Consumer Preferences for Non-Conventionally Grown Produce

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This study examines the potential for marketing fresh fruits and vegetables with labels indicating enhanced food and/or environmental safety attributes as compared to conventional produce. Four labels were investigated: Organic, Certified Organic, Certified Pesticide Residue-Free, and Grown with IPM. Results confirm findings of other surveys relating to concerns about pesticide residues. Seventy-one percent (71%) of respondents stated they believed that pesticide residues in food present a serious or moderate health hazard to consumers. In addition, 74% believed that pesticides pose a serious or moderate hazard to the environment, and 64% felt there was a serious or moderate hazard to farm workers. Results indicate there is a positive information effect for likelihood of purchasing for all of the labels, and this effect is statistically significant for all of the labels except for Certified Pesticide Residue-Free. The magnitude of the information effect for the Grown with IPM label was considerably higher than for the other labels, suggesting that there might be substantial payoffs for informing consumers about this label.

Surveys indicate that food safety issues, particularly pesticide residues in or on food, are an important concern for consumers. While the numbers vary among surveys, in most cases, pesticide residues emerge near the top of the list of food safety concerns (van Ravenswaay 1988). Additionally, comparing surveys over a 20-year period reveals that the level of concern has risen dramatically and confidence in the adequacy of government pesticide regulation has plummeted (Sachs et al. 1984).

The hypothesis of this study is that produce grown without or with reduced synthetic chemical inputs may be preferred by consumers over conventionally grown produce. Alternatively, consumers may prefer residue testing as an assurance that the produce they are consuming is safe. Several labels have been used or have been proposed for use on produce which indicate some form of enhanced food and/or environmental safety benefits over those of conventional produce. Four such labels were investigated in this study: Organic, Certified Organic, Certified Pesticide Residue-Free, and Grown with IPM. The authors assume the labels are visible to produce shoppers.

Since the labels imply different levels of safety benefits, one important question is whether consumers are knowledgeable enough about the meanings of the labels to make purchasing decisions that reflect their preferences with regard to food and environmental safety. Additionally, if consumers are informed about the labels, which label is most preferred, and would they be willing to pay more for labeled produce than for conventional produce?

Objectives

The primary goal of this study was to determine how consumers' preferences for purchasing and willingness to pay for produce with certain labels are influenced by receiving the label information. Specific objectives are:

1) Determine consumers' level of familiarity and/or experience with the labels.
2) Determine consumers' preferences for purchasing and willingness to pay for produce with the labels under conditions of; (a) their existing state of knowledge and, (b) information about the labels provided.
3) Identify, for each label, a segment of the population, based on demographic characteristics, that would be most positively influenced by information to purchase and willingness to pay for produce with the label.

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Data

A survey instrument was mailed to 1500 randomly selected households in the Northeast (ME, NH, VT, MA, CT, RI, NY, NJ, and PA).[1] The mailing list was obtained from Survey Sampling, Inc. (Fairfield, CT). The firm uses telephone directory listings that are updated quarterly. The sample was drawn proportionately according to the populations of the states in the study.

In order to test the information effect, information about the labels was provided to half of the sample (the "informed" group) so that their answers could be compared to the other half that did not receive information (the "uninformed" group). The sub-samples were chosen by sorting the mailing list by zip code so that they were geographically as similar as possible.

Five hundred and thirty-four (534) usable survey instruments were returned. The response rate was 42% after correcting for 225[2] non-deliverable instruments. The responses were almost equally divided between the informed and uninformed groups, with 263 informed and 271 uninformed responses.

The demographic characteristics of survey respondents were compared with 1990 Census data in order to determine if they were representative of the sampled population. The age profile of respondents was very similar to the Census data, but respondents were more highly educated, had a slightly higher median income ($40,000 per year versus $36,000), and minority groups were underrepresented (Table 1). Frequencies were calculated on answers to all of the questions separately for the informed and uninformed groups. These were subjected to chi-square analysis in order to detect responses that differed between the groups. The purpose of this was to determine if the two groups were similar with respect to beliefs about hazards of pesticides, familiarity and previous experience with the labels, demographics, and background variables such as gardening activity and whether they shop in health food stores. No important source of bias was found between the informed and uninformed groups. There were only three questions found to be statistically different, and none of these were considered to be important enough to have an impact on conclusions of the study. Two of these were household situation (married, single, etc.) and presence of household members aged 13-19, at the .10 and .05 levels, respectively. Previous pur chase experience of Certified Organic produce was also statistically different (.05), with more informed respondents stating they purchase it occasionally, and more uninformed respondents purchasing it regularly. When these two categories are combined, however, there is no statistical difference between the groups. No attempts were made to correct for possible bias or for non-respondents.

