

A Market Driven Approach to Ethnic Crop Production for the US East Coast

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Economic opportunities have arisen in the last decade for specialty crop agriculture catering to the ethnically diverse consumers along the eastern coast of the United States (Sciarappa 2001, 2003; Tubene 2001; Govindasamy et al. 2006; Mendonca et al. 2006). United States Census data show average population increases of 13% from 1990 to 2000 as compared to 48% for Asians and 58% for Hispanic/Latinos (US Census 1990, 2000). The ethnic population boom along the East Coast is even more pronounced. In ethnically diverse population hubs such as the Northeast Region, the Asian population growth reached 60%. Although the aggregate Hispanic/Latino rate of growth in the Northeast does not currently exceed the national average, the Mexican population in the Northeast has increased 174% (not including any non-documented illegal immigrants that are working in this region, many of whom may be seasonal help for agricultural growers). The rapid expansion of ethnic populations presents significant opportunities for fruit and vegetable producers in the region to take advantage of the comparative advantages associated with close proximity to densely populated areas. In response to a need for East Coast farmers to remain economically viable, a US Department of Agriculture, National Research Initiative study was initiated to document and quantify the current available market opportunities so that farmers may engage the market by growing crops targeted from a demand perspective.

A survey based on random sampling was prepared for four predominant and growing ethnic groups, specifically; Chinese, Indian, Mexican, and Puerto Rican. East Coast residents (271) were interviewed from each selected ethnicity totaling 1,084 samples. Bilingual surveys of these ethnic consumers developed food crop preference and ranking from a potential list of over 100 fruits and vegetables. Crop production experts along the East Coast from Florida to Massachusetts further narrowed this list based upon production and climatic zone criteria. Specific lists of vegetable preferences and ethnic community maps were compiled to connect growers to these emerging marketplaces and to direct crop demonstration plots for university partners.

The general objectives of this study were to: (1) identify and estimate the market size for ethnic segments that present significant opportunities to local growers; (2) assess demand, conduct production studies, and make recommendations for appropriate ethnic produce items to locally address this market; and (3) develop strategies and production timelines to coordinate production of select ethnic crops to exploit this market niche.

The intended outcome of the project was to generate and distribute science-based information about production, marketability, and utilization of selected ethnic crops and herbs. This initiative bridges the supply-demand

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gap, delivering practical solutions to economic problems faced by many vegetable growers, and contributes to the nutritional and health needs of regional consumers.

RESEARCH APPROACH

Market Niche Identification; Justification for Subject Group Selection

National Trends. Opportunities to capture anticipated market growth in certain ethnic markets were identified, specifically for ethnic market segments growing at faster rates than their ethnic and/or non-ethnic counterparts and for which growth is expected to continue. The primary groups meeting these criteria included Asians and Hispanics. The top two sub-groups within each of these segments were chosen for the study; Chinese and Asian Indian (Asian sub-groups) and Puerto Rican and Mexican (Hispanic sub-groups). Although the Filipino population and absolute growth for the same period ranked slightly higher than that of the Asian Indians, they were not selected as a subject group of study given that approximately half of the Filipino population in the United States resides in California (outside the geographic scope of the study).

Rationale and Significance. Despite the competitive disadvantages relative to year-round producers in lower production cost areas, significant comparative advantages exist for local East Coast growers as a result of densely populated areas rich in ethnic diversity. It has become increasingly necessary for these producers to adopt new crops and create new value-added opportunities in order to remain economically viable. Growing ethnic crops present opportunities for producers to exploit existing comparative advantages associated with serving densely populated local ethnic markets in order to sustain farming operations and increase profitability. The coordination of production and marketing are critical to avoid the threats of rapid over-production (which can quickly lead to an oversupply of a particular product and depressed prices) and overcome inadequate marketing infrastructure in order to move product into community markets. Establishing and extending existing cooperative marketing memberships or affiliations along the East Coast, from North to South, can create an improved market system that provides appropriate year-round supplies to the area.

Ethnic Consumer Survey

The research program includes the development, administration, and data collection from an ethnic consumer survey. The survey objective was to gather relevant consumer information from four ethnic groups (Chinese, Indian, Mexican, and Puerto Rican) to include demographics, shopping patterns and preferences, expenditures on selected ethnic produce, and willingness to pay premiums over traditional American produce. The data collected are being utilized to analyze ethnic consumers' patterns of purchase and propensity to purchase ethnic produce, estimate the associated market potential, and prioritize subsequent production studies of individual crops.

Survey Method. Sample sizes for each ethnicity were identified based on 2000 Census populations for Chinese, Asian Indians, Mexicans, and Puerto Ricans in the 16 East Coast states and the District of Columbia (Table 1). Sample sizes of 271 surveys for each of the four ethnic groups were statistically determined for a total of 1,084 surveys of ethnic produce consumers. (The sampling error associated with an East Coast sample of 271 people from each of the four ethnic groups is approximately $\pm 5\%$ with a 90% confidence interval.)

Further sample size requirements were established, based upon ethnic group by state, in accordance with a stratified random sampling method (stratified random sampling was used where the sample is selected such that ethnic groups are represented in the same respective proportion, by state, as they occur in the population, per Census 2000; Table 1). An additional sample size of 271 was established to gather data in a short survey delivered to non-purchasers of ethnic produce to assess their reasons for not purchasing these items.

