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Consumer Ratings of Edible Flower Quality, Mix, and Color

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SUMMARY. Two identical surveys were conducted with separate samples to determine consumer perceptions of the quality of five edible flower species. Participants were either members of a class that reviewed the history and uses of edible flowers at

an annual, 1-day event (Garden Days) or Michigan Master Gardeners who attended a similar class. Participants were shown a randomized series of projected photographic slides of five edible flower species and asked to indicate whether they found the flower quality acceptable. The slides depicted a range of ratings of mechanical damage, insect damage, or flower senescence on a Likert reference scale (1 through 5) developed by the researchers. A flower rated 5 was flawless, while a flower rated 1 had substantial damage. Nearly one-half of all participants had eaten edible flowers before the study, and 57% to 59% had grown them for their own consumption, indicating many individuals had previous experience. Both samples rated flower quality equally and found pansy (*Viola × wittrockiana* 'Accord Banner Clear Mixture'), tuberous begonia (*Begonia × tuberhybrida* 'Ornament Pink'), and viola (*Viola tricolor* 'Helen Mount') acceptable from stage 5 to 3. Both groups found the nasturtium (*Tropaeolum majus* 'Jewel Mix') flowers acceptable at only rating 5. Garden Days participants rated borage (*Borago officinalis*) acceptable from ratings 5 to 3, while the Master Gardeners rated their acceptability from only 5 to 4. Participants also rated flower color (yellow, orange, and blue) as equally acceptable.

Rigid plastic containers of edible flowers can be found in some grocery store produce departments. Though the number of containers purchased is small, upscale clientele and caterers may purchase edible flowers as an ingredient or garnish for meals, especially during holiday periods (Rusnak, 1999a). For the hotel and restaurant market, Quail Mountain Herbs (Watsonville, Calif.) seasonally produces 50 different edible flowers, includ-

ing nasturtium, pansies, and chrysanthemums (*Chrysanthemum leucanthemum*) (Forkush, 1999). Although larger quantities and species are offered to chefs, consumers may purchase fewer quantities of a mix of edible flowers.

Consumer perception of product quality is often the factor that creates customer loyalty and repeat purchases (Foodservice Equipment and Supplies, 1999). Food service venues such as restaurants strive to maintain or improve quality levels. Consumers who were surveyed about choosing a restaurant listed food quality as the most important factor (Dulen, 1999). A restaurant's reputation can be tarnished if the coffee served is of poor quality (Bendall, 1999). Quality of a product such as edible flowers, which may serve as a garnish or food item, may be as important as the coffee that is served. Consumers eat with their eyes well before they taste with their mouths (Little, 1980). An edible flower that is visually appealing to consumers may invite them to taste the flower. Consumers then decide whether they want to continue eating the edible flower or sample another species or cultivar. If the flower isn't appetizing, it may reduce visual appeal of the meal and convince the person not to eat it.

In the floriculture industry, quality is also essential for customer satisfaction. Consumers want more varieties of top quality plants with a longer shelf life (Shaw, 1998). As with most products, if customers do not feel that they are purchasing a high-quality item, they may choose a competitor's product. Customers often are willing to pay more for a higher-quality product (Shaw, 1998). Packages of edible flowers should contain a desirable mix of species that are palatable, have a reasonably long shelf life, and are high quality, and the package should contain information such as how to store and use the product.

For edible flowers, product quality must begin with planning during the production stage. Since no pesticides are registered for use on edible flowers (Kosztolnyik, 1996), alternative pest management strategies must be used. With an increase in the demand for organic products, edible-flower producers may consider growing them using certified organic methods. Supply and demand for organic products has increased, and although product quality has improved (Rusnak, 1999b), organic items must continue to meet or exceed consumers' expectations to be profitably competitive with conventional products.

Research conducted at Michigan State University, East Lansing, Michigan. Use of trade names does not imply endorsement of the products named nor criticism of similar ones not named. The authors thank the Garden Days and Master Gardener coordinators at Michigan State University for permission to conduct these surveys.