Analytical Procedures: The Ordered Logit Model

The likelihood of purchase and willingness to pay questions were asked such that the respondents answered on a scale of 1 to 5 with answers ranging from very likely to very unlikely and would pay more than 20% more to would not purchase, respectively.

The two most common estimation procedures used when the dependent variables are discrete are Probit and Logit. Both are estimated by Maximum Likelihood Estimation (MLE). The Logit procedure, however, is preferable since the dependent variable has more than two categories (Aldrich and Nelson, 1984) and the normality assumption for Probit is not very strong for econometric applications (Theil, 1971). Additionally, Logit can be used when it is desirable for the estimation procedure to take into account an inherent ordering of the categories of the depend-

[1] Considerable effort went into the design of the questionnaire to make it clear and easy to complete, minimize bias associated with wording of questions, and enhance the return rate. It was critiqued by a number of professionals familiar with survey work, including the director of the Survey Research Facility at the Cornell Institute for Social and Economic Research (CISER). An informal pretest was done, and the mailings were carried out following the technique of Dillman 1978, except that, due to insufficient funds, bulk mail rather than first class had to be used.

[2] Since bulk mail was used, the undeliverable questionnaires were not returned, so it was impossible to know exactly how many were not delivered. Survey Sampling, Inc. reports a fairly consistent deliverable rate of 85% for their mailing lists, so this was used to calculate the undeliverables. In fact, the 85% is based on first class mail, so the actual deliverable rate may have been even lower.

Table 1. Demographic Characteristics of Survey Respondents Compared with 1990 Census Data for the Northeastern United States.

	Survey Respondents percent[b]	1990 Census[a] percent[b]
Age[c]		
25-44	46	49
45-64	30	30
65 +	22	20
Education		
Bachelor's degree or higher	49	25
High school or technical school degree or some college	46	55
Less than high school degree	6	20
Ethnic Identity[c]		
Caucasian	94	72
African American	1.4	17
Hispanic	0.4	11
Asian	2.2	3.8
Native American	0.4	0.3
Other	1.4	5.5
Median Household Income	$40,000	$36,000

a - Census data is expressed as % of the population over 25 in order to be comparable to survey data.
b - Percentages may not sum to 100 due to rounding error.
c - Census data for age and ethnic identity were from New York State, which makes up more than one-third of the population of the Northeast.

ent variable. This is termed the ordered Logit procedure and was used to address objectives 2 and 3.

The equations for likelihood of purchase are:

(1) $BuyO = \alpha_0 + \alpha_1 Age + \alpha_2 Livenow + \alpha_3 Sex + \alpha_4 Info$

(2) $BuyCO = \beta_0 + \beta_1 Age + \beta_2 Livenow + \beta 3 Sex + \beta_4 Info$

(3) $BuyPF = \delta_0 + \delta_1 Age + \delta_2 Livenow + \delta_3 Sex + \delta_4 Info$

(4) $BuyIPM = \phi_0 + \phi Age + \phi_2 Livenow + \phi_3 Sex + \phi_4 Info$

The equations for willingness to pay are:

(5) $PayO = \gamma_0 + \gamma_1 Age + \gamma_2 Livenow + \gamma_3 Income + \gamma_4 Info$

(6) $PayCO = \lambda_0 + \lambda Age + \lambda_2 Livenow + \lambda_3 Income + \lambda_4 Info$

(7) $PayPF = \mu_0 + \mu_1 Age + \mu_2 Livenow + \mu_3 Income + \mu_4 Info$

(8) $PayIPM = \eta_0 + \eta_1 Age + \eta_2 Livenow + \eta_3 Income + \eta_4 Info,$

where:

Age = continuous variable constructed by taking the midpoints of the age categories,
Livenow = 1 if live in suburban/rural setting (suburban, village or hamlet, or rural); 0 otherwise (metropolitan or small city),
Sex = 1 if female; 0 male,
Income = continuous variable constructed by taking the midpoints of the income categories,
Info = 1 if received information; 0 otherwise.