Implementation and Outcomes. An outsourced firm specializing in telephone and internet data collection, The Wats Room Incorporated (WATS), was contracted to conduct 1,355 telephone interviews using Computer-Assisted Telephone Interview (CATI) technology. Their surveys were conducted by phone to ensure that a statistically significant randomized sample was obtained. This entailed targeting and achieving the required sample sizes

by ethnicity and state while minimizing any costs associated with sample surpluses in certain states and deficits in others (as might occur with a mail-administered survey).

Qualified (bi-lingual) interviewers received on-site Human Subjects Certification Program (HSCP) training, per Federal-wide Assurance guidelines, in addition to survey-specific training and practice, prior to conducting actual interviews. (HSCP includes background material on human subject research which includes history, policies, regulations, procedures and ethical practices.) A member of the Rutgers research team was on-site at WATS in Rochelle Park, New Jersey during this training to monitor the process, tour the facility, and oversee operations. Ongoing interviewer monitoring throughout the field period was conducted by WATS. Interviewing commenced in late February 2006, continued into March, with initial results available by the end of March and final data files provided in early May, 2006.

Over 13,000 potential interviewee leads were utilized by WATS in order to meet the sample size requirements. These leads were generated by ethnic surnames, selected using a randomized selection process, and further randomized through CATI programming. Ultimately, a total of 1,366 phone surveys were completed by ethnic consumers as follows; 1,084 long-version surveys by purchasers of ethnic produce (271 ethnic produce purchasers from each of the four ethnicities surveyed; Chinese, Asian Indian, Mexican, and Puerto Rican) and 282 short-version surveys by non-purchasers of ethnic produce (defined as not having purchased within the past year), irrespective of ethnic group (Table 2; the actual number of short-version surveys collected exceeded the objective slightly, resulting in 1,366 useable surveys as compared to the original 1,355 objective). Roughly 10% of the numbers selected at random for each ethnic group yielded complete interviews. However, many of telephone numbers originally selected were non-residential or non-working numbers. Removal of these non-working numbers from the equation reveals that 14% of the calls to working residential numbers resulted in completed interviews. Many multiple call attempts to working residential numbers were unsuccessful in contacting the principal grocer shopper in the house, as required for the survey interview. Surveys were conducted between 5 pm and 9 pm EST to accommodate those shoppers that work. Despite repeat call attempts of up to 10 telephone calls and/or three appointment setting follow-ups per number, many qualified interviewees could not be reached. The cooperation rate, or completed interviews as a percent of calls to a qualified (accessible) interviewee, was

Table 1. East coast ethnic populations (United States Census 2000).

State	Ethnic group			
	Chinese	Asian Indian	Mexican	Puerto Rican
Connecticut	19,172	23,662	23,484	194,443
Delaware	4,128	5,280	12,986	14,005
District of Columbia	3,734	2,845	5,098	2,328
Florida	46,368	70,740	363,925	482,027
Georgia	27,446	46,132	275,288	35,532
Maine	2,034	1,021	2,756	2,275
Maryland	49,400	49,909	39,900	25,570
Massachusetts	84,392	43,801	22,288	199,207
New Hampshire	4,074	3,873	4,590	6,215
New Jersey	100,355	169,180	102,929	366,788
New York	424,774	251,724	260,889	1,050,293
North Carolina	18,984	26,197	246,545	31,117
Pennsylvania	50,650	57,241	55,178	228,557
Rhode Island	4,974	2,942	5,881	25,422
South Carolina	5,967	8,356	52,871	12,211
Vermont	1,330	858	1,174	1,374
Virginia	36,966	48,815	73,979	41,131
Total	884,748	812,576	1,549,761	2,718,495

approximately 37% (the cooperation rate is defined for these purposes as completed interviews as a percentage of the sum of completed interviews, refusals, and language barriers cited).

The surveys were administered by trained, bilingual phone interviewers in order to minimize response bias due to potential language barriers. The interview languages made available were as follows; (1) Chinese interviews offered/conducted in English, Mandarin, and Cantonese; (2) Indian interviews offered/conducted in English and Hindi; and (3) Mexican and Puerto Rican offered/conducted in English and Spanish (reflective of respective dialect differences between the two countries of origin; used, as needed, according to interviewer confirmation of respondent’s country of origin). The results of the produce expenditure data from 1,084 surveys completed by ethnic produce purchasers, combined with the expertise of local crop specialists (and consideration for logistical concerns), provided the tools necessary to prioritize crops for subsequent production research.

SURVEY RESULTS

Survey Outline: Sequence and Content

Two versions of the survey were administered; long and abridged. The questionnaire was designed to first assess whether the ethnic respondent was a consumer of ethnic produce (in the past twelve months) or not, using a “yes” or “no” screening question. Then a skip sequence was used by the interviewer, depending on the interviewee’s response, to either; if “yes,” continue with a line of questioning that will help to identify ethnic produce demand factors, or if “no,” identify reasons for not purchasing ethnic produce (potential market opportunities).