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Delicate edible flowers should be properly packaged to protect them. They can be marketed in rigid plastic containers similar to those used to store and protect strawberries (*Fragaria ×ananassa*) and other highly perishable items. Packages not only protect easily damaged items, but also reduce condensation and mildew for items such as packaged strawberries (Fite, 1998), and this advantage should extend to edible flowers. Even if all precautions were taken to protect the product, store managers should monitor product quality and remove any containers of edible flowers from the shelves once deterioration is noticeable.

Research has shown that flower color is the most important product attribute, followed by container price and size (Kelley et al., 2001a). Further, researchers understand that a mix of species and cultivars is preferred to a single color or species (Kelley et al., 2001a), but how much deterioration will consumers tolerate in a mix of edible flower species? Our objective was to provide information to answer questions regarding consumer preferences and quality perceptions of edible flowers. We hypothesized that groups of gardening enthusiasts with knowledge about flowers and flowering plants would be able to rate the acceptability of five species of edible flowers with various degrees of damage. We were more interested in how a sample of consumers who may be more experienced with flowers, and perhaps more critical of flower quality, would rate edible flowers. Less critical consumers should have similar or lower expectations.

Materials and methods

Two major Michigan cities, Detroit and Grand Rapids, are considered viable test markets (Waldrop, 1992), which means that their populations closely resemble a typical United States city. Results collected in test markets are often extrapolated to other typical cities as one indication of how well the product tested might be perceived.

Master Gardeners (MG) are more interested or experienced in gardening and have, perhaps, a heightened sensitivity and awareness of flower quality than consumers who are not knowledgeable about growing flowers or flowering plants. Garden Day (GD) participants elected to attend gardening programs because of their overall interest in gardening and had a similar level of flower awareness. Both groups were

Michigan residents, some of whom resided in test market areas. Twenty-nine percent of MG were residents of metro Detroit, with an additional 15% residing in the Grand Rapids metro area. Twenty-two percent of GD participants were residents of metro Detroit, but none

were from Grand Rapids. The remainder of MG and GD participants were from the greater Lansing area, cities surrounding the two metro areas, and states bordering Michigan. Although the samples were drawn from cities identified as representative, we found them

Fig. 1. A flawless nasturtium flower that was rated 5.

Fig. 2. A nasturtium flower that had the most damage and was rated 1.

to be an indication, perhaps more critical than we might expect, of groups of average Americans who were less involved in gardening.

The Michigan MG participants attended a 2-d annual program that allowed members to enroll in classes on various gardening-related topics. Fifty-one self-selected members preregistered and attended a 1.5-h seminar on edible flowers on 29 June 1999. GD participants also had the opportunity to attend seminars on other topics during the 2-d annual meeting. Twenty-three self-selected GD participants enrolled in a presentation on either 5 or 6 Aug. 1999. All participants were given a survey form that included a scale for visual quality assessment and were asked several other questions pertaining to edible flower preferences, uses, and demographics.

Participants were shown a randomized series of five edible flower species: projected photographic slides [with a projected size of 4×5.7 ft (1.22×1.73 m)] of: pansy 'Accord Banner Clear Mixture', tuberous begonia 'Ornament Pink', viola 'Helen Mount', borage, and nasturtium 'Jewel Mix'. Each slide showed a flower that researchers had rated by using a scale of 1 to 5. Each stage of the scale corresponded with a postharvest visual assessment scale developed by the researchers, because no damage assessment scales for edible flowers were identified in the literature. A flower rated 5 was flawless (Fig. 1). As the numerical rating decreased, the amount of damage or flaws increased. Flowers rated 1 had the most mechanical, insect, or senescence damage (Fig. 2). Flower color was also affected, and flowers that had ratings lower than 5 had increasing degrees of petal discoloration.