The suffixes denote the following:

O = Organic label
CO = Certified Organic label
PF = Certified Pesticide Residue-Free label
IPM = Grown with IPM label.

The variables included in the equations were those shown to be significant by preliminary regression runs. The education variable was not found to have an effect on the outcomes of either likelihood of purchasing or paying more and was therefore not included in the equations. Similarly, sex was not found to have an effect on willingness to pay and income did not affect purchase likelihood.

This study does not focus on the predictive ability of the equations, but on testing of the information effect as well as investigating the importance of demographics in purchase likelihood and willingness to pay. Byrne et al 1991 argue that inclusion of independent variables such as beliefs and behaviors may enhance the predictive ability of the equation at the expense of valid parameter estimates for the variables of interest. For this reason, only the variables of interest are included in the equations, i.e., the information and demographic variables. The analysis used the ordered logit procedure as discussed in Maddala (pp. 46-49).

Methodological Considerations

This paper contributes to the development of a methodology for evaluating consumer 'stated' preferences, i.e., willingness to purchase and/or pay. First, it is built upon the theory of two-stage utility maximization. In the first stage, consumers maximize utility with respect to all goods, while in the second stage, produce with a label is considered to be a product which is differentiated from unlabeled produce by virtue of the attributes implied by the label, and therefore is a substitute for unlabeled, or conventional, produce, i.e., lettuce with the Organic label is a different product than conventionally grown lettuce. Therefore, demand schedules can be obtained from the utility maximization process. The unavailability of price and quantity data for produce with the labels limit the ability of our model to produce demand schedules at the present time. However, as this data becomes available, the explanatory power of the model should increase (see Underhill).

The second aspect of our model which contributes to the body of literature on methodology is the use of a Logit estimator and the interpretation of "predicted probabilities" and "marginal effects" that result from the estimation[3]. Though predicted probabilities do not necessarily translate to purchase behavior, they do serve to compare probable behavior across labels. Moreover, the marginal effects of the demographic variables across labels adds to the understanding of references between labels. We feel the model accurately measures the impact of information on consumer preferences and this measurement is most likely the better application of the model.

Synthesis of Survey

Beliefs About the Hazards of Pesticides

Three questions were asked in which respondents were asked to circle the statement they most agreed with regarding hazards posed by pesticides to consumers, the environment, and farm workers. Five statements were given for each question, ranging from very hazardous to not likely to pose a hazard.

For the question about hazards to consumers, slightly over two of three respondents felt that pesticide residues in food pose a serious to moderate health hazard. This is consistent with previous surveys. One in ten felt that even though there may be residues in food, they did not present a hazard, and very few felt that it was not likely that any residues remained in food.

Nearly three in four felt that pesticides pose a serious to moderate hazard to the environment, few(6%) felt that contamination of the environment from pesticides was not a problem, and fewer yet felt that pesticides were not likely to cause contamination of the environment.

Two in three felt that pesticides (even if used according to directions) present a serious to moderate hazard for farm workers, while some (16%) felt that pesticides only presented a hazard if not used according to directions, and almost no respondents felt that there was no hazard to farm workers.

Chi-square analysis on responses to the belief questions revealed no significant difference in responses given by the informed versus the uninformed groups.

[3] Overall probabilities and marginal effects are calculated at the means of the independent variables.

Familiarity and Experience with the Labels

Three questions were asked to assess respondents' familiarity with produce with the labels. The first asked if they had ever seen the labels on produce in a store where they shop, the second asked if they were familiar with what is meant by the labels, and the third asked about frequency of purchasing the labeled produce. Table 2 summarizes the responses to these questions.

Overall, 62% had seen the Organic label, as opposed to only 13% who had seen the Certified Organic label. Only 4% reported seeing the CPRF label and 1.3% had seen Grown with IPM.

Of those who had seen the Organic label, 53% reported purchasing produce labeled as Organic regularly or occasionally. This translates to 33% of all respondents[4]. Since only 17% reported shopping in health food stores, and since the availability of Organic produce at conventional grocery stores is limited, it may be that farmers' markets and other direct marketing efforts account for a significant portion of the Organic produce sold in the Northeast. Of those who had seen the Certified Organic label, 15% reported purchasing it regularly or occasionally, which translates to about 2% of respondents. Eight percent of those who had seen the CPRF label purchase it regularly or occasionally (0.3% of respondents), and 2% of those who had seen Grown with IPM purchase it (.03% of respondents)[5].