The “purchasers” (respondents answering in the affirmative) proceeded to complete the longer form of the survey, inclusive of questions about their purchase patterns (frequency, spending, point of purchase, quantity, price, and average expenditures) and preferences and opinions with regard to product, placement, and price. Such inquiries were made to quantify demand, assess the importance of product attributes, compare ethnic versus conventional outlets (consumer perception), and determine price potential (via consumer willingness-to-pay a premium over comparable American or conventional substitutes). These respondents were also asked questions about different promotions and advertisements and whether or not they influence purchase decisions. In addition, each respondent was asked whether or not he/she grows ethnic produce for consumption at home and whether he/she is a vegetarian. Demographic inquiries were made with regard to neighborhood, residency, household size and age composition, languages and proficiency, and country of origin, in addition to other basic socio-economic factors (age, education, income, etc.).

The “non-purchasers” (respondents with a negative answer) were urged to provide reasons they do not generally purchase ethnic produce and were prompted with plausible causes, if need be, such as “do not like ethnic produce,” “lack of availability,” “poor selection,” “ethnic outlet not available or too far,” or “other.” These respondents then proceeded to complete the abridged form of the survey. Both purchasers and non-purchasers were asked questions about their relative willingness (i.e. more willing, indifferent, less willing, or unsure) to buy ethnic produce based on certain factors and/or product attributes.

Table 2. Ethnic produce survey respondent summary.

Ethnic group	Number of completed surveys		Total
	Purchasers ^z	Non-purchasers ^y	
Chinese	271	107	378
Asian Indian	271	36	307
Mexican	271	105	376
Puerto Rican	271	34	305
Total	1,084	282	1,366

^zPurchasers are respondents that indicated they have purchased ethnic fruits and vegetables within the past 12 months.

^yNon-purchasers are respondents that indicated they have not purchased ethnic fruits and vegetables within the past 12 months.

The long version of the survey (completed by purchasers only) was intended to gather demand and marketing information inclusive of the proverbial “4 P’s” of marketing (Product, Placement, Price, and Promotion). The results of these surveys were used to assess the market demand for the respective high-potential ethnic markets, and to direct subsequent research (i.e. prioritize production crops) to satisfy and/or capture some of this demand. The abridged survey version (completed by “non-purchasers,” irrespective of ethnic group), was collected to ascertain reasons for non-purchase and identify potential new, extended opportunities to exploit these markets. This shortened version gathered primarily the promotion and placement preferences, to maximize the marketing reach of the initial project efforts by attempting to address such potentially underserved markets.

Consumer Produce Expenditures

The preliminary focus of the purchase pattern survey results data was to quantify the average weekly expenditure for specific ethnic crops, to prioritize the subsequent production research. Detailed data including the quantity, unit of measure (pounds/bunches/numbers), price, and average expenditure for each produce item was collected and analyzed. Once summarized, this data yielded average expenditures for each crop, by ethnic group, and served as a common denominator to compare and prioritize crops across groups (described in greater detail in the “Crop Selection Process” section that follows).

Consumer Demographics

The purpose of the socio-demographic data collection is to identify relationships between ethnic consumer expenditures and the respective demographic profiles. In addition to the typical socio-demographic data (age, education, income, etc.), information such as birthplace, length of residency in the United States, and age of immigration to the United States was collected to measure acculturation.

Additional analysis of the survey sample expenditures and demographics as they correspond to consumer shopping patterns, preferences, and related practices, will be utilized to develop predictive demand models for the larger populations. These models will facilitate effective distribution efforts by enabling producers, wholesalers, and retailers to target appropriate markets and locations, based upon demographic profiles and geographic population concentrations. Mapping tools developed for such purposes will help suppliers to identify markets of interest, from both a top-down (locate ethnic concentrations; ethnic population, by state, by municipality) and bottom-up approach (determine market reach; ethnic populations, by proximity to market, by state). This will help to marry the supply with local demand, as appropriate, to optimize marketing efforts.

CROP SELECTION PROCESS

Identify Ethnic Crops of Interest (100+ Crops)

Create Initial Ethnic Crop List. An initial list of ethnic crops commonly sold/marketed and considered as ethnic produce items for each of the four ethnic groups of study was compiled based upon a combination of focus groups and identification through related research (Govindasamy 2006).

Conduct Process of Elimination. To determine which crops from the initial list to include in the survey, a panel of over 10 experts (marketing, field/extension, and crop specialists) scrutinized the potential list of more than 100 ethnic crops to eliminate those with existing production barriers that could impede their local production and/or marketplace success. Production barriers included local climate limitations, growth cycle (relatively short cycle necessary to grow in designated East Coast production sites), seed supply availability and regulation, and local competition and/or commodity nature of certain produce items. Thus, specialty crops with short post-harvest life were given priority over commodity and less-perishable crops such as beans and certain peppers used primarily as spices.

This process (Fig. 1) reduced the survey crop candidate list by more than 50%, resulting in a refined list of 42 crops (10 each for Asian Indian, Mexican, and Puerto Rican, and 12 for Chinese) to assess demand. Due to budgetary constraints, the list required further reductions to arrive at a final list of approximately 28 crops (7 per ethnicity), to be included in subsequent production research (Table 7). Assessment of the survey results, along with additional production evaluation for each, was conducted to achieve program goals.

