0	4.8	3.5	3.8	4.1
Appealing fragrance	3.2	3.6	3.2	3.9	3.3	2.7	4.1	2.7*	3.8	3.9
Pleasing fragrance	3.2	3.9	3.5	4.1	3.6	3.3	4.2	3.1*	3.4	3.9
Appealing taste	4.8	3.8	3.7	3.8	3.7	2.6	5.0	3.2*	3.8	4.4
Desirable taste	5.5	3.8*	4.3	4.1	4.7	3.0	5.4	3.6*	4.2	4.8
Purchase this flower	3.8	3.4	2.8	3.9	2.4	3.4	3.6	3.6	3.1	4.2
Use in a salad	3.7	3.6	3.2	3.7	3.1	2.9	4.2	3.4	3.4	4.0
More likely to purchase if grow organically	3.0	3.9	3.5	4.0	3.1	3.1	4.2	3.6	3.1	4.6
Purchase with 10% insect damage	1.8	1.9	1.7	1.8	1.7	1.6	2.2	1.6	1.7	2.0
<i>Nasturtium</i>										
Visual appealing	6.5	6.2	6.4	5.8	6.6	5.9	6.2	6.2	6.2	6.4
Visual desire	5.8	5.4	6.2	5.3	6.2	4.6*	6.0	5.6	6.0	5.6
Interest in tasting	4.5	4.8	5.4	4.8	6.3	3.3*	5.2	5.1	5.6	4.5
Appealing fragrance	4.7	5.3	4.6	5.9	4.7	5.4	4.9	5.9	4.9	5.6*
Pleasing fragrance	4.8	5.0	4.7	5.9	4.9	5.7	4.7	6.1	5.0	5.6*
Appealing taste	4.3	5.5	6.0	5.0	5.4	5.4	5.2	5.8	5.3	5.4
Desirable taste	3.7	5.2	5.6	5.0	4.9	5.9	4.9	5.2	4.4	5.4
Purchase this flower	3.0	5.3*	5.3	4.5	5.0	4.9	4.2	5.6	4.6	4.9
Use in a salad	4.8	5.4	6.0	4.7	5.7	5.0	5.1	5.6*	5.4	4.9
More likely to purchase if grow organically	4.8	5.2	5.7	5.1	6.1	4.7*	5.1	5.1	4.8	5.1
Purchase with 10% insect damage	1.5	2.1	2.1	1.7	2.1	1.7	1.9	1.6	2.0	1.9

*Mean differences of attributes within categories (price of least expensive entree, etc.) significant at $P \leq 0.10$ based on Fisher's exact test (2-tail probability).

used nasturtium. Forty-six percent of the chefs would consider using the flowers at least once a week, and the majority (58%) would use them two to three times a week. Prices that chefs were willing to pay for the flowers varied greatly. They were willing to pay \$1.00 to \$10.00 per dozen for viola, \$1.00 to \$5.00 for borage, and \$2.00 to \$15.00 for nasturtium. At least one chef reported that the restaurant grew edible flowers in the garden. Although actual use is low, the potential for increasing use of edible flowers among these chefs appears to be great.

Sample comparisons, consumer and professional chefs. We analyzed the mean ratings of both chefs and consumer participants to determine if the two groups had similar opinions about the edible flower species. For the visual and fragrance attributes of viola, consumers and chefs expressed similar perceptions (Table 4). However, consumers liked the taste better and were more likely to purchase and use viola than were chefs. Consumers liked borage better than did chefs, except for fragrance. In contrast, three nasturtium attributes were rated higher by chefs. Few mean ratings for nasturtium were significantly different between the two groups, with the exception of visual appeal, appealing fragrance, and purchase of the flower. Similarities in ratings may indicate that no separate marketing strategy is warranted. Consumers and chefs appear to have similar preferences about attributes for nasturtium, but this is less true for viola and borage.

There was a significant correlation between the decision to purchase and taste the flower for both participant groups. The relationship between taste and purchase for viola was stronger for chefs ($r = 0.51$) than for consumers ($r = 0.13$). For borage, these correlations were higher (chefs $r = 0.71$, consumers $r = 0.64$), but, for nasturtium they were similar (chefs $r = 0.78$ and consumers $r = 0.60$). This indicates that consumer ratings for "tasty" flowers are strongly related to their willingness to purchase the flower.