Overall, 78% of the respondents stated that they were familiar with what is meant by Organic, 44% were familiar with Certified Organic, 43% with Certified Pesticide Residue-Free, and only 13% with Grown with IPM. The implications for the information effect are that: 1) for Organic, since a majority of people are familiar with the concept, providing information may not have as much of an effect on likelihood of purchasing as it would for the other labels, 2) since less than half reported knowledge of Certified Organic and Certified Pesticide Residue-Free, a larger information effect would be expected, and 3) since so few respondents reported knowledge of Grown with IPM, there is a potential for a significant information effect.

Since the focus of the study was to ascertain the effect of informing consumers in general, rather than individuals, the level of knowledge of individual respondents was not used in the analysis of likelihood of purchase or willingness to pay. Since the assumption underlying this study is that the knowledge level of respondents is similar to that of the population being sampled, i.e., residents of the Northeast, results of the study can be extended to give an indication of how consumers would respond to information about the labels. Likewise, beliefs about hazards of pesticides were not entered into the analysis[6].

Insight was gained about how respondents with and without previous experience with the Organic label perceive the quality and appearance of produce with the label as compared to conventional produce. Two questions were asked in which quality and appearance were rated as compared to conventional produce on a scale of 1 to 5, from much better to much worse. Chi-square tests were performed on the answers given by respondents who had seen or purchased the label versus those who had not. Interestingly, there was no significant difference at the .10 level. This result is significant since respondent misperception[7] is considered to be an important source of bias in contingent valuation studies (Mitchell and Carson 1988). Assuming that perceived quality and appearance are important factors in the purchase decision, this result may indicate that respondents without previous experience with the labels are as able to answer accurately whether they would purchase and pay more for produce with the label as are those with experience.

[4] Calculated by: 53% of those who had seen the label purchase it regularly or accasionally multiplied by 62% who had seen the label = 33% of all respondents.

[5] The low percentage for purchasing the CPRF label may indicate that this produce is not available regularly enough for respondents to purchase it with any regularity or that it is not labeled at the retail level. This is certainly the case for Grown with IPM.

[6] The authors recognize the bias in our sample and therefore accept the limitations of extending our findings to the general public.

[7] Respondent misperception occurs when respondents do not correctly perceive some attribute(s) of the good being valued and is more likely to occur when they are notfamiliar with the good.

Table 2. Respondents' Familiarity and Experience with the Labels.

Label	Familiar with Concept	Ever Seen Label	Purchase Regularly or Occasionally
	----------percent----------		
Organic	78	62	33
Certified Organic	44	13	2
CPRF	43	4	0.3
Grown with IPM	13	1.3	0.03

Table 3. Predicted Probabilities for Purchasing the: Organic (O), Certified Organic (CO), Certified Pesticide Residue-Free (CPRF), and Grown with IPM (IPM) Labels

			P_0 Very Likely	P_1 Somewhat Likely	P_2 Not Sure	P_3[1] Unlikely
Overall Probabilities						
Informed		O	.4745	.3270	.1448	.0537
		CO	.4384	.3259	.1741	.0616
		CPRF	.4119	.3154	.1949	.0779
		IPM	.3071	.2936	.2869	.1124
Uninformed		O	.3967	.3496	.1815	.0722
		CO	.3634	.3400	.2143	.0824
		CPRF	.3851	.3195	.2092	.0863
		IPM	.1639	.2356	.3779	.2227
Marginal Effects						
Information	(R^2= .032)[c]	O	.0778	-.0226	-.0367	-.0185
	(R= .030)[c]	CO	.0750	-.0141	-.0402	-.0208
	(R= .000)	CPRF	.0268	.0041	-.0143	-.0084
	(R= .127)[a]	IPM	.1432	.0580	-.0910	-.1103
Age	(R= -.101)[a]	O	-.0049	-.0045	.0082	.0012
	(R= -.096)[a]	CO	-.0048	-.0045	.0080	.0013
	(R= -.089)[a]	CPRF	-.0046	-.0041	.0073	.0014
	(R= -.035)[c]	IPM	-.0019	-.0022	.0026	.0015
Sex	(R= .045)[b]	O	.0892	-.0247	-.0426	-.0219
	(R= .062)[b]	CO	.1068	-.0182	-.0579	-.0306
	(R= .000)	CPRF	.0189	-.0028	-.0101	-.0059
	(R= .014)	IPM	.0463	-.0203	-.0301	-.0365
Livenow	(R= -.089)[a]	O	-.1583	.0533	.0707	.0344
	(R= -.099)[a]	CO	-.1721	.0425	.0869	.0427
	(R= -.027)[c]	CPRF	-.0791	.0143	.0413	.0235
	(R= .000)	IPM	-.0315	-.0127	.0208	.0234