Assess Demand and Supply (Production Potential: 42 Crops)

Rank Crops by Ethnicity. Results of the USDA-NRI survey of 271 randomly selected East Coast consumers from each of the four ethnic groups were used to rank the crops included in the questionnaire, within ethnicity, according to expenditure and/or purchase data. Multiple criteria were established to rank produce items according to: (1) mean (weekly) expenditures across all respondents (including zero purchases); (2) mean (weekly) expenditures across only respondents purchasing that item (excluding zero purchases); (3) frequency of purchase across respondents (binary; 1 or 0 for purchase or non-purchase, respectively), (4) volume (number of pounds, bunches, or units) purchased by each respondent for each produce item; and (5) overall rank (average of results rankings #1 thru #4) for each produce item.

Although the rank order varied somewhat across the multiple criteria, a few produce items from each ethnicity consistently ranked 8 or higher in a majority (at least 3 out of 5) of the criteria. This allowed for a systematic approach to eliminate crops from the final production study. An Overall Rank threshold of 8 (average rank higher than 7) was established to help identify crops with relatively low survey demand. Crops were also evaluated for production research potential (research interest, yield potential, and anticipated cost effectiveness) by field study participants at each site. A combined assessment (actual demand and projected production potential) was particularly important in cases where a single systematic approach was not sufficient to distinguish between crops for research prioritization purposes.

Re-visit Research Candidates; Examine Survey Demand Rank. Expenditure results of the Chinese consumers surveyed revealed a distinct ranking of 12 Chinese crops (Table 3). Five Chinese crops received an Overall Rank of 8 or higher and a rank of 8 or higher in a majority of the 5 categories, suggesting lower marketplace potential relative to their 1 thru 7 ranked counterparts. Three out of these 5 crops consistently ranked 8 or higher in every category. The remaining two2 crops had only a marginally preferred rank of 6 or 7 in one of the 5 categories. As such, none of the 5 crops were considered strong candidates for further research. Rather, the top 7 ranked crops based on “Overall” survey demand were the crops recommended for production research.

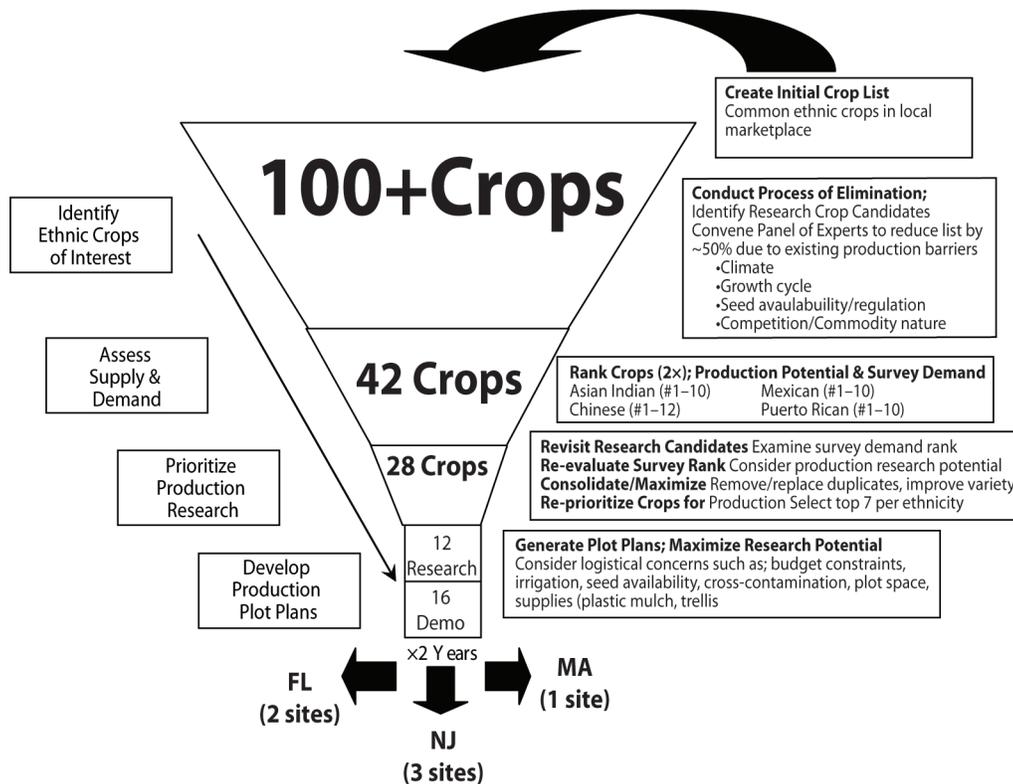


Fig. 1. Ethnic produce project: crop selection process.

Results of the similarly surveyed Asian Indian consumers reveal the ranking of 10 Indian crops (Table 4). Three crops received an Overall Rank of 8 or higher and had a rank of 8 or higher in a majority of the 5 categories. However, 2 of these 3 crops had a favorable rank (of 4) in one category (each) and as such, warranted further consideration based upon evaluation of their respective production research potential. As a result, both of these crops were still considered for production and were further evaluated. In this particular instance, one of these crops is purchased by the bunch and, as such, was generally purchased in lower quantities relative to other vegetables purchased by the pound or in numbers. Consequently, “frequency” (versus “quantity”) of purchase was given special consideration for comparisons and ranking purposes.