Conclusions. Most of the participants found nasturtium and viola visually acceptable, while more than half found borage visually acceptable. Viola and nasturtium had an acceptable fragrance rating from more than half of all participants. The acceptability of flower taste varied for consumers vs. professional chefs. At least a portion of both groups liked the taste and would appear to be potential target markets for edible flowers. The species tested appear to have moderate to high market poten-

Table 4. Mean rating of chef vs. consumer acceptability of three species of edible flowers based on visual, fragrance, taste, and usage attributes.

Attributes	Viola		Borage		Nasturtium	
	Chef	Consumer	Chef	Consumer	Chef	Consumer
Visual appealing	6.1	6.7	4.7	5.8*	6.2	5.7*
Visual desire	6.0	6.4	4.5	5.6*	5.9	5.6
Interest in tasting	5.5	6.1	4.2	5.5*	5.6	5.5
Appealing fragrance	5.3	5.4	3.8	3.9*	5.8	5.0*
Pleasing fragrance	5.6	5.5	4.0	3.9*	5.8	4.9
Appealing taste	3.8	4.8*	4.3	4.6	5.4	5.4
Desirable taste	4.2	4.7*	4.7	4.5	5.5	4.7
Use in a salad	4.1	4.8*	3.7	4.0*	5.2	4.0
Purchase this flower	3.7	5.0*	3.8	4.3	5.0	4.2*

*Mean differences of attributes within categories (chef vs. consumer) significant at $P \leq 0.10$ based on Fisher's exact test (2-tail probability).

tial, suggesting that a new niche market exists for growers and retailers. We saw many similarities between consumers and chefs in their perceptions of edible flowers.

Given these ratings, we believe that there is adequate reason to further investigate market potential of these flowers. In future studies to determine consumer preferences, determining the effect fragrance has on taste, or on consumers' choice to buy an edible flower product, may be possible. However, packaging could eliminate this as a factor in the decision to buy.

When analyzing the use characteristic data, one important factor is whether the participant would consider purchasing the flower if it were available. Whether a person will buy a product has a profound effect on whether the product will be available in the long term. The fact that at least 58% of the participants reported that they would buy the flowers, if available, supports the hypothesis that more consumers would purchase them if they were readily available. Another consumer segment may choose to grow their own edible flowers. In this study, at least 48% indicated that they would be likely to grow them. These results indicate that grocery stores or specialty food stores may be ready for product and price trials. This may be a more effective variable for market segmentation.

Chefs indicated they would be more likely to purchase viola and borage if grown organically, suggesting that chefs are not only concerned about serving attractive, fragrant, and palatable flowers, but also prefer flowers that have been grown organically. Nevertheless, few would accept flowers that had 10% insect damage. These two responses pose a challenge to producers. Chefs would prefer to purchase organically grown flowers, but would not buy them if they were flawed. Research

can help marketers close the gap between an expectation of no tolerance for blemishes and efficacy of pest control methods acceptable in organic production. Flowers grown using certified organic methods may incur more insect damage, since pesticides cannot be used for rapid control of outbreaks. Researchers may need to provide information indicating how growers can produce edible flowers with minimal insect damage.

Other areas should be investigated as well. These questions include: the effect of the visual and fragrance characteristics on the decision to purchase, how much will customers pay for edible flowers, how many flowers customers will purchase, and what effect color intensity has on the decision to purchase.

Literature Cited

- Badertscher, K.B. and S.E. Newman. 1996. Flowers. Colorado State Univ. Coop. Ext. Bul. 7.237.
- Barash, C.W. 1993. Edible flowers: From garden to palate. Fulcrum Publ., Golden, Colo.
- Barash, C.W. 1998a. The flavors of flowers. The Herb Companion 10(4):32-37.
- Barash, C.W. 1998b. Please eat the flowers. Horticulture 95(5):36-40.
- Belsinger, S. 1991. Flowers in the kitchen: A bouquet of tasty recipes. Interweave Press, Loveland, Colo.
- Bruner II, G.C. and P.J. Hensel. 1996. Marketing scales handbook. Amer. Mktg. Assoc., Chicago.
- Evans, R.D. 1993. Flowers as food. Small Farm Today 10(2):18-21.
- Kosztolnyik, L. 1996. Selling edible flowers. Natural Food Merchandiser 17(7):74.
- McVicar, J. 1992. Good enough to eat: Growing and cooking edible flowers. Kyle Cathie, London.
- SAS Institute, Inc. 1998. ver. 6.12 for Win95, SAS Inst., Cary, N.C.
- Whitman, A.T. 1991. Edible flowers and culinary herbs: New uses for traditional crops, new crops for traditional growers. GrowerTalks 54(13):22-23, 25, 27, 31, 33.