As each slide was shown, participants were asked to indicate on their survey form whether the flower quality was acceptable. Each slide was shown a

second time, in the same order, to ensure that participants had an adequate opportunity to examine each flower carefully. Our hypothesis was that consumers would consider flower quality acceptable from ratings 5 through 3. By using the amount and types of damage, we hypothesized that flowers that received a rating of either 1 or 2 would have enough damage and significant browning to be unappealing to consumers. After viewing slides, participants were asked to examine and rate slides of three different colored pansies (yellow, orange, and blue), using a seven-point Likert scale (7 = highest rating), adapted from Bruner and Hensel (1996). They were asked to use the flower color to decide how likely they would be to eat the pansy shown. Next, participants were asked to rate how likely they would be to purchase edible flowers grown organically that had 10% insect damage, whether they had ever eaten edible flowers before, how they obtained the edible flowers, and if they preferred mixtures of edible flower species or a single species. Finally, participants responded to a series of demographic questions. The SPSS software for Windows 95 program was used to test the results for significance (SPSS Inc., Chicago).

The researchers hypothesized that GD participants and the MG would tolerate a similar threshold of edible flower damage before indicating an unwillingness to purchase a container of edible flowers. In general, they had similar experiences with edible flowers and also possessed similar demographic characteristics. Further, the researchers hypothesized that if at least 50% of the participants found a flower acceptable at a particular rating, it would likely be saleable. We recommend that packages of edible flowers remain in stores until the threshold rating is reached. By not discarding them at the first sign of a change

in appearance, store managers might sell more packages, which would reduce product shrinkage and possibly enhance profitability. We recommend that store managers not leave packages in the display area past the acceptable stage. Consumers should view only packages of edible flowers that are above the threshold level.

Results and discussion

The demographic characteristics of both groups were similar, except that 23% more MG participants were married (Table 1). Nearly half of both groups indicated that they had eaten edible flowers in the past three months including: dandelion (*Taraxacum officinale*), nasturtium, lavender (*Lavandula angustifolia*), chives (*Allium schoenoprasum*), violet, borage, mint (*Mentha* sp.), tulip (*Tulipa* sp.), calendula (*Calendula officinalis*), arugula (*Eruca vesicaria*), and signet marigold (*Tagetes tenuifolia*). This result indicated that participants had some recent experience with the product, perhaps sensitizing them to the product attributes. Only 12% of the participants in both groups purchased edible flowers in the past year, while slightly more than half of the GD and MG participants, respectively, were growing edible flowers for personal consumption. More than half of both groups preferred mixtures of edible flowers. At least 44% of both of these groups had eaten edible flowers and could assess damage with a critical eye.

More than half of both MG and GD participants rated flower quality of pansy, tuberous begonia, and viola acceptable at stages 5 through 3 (Table 2). Less than half of both groups rated nasturtium acceptable at stages lower than 5. Flower quality of borage was acceptable at stage 3 for 50% of the GD participants and 47% of MG participants.

Participants were asked to answer a series of questions regarding preferences

Table 1. Comparison of demographic characteristics and edible flower preferences for Master Gardeners and Garden Days participants.

Attribute	Master Gardener participant	Garden Day participant	Significance
Mean age (years)	45	46	NS
College or technical school graduate (%)	53	59	NS
Two-person families (%)	36	42	NS
Income \$40,000 to \$60,000 (%)	21	37	NS
Married (%)	82	59	*
Female (%)	86	91	NS
Eaten edible flowers before (%)	44	45	NS
Purchased edible flowers before (%)	12	12	NS
Grew edible flowers before (%)	57	59	NS
Preferred a mixture of edible flower species (%)	65	68	NS

NS, *Nonsignificant or significantly different at $P \leq 0.05$ in rows, as based on a two-tailed t test and chi-square.

Table 2. Percentage of Garden Days (GD) or Master Gardener (MG) participants who rated edible-flower quality acceptable for five species. Scale of 1 through 5 (5 = perfect).