The results of the similarly surveyed Mexican consumers reveal the ranking of 10 select Mexican crops (Table 5). With the exception of the Anaheim pepper, the 3 crops that carried an Overall Rank of 8 or higher consistently did so across all criteria. Although the Anaheim pepper had a rank of 8 or higher in a majority of the categories, it had a favorable rank (of 6) in one category. As a result of this exception, and due to the production interest in pepper cultivar, the Anaheim pepper was further considered and ultimately recommended for inclusion in production research.

The results for surveyed Puerto Rican consumers reveal the ranking of 10 select Puerto Rican crops (Table 6). Three crops received an Overall Rank of 8 or higher, but only 2 of those had a rank of 8 or higher in a majority of the 5 categories. Dominican eggplant (or Berenjena) had a rank of 7 in 3 out of 5 categories. As a result of this marginal rank, and given the favorable rank for eggplant in each of the Asian Indian and Chinese data sets, this additional cultivar was further considered for production research. The 2 other crops with an Overall Rank of 8 or higher also warranted a closer look, given their favorable rank in one category (each) and were still considered for production research.

Re-evaluate Survey Rank: Consider Production Potential. Once the survey data rankings were examined, any crops that did not rank higher than 7 for *all* criteria were re-evaluated to either further justify their inclusion in the existing top 7 Overall Rank standings for each ethnicity, or adjust the proposed 7 production crops for each

Table 3. Chinese ethnic produce survey ranking.

Produce	Rank based on criteria (weekly purchases)						Average exp (\$)
	Avg. expenditure: includes all purchasers ^z	Avg. expenditure: excludes “0” expenditures ^y	Produce purchase frequency	Produce volume bought	Average rank	Overall rank	
Baby pak choy	1	1	2	2	1.5	1	2.26
Pak choy	2	5	1	1	2.25	2	1.77
Oriental eggplant	3	2	5	4	3.5	3	1.60
Snow peas	4	4	6	6	5	4	1.29
Oriental spinach	5	7	4	5	5.25	5	1.28
Napa cabbage	7	10	3	3	5.75	6	1.04
Ridged gourd/luffa	6	3	8	7	6	7	1.10
Edamame	8	8	7	9	8	8	0.79
Oriental mustard	9	9	9	8	8.75	9	0.71
Malabar spinach	11	6	12	12	10.25	10	0.20
Basil	10	12	10	10	10.5	11	0.22
Perilla	12	11	11	11	11.25	12	0.19

^zPurchasers are respondents that indicated they have purchased ethnic fruits and vegetables within the past 12 months. Includes all purchasers’ responses (whether the respondent purchased a particular item or not; i.e. includes purchases reported as “0”).

^yIncludes only the purchasers who purchased the corresponding item (such that the number of purchasers varies by item; i.e. excludes purchases reported as “0” for a given item).

ethnicity, as appropriate. This analysis took into account additional considerations such as appropriateness of individual ranking criteria (some measures may be inappropriate or less relevant for comparisons of certain crops), increased prioritization as a result of cross-ethnicity demand, research need for crop variety (production) comparisons, among other considerations.

Table 4. Asian Indian ethnic produce survey ranking.

Produce	Rank based on criteria (weekly purchases)						
	Average expenditure: includes all purchasers ^z	Average expenditure: excludes “0” expenditures ^y	Produce purchase frequency	Produce volume bought	Average rank	Overall rank	Average expenditure (\$)
Bitter gourd	1	2	3	2	2	1	2.48
Eggplant	2	6	1	1	2.5	2	2.23
Fenugreek leaves	3	8	2	3	4	3	1.48
Cluster beans	4	3	6	5	4.5	4	1.33
Bottle gourd	5	7	5	4	5.25	5	1.31
Mustard leaves	6	1	8	7	5.5	6	1.06
Ridged gourd	7	5	7	6	6.25	7	0.94
Mint leaves	8	10	4	8	7.5	8	0.68
Amaranth	9	4	10	10	8.25	9	0.61
White pumpkin	10	9	9	9	9.25	10	0.56

^zPurchasers are respondents that indicated they have purchased ethnic fruits and vegetables within the past 12 months. Includes all purchasers’ responses (whether the respondent purchased a particular item or not; i.e. includes purchases reported as “0”).

^yIncludes only the purchasers who purchased the corresponding item (such that the number of purchasers varies by item; i.e. excludes purchases reported as “0” for a given item).

Table 5. Mexican ethnic produce survey ranking.

Produce	Rank based on criteria (weekly purchases)						
	Average expenditure: includes all purchasers ^z	Average expenditure: excludes “0” expenditures ^y	Produce purchase frequency	Produce volume bought	Average rank	Overall rank	Average expenditure (\$)
Chili jalapeno	1	3	2	1	1.75	1	2.76
Tomatillo	2	4	3	2	2.75	2	1.73
Calabaza	3	2	4	4	3.25	3	1.49
Chili poblano	5	1	6	6	4.5	4	1.28
Calabacita	4	5	5	5	4.75	5	1.28
Cilantro	6	10	1	3	5	6	1.24
Chili serrano	7	7	7	7	7	7	0.92
Anaheim pepper	8	6	8	8	7.5	8	0.83
Chili habanero	9	9	9	9	9	9	0.24
Tutuma	10	8	10	10	9.5	10	0.10

^zPurchasers are respondents that indicated they have purchased ethnic fruits and vegetables within the past 12 months. Includes all purchasers’ responses (whether the respondent purchased a particular item or not; i.e. includes purchases reported as “0”).