O - Model Likelihood Ratio=1041, R-like=.145, χ^2 =30.58, 4 d.f., p=.0000
CO - Model Likelihood Ratio=1023, R-like=.154, χ^2 =33.10, 4 d.f., p=.0000
CPRF -Model Likelihood Ratio=1044, R-like=.074, χ^2 =13.77, 4 d.f., p=.0018
IPM -Model Likelihood Ratio=1108, R-like=.128, χ^2 =27.70, 4 d.f., p=.0000
1 - The categories Somewhat Unlikely and Very Unlikely were combined.
2 - R refers to the partial-R statistic, which measures the contribution of the variable to the explanatory power of the model.
a - significant at the .01 level
b - significant at the .05 level
c - significant at the .10 level

Logit Model Results

Likelihood of Purchasing Produce with the Labels

Results of the ordered Logit regressions for likelihood of purchase can be found in Table 3. The information effect was found to be positive for all of the labels and was significant for all but the Certified Pesticide Residue-Free label, i.e., there is a greater likelihood of purchasing when information is provided. The magnitude of the shift in probability from less to more likely that is attributable to the information effect was, however, much greater for Grown with IPM (.2012) than for Organic (.0778) or Certified Organic (.0750). This is due, no doubt, to the fact that consumer knowledge about the Grown with IPM label was much lower than for the other labels before information was provided.

The calculated probabilities of being somewhat or very likely to purchase the labels imply a preference ranking for the labels and this is shown in Table 4[8]. The ranking for informed consumers is Organic, Certified Organic, Certified Pesticide Residue-Free, and Grown with IPM and for uninformed consumers it is similar, except that Certified Organic and Certified Pesticide Residue-Free are ranked about the same. Even though the information effect for Grown with IPM is much greater than for the other labels, it is still ranked lower for likelihood of purchasing.

The ranking of the labels can give an indication of the relative importance of food versus environmental safety to respondents. Since most individuals assume that organic produce is guaranteed to be free of residues by virtue of the fact that no pesticides were used (Ott et al 1991)[9], the food safety implications of the Organic and Certified Pesticide Residue-Free labels are probably very similar. However, respondents clearly prefer the Organic label, which may imply that the environmental safety aspects of organic production methods, as well as the food safety attributes, are important.

[8] This method of obtaining a ranking was chosen over asking a ranking question because respondents often misunderstand ranking questions and do not answer appropriately (J. Maestro-Scherer, CISER, personal communication).

[9] In fact, residues can be found in organic produce if the land it was grown on was previously used for conventional production.

Table 4. Ranking of Labels for Likelihood of Buying From Predicted Probabilities -- Somewhat or Very Likely.

	Probability (%)	Ranking
Informed		
Organic	80.2	1
Certified Organic	76.4	2
Certified Pesticide Residue-Free	72.7	3
Grown with IPM	60.1	4
Uninformed		
Organic	75.0	1
Certified Organic	70.3*	2.5
Certified Pesticide Residue-free	70.5*	2.5
Grown with IPM	40.0	4

* Judged to have the same ranking.

An important result of the label ranking is that Certified Organic is ranked lower than Organic. This indicates that consumers do not attach much value to certification of organic produce and implies that there is no advantage in the marketplace to producers for certification. Two points should be mentioned: 1) certification of organic produce will be mandated by federal law for farms with sales of over $5,000 per year, so this result will be irrelevant except for small or part-time farms and 2) a study of New Jersey retailers (Morgan and Barbour 1990) found that they do value certification as a means of ensuring that produce sold to their customers as organic is that.