Species damage rating	Pansy		Tuberous begonia		Viola		Nasturtium		Borage	
	GD	MG	GD	MG	GD	MG	GD	MG	GD	MG
5	100	96 ^{NS}	96	96 ^{NS}	100	100 ^{NS}	77	78 ^{NS}	90	92 ^{NS}
4	100	96 ^{NS}	96	88 ^{NS}	77	51*	35	24 ^{NS}	59	71 ^{NS}
3	95	71*	86	78 ^{NS}	96	84 ^{NS}	5	10 ^{NS}	55	47 ^{NS}
2	26	10 ^{NS}	0	4 ^{NS}	26	14 ^{NS}	0	0 ^{NS}	17	2*
1	4	2 ^{NS}	23	16 ^{NS}	5	0 ^{NS}	0	0 ^{NS}	36	8*

^{NS}*Nonsignificant or significantly different for each species at $P \leq 0.05$. Statistics performed by using the Kruskal-Wallis test.

for edible flower-color (Table 3). More than 67% of all participants were very likely to eat all three colors of pansies (yellow, orange, and blue); however, more participants favored yellow and blue pansy flowers than orange. Participants' answers to these questions will enable growers and markets to define what colors should be included in containers of edible flowers. Research has shown that a container of edible flowers with all three colors is preferred (Kelley et al., 2001a). Results from research with more critical individuals support this finding. First time edible-flower buyers were unable to taste them before the purchase but relied on the flowers' appearance. Color was a critical component of floral purchases and may be indicative for edible flowers too. Behe et al. (1999) showed that there was a group of consumers who may purchase blue geraniums (*Pelargonium xhortorum*), before a blue geranium was developed. Some consumers may prefer blue edible flowers, while others may find this color unappetizing.

Participants were also very likely to purchase edible flowers grown organically but were very unlikely to purchase those with 10% insect damage. This information will assist growers who may be making decisions concerning how the flowers should be grown.

After reviewing these data from these perhaps more highly sensitized customer groups, we believe that consumers may purchase edible flowers at quality levels that are less than perfect. However, there

is a threshold below which flowers would not be purchased. We can conclude that flowers do not have to be perfect but may be sold with minor flaws, even to consumers with some experience growing or eating flowers.

Information about edible flower quality will help producers and marketers create mixes, package sizes, and pricing techniques that may increase market share and profits. Participants in several marketing surveys have indicated that there is an interest in edible flowers and that potential consumers care about flower quality as well as how the flower is grown and treated. Few companies are producing edible flowers to be sold through retail outlets. As the interest in edible flowers as a garnish and an ingredient increases, new mixes, new colors, and larger quantities may be sold. Edible flowers may also potentially be included in ready-to-go meals or prepackaged salad mixes.

Other factors should be considered when edible flower products are created. The mix of edible flowers may be a factor in the purchasing decision as well as the flower quality. Robertson and Chatfield (1982) found that flower bouquet composition affected a consumer's preference. Little is known regarding which species or mix of edible flowers consumers would prefer and how quality affects the purchasing decision (Kelley et al., 2001b; unpublished data). Currently, marketed containers of edible flowers contain several species. Consumers may prefer a more homogeneous or heterogeneous mix. The desired

mix of edible flowers also may be situational, a function of whether the flowers will be used as a garnish or as a food. Future studies should concentrate on these areas and this research may help determine whether consumers can detect a small amount of damage on edible flowers in packages.

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Table 3. Comparison by percentage of Garden Days (GD) and Master Gardener (MG) participants who would be very likely to eat or purchase selected edible flowers.

Variable	GD	MG	Significance
Number in sample	23	51	
Eat a yellow pansy	91	90	NS
Eat an orange pansy	74	67	NS
Eat a blue pansy	91	94	NS
Purchase edible flowers grown organically	90	86	NS
Purchase edible flowers with 10% insect damage	24	35	*

^{NS}*Nonsignificant or significantly different at $P \leq 0.05$ in rows, as based on a two-tailed *t* test.