^yIncludes only the purchasers who purchased the corresponding item (such that the number of purchasers varies by item; i.e. excludes purchases reported as “0” for a given item).

Consolidate/Maximize Across Ethnicities. A final review of the combined selected 7 crops from each ethnicity resulted in further consolidation and re-prioritization of crops for production research. Further additions, deletions, and substitutions were made to the initially selected 7 crops for each ethnicity to eliminate duplication and maximize production research efforts across ethnic groups. This consolidation process enabled the introduction and/or substitution of different varieties of the same crop so that production research may be appropriately concentrated to allow for variety comparisons and optimize the research findings.

Table 6. Puerto Rican ethnic produce survey ranking.

Produce	Rank based on criteria (weekly purchases)						
	Average expenditure: includes all purchasers ^x	Average expenditure: excludes “0” expenditures ^y	Produce purchase frequency	Produce volume bought	Average rank	Overall rank	Average expenditure (\$)
Batata	1	4	2	1	2	1	1.74
Aji dulce	3	2	4	3	3	2	1.58
Cilantro	2	8	1	2	3.25	3	1.68
Calabaza	4	9	3	4	5	4	0.96
Fava beans	6	6	6	6	6	5	0.63
Pepinillo	5	10	5	5	6.25	6	0.70
Chile caribe	7	3	8	9	6.75	7	0.56
Beena					7.25	8	0.51
Calabacita	9	5	9	8	7.75	9	0.43
Verdolaga	10	1	10	10	7.75	10	0.10

^xPurchasers are respondents that indicated they have purchased ethnic fruits and vegetables within the past 12 months. Includes all purchasers’ responses (whether the respondent purchased a particular item or not; i.e. includes purchases reported as “0”).

^yIncludes only the purchasers who purchased the corresponding item (such that the number of purchasers varies by item; i.e. excludes purchases reported as “0” for a given item).

Table 7. The 28 final crops.

Ethnic group	Plot type	Ethnic crop name	Ethnic group	Plot type	Ethnic crop name
Chinese	Research	Baby pak choy	Mexican	Research	Anaheim pepper
		Oriental eggplant			Chili jalapeno
		Smooth luffa			Tomatillo
	Demo	Napa cabbage		Demo	Calabacita
		Oriental spinach			Chili pablano/ancho
		Pak choy			Chili serrano
Asian Indian	Research	Snow peas	Puerto Rican	Research	Tatuma
		Bottle gourd			Aji dulce
		Eggplant (raavayya)			Berenjena
	Demo	Ridged gourd		Demo	Pepinillo/bitter gourd
		Cluster beans			Batata
		Eggplant (bharta)			Calabaza/tropical pumpkin
		Fenugreek leaves			Chile caribe
	Mint leaves (spearmint)				

Table 8. The “100+” crops originally considered (final selections for trials in bold print).

Crop name	Scientific name	Family
Aji dulce	<i>Capsicum chinense</i>	Solanaceae
Alligator pear/christophone/summer squash	<i>Cucurbita sechium edule</i>	Cucurbitaceae
Amaranth: var. red, green, African,	<i>Amaranthus</i> spp.	Amaranthaceae
Angled luffa/ridged gourd/Chinese okra/ California okra	<i>Luffa acutangular</i>	Cucurbitaceae
Annatto/achiote	<i>Bixa orellana</i>	Bixaceae
Avocado	<i>Persea americana</i>	Lauraceae
Baby bananas/ninos/burro/manzano	<i>Musa sapientum</i>	Musaceae
Baby corn, corn husk	<i>Zea mays</i>	Graminae
Bamboo shoot	<i>Phyllostachys dulcis</i>	Graminae
Bananas	<i>Musa paradisiaca</i>	Musaceae
Basil	<i>Ocimum basilicum</i>	Labiatae
Batata/tropical sweet potato	<i>Ipomoea batatas</i>	Convulvulaceae
Beans: var. black beans, pinto beans, kidney beans, red beans	<i>Phaseolus vulgaris</i>	Leguminosae
Bitter melon/bitter gourd/pepinillo	<i>Mormordica balsamina,</i> <i>M. charantia</i>	Cucurbitaceae
Bottle gourd, calabash gourd	<i>Lagenaria siceraria</i>	Cucurbitaceae
Breadfruit	<i>Artocarpus altilis</i>	Moraceae
Bunching onion/Oriental green onion, Chinese leek	<i>Allium</i> spp.	Alliaceae
Cactus pads	<i>Opuntia humifusa, O. vulgaris</i>	Cactaceae
Calabacita/zucchini & calabaza/winter squash	<i>Cucurbita maxima</i> = <i>C. moschata</i>	Cucurbitaceae
Cassava/yuca/manioc	<i>Manihot esculenta</i>	Euphorbiaceae
Celery/apio	<i>Apium graveolens</i> var. <i>dulce</i>	Umbelliferae
Chickpeas	<i>Cicer arietinum</i>	Leguminosae
Chili: var. Anaheim/New Mexico, ancho/poblano, banana pepper, caribe, cubanelle, habanero, jalapeno, serrano, cherry pepper, oriental sweet, etc.	<i>Capsicum annuum</i>	Solanaceae
Chili: var. manzano, peron, rocoto	<i>Capsicum pubescens</i>	Solanaceae
Chinese cabbage: var. baby pak choy/choi (= baby bok choy/choi), napa cabbage, pak (or bok) , choy/ choi, yu choy/choy, edible rape, etc.	<i>Brassica rapa</i>	Cruciferae
Chinese kale	<i>Brassica oleracea alboglabra</i>	Cruciferae
Chinese mustard/Oriental mustard	<i>Conringia orientalis</i>	Cruciferae
Chinese peas/snow peas	<i>Pisum sativum</i>	Leguminosae
Cilantro/coriander/cilantrillo	<i>Coriandrum sativum</i>	Umbelliferae
Cluster beans	<i>Cyamopsis tetragonoloba</i>	Fabaceae
Culantro	<i>Eryngium foetidum</i>	Umbelliferae
Edamame	<i>Glycine max</i>	Leguminosae
Edible burdock	<i>Arctium lappa</i>	Asteraceae
Eggplant/berenjena/aubergine/ garden egg: var. Oriental, bharta, raavayya, bitterball, pushpa, etc.	<i>Solanum melongena</i>	Solanaceae

Table 8. The “100+” crops originally considered (final selections for trials in bold print).

Crop name	Scientific name	Family
Fava beans	<i>Vicia faba</i>	Leguminosae
Fenugreek leaves	<i>Trigonella foenum-graecum</i>	Leguminosae
Flowering Chinese cabbage	<i>Brassica parachinensis</i>	Cruciferae
Garland chrysanthemum	<i>Brassica rapa pekinensis</i>	Cruciferae
Hon-tsai-tai	<i>Brassica</i> spp.	Cruciferae
Jicama/Mexican potato	<i>Pachyrhizus tuberosus</i>	Leguminosae
Jute (vegetable)	<i>Corchorus olerarius</i>	Malvaceae
Key lime	<i>Citrus aurantifolia</i>	Rutaceae
Kohlrabi	<i>Brassica oleracea</i>	Cruciferae
Komatsuna/Japanese mustard spinach	<i>Brassica rapa perviridis</i>	Cruciferae
Lablab bean/hyacinth bean	<i>Lablab purpureus</i>	Leguminosae
Lamb’s quarters/epazote	<i>Chenopodium ambrosioides</i>	Chenopodiaceae
Malabar spinach	<i>Basella alba</i>	Basellaceae
Mango (fruit)	<i>Mangifera indica</i>	Anacardiaceae
Mango (seed)	<i>Bromus mango</i>	Graminae
Mexican garlic	<i>Leucaena esculenta</i>	Fabaceae
Mexican papaya	<i>Carica papaya</i>	Caricaceae
Mung bean	<i>Vigna radiata</i> = <i>Phaseolus aureus</i>	Leguminoceae
Mushroom (button)	<i>Agaricus bisporus</i>	Agaricaceae
Mushroom (amanita)	<i>Amanita velosa</i>	Amanitaceae
Okra	<i>Abelmoschus esculentus</i>	Malvaceae
Oriental celery	<i>Apium graveolens</i>	Umbelliferae
Oriental cucumber	<i>Cucumis sativus</i>	Cucurbitaceae
Oriental melon	<i>Cucumis</i> sp.	Cucurbitaceae
Oriental root radish	<i>Raphanus sativus</i>	Cruciferae
Oriental spinach	<i>Spinacea oleracea</i>	Chenopodiaceae
Oriental squash	<i>Cucurbita argyrosperma</i>	Cucurbitaceae
Peppermint	<i>Mentha</i> × <i>piperita officinalis</i>	Labiatae
Perilla/shiso	<i>Perilla frutescens</i>	Labiatae
Pickling melon	<i>Cucumis melo conomon</i>	Cucurbitaceae
Pineapple guava/Brazilian guava	<i>Feijoa sellowiana</i>	Myrtaceae
Plantain	<i>Musa sapientum</i>	Musaceae
Root turnip/leafy turnip	<i>Brassica rapa</i>	Cruciferae
Roselle	<i>Hibiscus sabdariffa</i>	Malvaceae
Smooth luffa/Sponge gourd/edible luffa	<i>Luffa aegyptiaca</i>	Cucurbitaceae
Snake gourd	<i>Trichosanthes cucumerina anguina</i>	Cucurbitaceae
Spearmint	<i>Mentha spicata</i>	Labiatae
Sugarcane	<i>Saccharum officinarum</i>	Graminae
Tamarind	<i>Tamarindus indica</i>	Fabaceae
Taro/malanga/yautia/elephant ear	<i>Xanthosoma saggitifolium</i>	Araceae
Tomatillo/Mexican green tomato/Mexican husk tomato	<i>Physalis philadelphica</i> = <i>P. ixocarpa</i>	Solanaceae
Tomato	<i>Lycopersicon esculentum</i>	Solanaceae

Table 8. The “100+” crops originally considered (final selections for trials in bold print).

Crop name	Scientific name	Family
Tropical guava	<i>Psidium guajava</i>	Myrtaceae
Tatuma/white Mexican squash	<i>Cucurbita</i> sp.	Cucurbitaceae
Verdolaga/purslane	<i>Portulaca oleracea</i>	Portulacaceae
Wasabi/Japanese horseradish	<i>Wasabia japonica</i>	Cruciferae
White choy sum (= Pak/bok choi)	<i>Brassica chinensis</i> or <i>B. campestris</i>	Cruciferae
White pumpkin	<i>Cucurbita</i> sp.	Cucurbitaceae
White sapote	<i>Casimiroa edulis</i>	Rutaceae
Winter melon/fuzzy melon	<i>Benincasa hispida</i>	Cucurbitaceae
Yardlong bean	<i>Vigna unguiculata sesquipedalis</i>	Leguminosae

Prioritize Production Research (28 Crops)

To select appropriate crops for production per ethnicity special consideration was given to logistical concerns and 7 (re-prioritized) crops from each ethnicity were recommended for production research (Table 7; the binomials and families for the original list of “100+” crops considered, consisting of roughly 40 genera and species, is shown in Table 8).

Develop Production Plot Plans

Identify Top Priority Crops per Ethnicity for Replicated Trials. Within the 7 crop selections per ethnic group, 3 from each ethnicity were selected for replicated plots. Logistical concerns (space and budget constraints) drove decisions to replicate crops that were of similar species and/or production systems. Therefore, species with cross-ethnic demand were given higher priority for research (replication) selection purposes, to optimize the research benefits (maximize the research return on investment). As such, cucurbits (specifically gourds), eggplants (of various ethnic cultivars), and capsicum peppers were given high priority and the resulting research crops included 4 cucurbits, 3 eggplants, and 3 peppers. In addition, baby pak choy and tomatillo were included for their high survey demand, where high priority options were exhausted. (Additional pepper cultivars were available from the Mexican crop list, but one chili and one non-chili were included for replicated plots and this was deemed sufficient. Therefore tomatillo was chosen in lieu of a third pepper cultivar). 3.

The remaining 4 (of 7) production crop selections from each ethnic group were recommended for demonstration (demo) plots. This resulted in 12 research crops and 16 demo crops for a total of 28 production plots (3 research crops × 4 ethnic groups = 12 research plots; likewise 4 demonstration crops × 4 ethnic groups = 16 demo plots).

Develop Research and Demonstration Crop Plot Plans. Additional logistical concerns (irrigation, seed availability, supplies), combined with seasonal factors, may cause slight deviations in the field plans across sites between years (a shift between crops for research and demonstration crops or further variety substitution, due to lack of seed availability and/or cross-pollination concerns). A recommended plot plan, inclusive of additional space for cooperators’ choice crops, was developed for use by individual participating site planners in order to provide a pragmatic field design that would still logically permit the statistical inclusion of data across locations for comparative analyses.

ETHNIC CROP PRODUCTION AND RESEARCH PROGRAM

After completing the first phase of the ethnic produce project related to consumer survey results, the second phase focused on crop production research and demonstration. The four primary objectives of this phase were to: (1) establish a common set of field demonstration and research plots in each collaborating state; (2) demonstrate and evaluate a variety of ethnic crops grown at each site; (3) conduct case-studies of specialty-ethnic produce growers; and (4) communicate ethnic crop production information to advisors and growers via presentations, tours, websites, fact sheets, articles, and other forms of informational literature.

Demonstration and Research Plot Procedures

For the 2006/2007 trials, 4 demonstration crops and 3 research crops selected on previously described criteria were established at 6 sites located in three states along the East Coast: 2 in Florida, 1 in Massachusetts, and 3 in New Jersey.

Crop quality and yield parameters were measured and evaluated statistically for each site, with specific regard for cost factors, seasonal/monthly yield variations, and seed availability (imports or recently developed hybrids) in order to make recommendations for geographic sequencing of production, by month/season. The goal is to sustain a 12 month production supply in the Eastern United States in a cooperative venture to ward off the threat of imports into the East Coast to exploit local comparative advantages (such as grower proximity-to-market) and to assess the ability to increase local supply during peak demand periods (such as holidays).

Test Design, Trial Implementation and Evaluation Parameters

Summer 2006 demonstration and research trials were established by collaborators in Massachusetts and New Jersey on research farms. The trials included several commercially available cultivars of the selected crops blocked by ethnic market, crop type, and/or production system. Crop quality and yield parameters were measured and evaluated statistically to determine suitability for commercial production. Winter production will begin in Florida in early-2007. Special attention will be paid to variations in yield and quality of produce as may be affected by season and geographic location. All trials will run for two seasons at each location.

The approach outlined in this paper uses a detailed market driven assessment and then custom tailors field production research and supportive applied studies to bolster and drive the market study. Such a model is often discussed but rarely practiced. We propose that the approach described here is an excellent model to bridge the gap between consumers, distributors, and growers. This method allows a more carefully and purposefully strategic approach to new crop introduction by providing the needed research support to commercial growers trialing new crop species and linking the research to specific consumer demands.

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