Demographics. For both the informed and uninformed groups, respondents' place of residence (Livenow) was an important factor in the likelihood that they would purchase produce with the labels[10], and was negative, indicating that those in rural or suburban settings are less likely to purchase than those in metropolitan areas. One possible reason for this outcome is that rural and/or suburban dwellers may use relatively more pesticides than urban dwellers. Age was also significant and negative, indicating that the likelihood of purchasing any of the labels decreases with age. Females have a somewhat higher prob-

[10] The low partial-R statistic for Livenow in the Grown with IPM regression results from a cancelling out of the effects of the informed versus uninformed groups, as determined by subsequent regressions with interaction variables which are discussed below.

ability of purchasing the Organic and Certified Organic labels.

Interactions Between Demographics and the Information Variable. In order to detect slope shifts, i.e., differing effects of information over the values of the demographic variables, interaction variables were introduced into the Logit regressions. The interaction effects can be found in Table 5. The value of interaction effects in this application is that segments of the population can be identified which would be more receptive to information about the labels, and therefore, informing the public can be carried out more efficiently by targeting those segments.

Table 5. Interaction Effects of the Demographic Variables with the Information Variable.

	Buy CO[c]	Buy IPM[b]	Pay PF[c]	Pay IPM[b]
Age*Info		–		
Sex*Info	+			
Livenow*Info		+		
Income*Info			–	–

b - significant at the .05 level
c - significant at the .10 level

The most important interaction found in the study is between Livenow and Information for the Grown with IPM label. Livenow*Info is positive, indicating that information has a greater positive effect on rural/suburban consumers than on urban consumers. Since Livenow is negative, this implies a sign change of the slope with information. The implications are that not only are informed rural/suburban consumers more likely to purchase the label than when uninformed, but that they are more likely to purchase it than urban consumers who are also informed. This is sufficient evidence that informing rural/suburban consumers about the Grown with IPM label would significantly increase their likelihood of buying it.

Age*Info is negative for the Grown with IPM label, indicating that information has less of an effect on older consumers, who are already less likely to buy the Grown with IPM label, and conversely, has a greater effect on younger consumers, who already are more likely to buy. Since Age already has a negative slope, this indicates even more of a differential between likelihood of purchasing by younger vs. older consumers when they are informed.

For the Certified Organic label, Sex has a positive interaction with information, indicating that information has a greater positive effect on females than on males. Females already have a greater likelihood of buying this label, so information results in an even greater differential between males and females.

Willingness to Pay More for Produce with the Labels than for Conventional Produce

The information effect was found to be significant for only the Organic and Grown with IPM labels with respect to paying more than for conventional produce. See Table 6. Again the magnitude of the shift in probability from less to more willingness to pay that is attributable to the information effect was greater for Grown with IPM (.1100) than for Organic (.0777). The ranking of the probabilities of paying more for both informed and uninformed consumers show that all of the labels are preferred over Grown with IPM, but among the others there are no apparent preferences. See Table 7.

Table 6. Predicted Probabilities for Paying More for the: Organic (O), Certified Organic (CO), Certified Pesticide Residue-Free (CPRF), and Grown with IPM (IPM) Labels

			P_0 20% or Greater	P_1 10% More	P_2[1] Would not Pay More
Overall Probabilities					
Informed		O	.1372	.4475	.4153
		CO	.1548	.4256	.4195
		CPRF	.1487	.4233	.4279
		IPM	.1032	.3837	.5131
Uninformed		O	.1041	.4030	.4930
		CO	.1183	.3851	.4966
		CPRF	.1199	.3904	.4897
		IPM	.0683	.3086	.6231
Marginal Effects					
Information	(R= .029)[c]	O	.0331	.0445	-.0777
	(R= .025)	CO	.0365	.0405	-.0771
	(R= .000)	CPRF	.0288	.0329	.0618
	(R= .060)[b]	IPM	.0349	.0751	-.1100
Age	(R= -.077)[a]	O	-.0017	-.0023	.0040
	(R= -.104)[a]	CO	-.0025	-.0027	.0052
	(R= -.069)[b]	CPRF	-.0017	-.0020	.0037
	(R= -.036)[c]	IPM	-.0009	-.0020	.0029
Livenow	(R= -0112)[a]	O	-.0848	-.0908	.1418
	(R= -.118)[a]	CO	.0993	-.0857	.1851
	(R= -.080)[a]	CPRF	-.0701	-.0671	.1372
	(R= -.095)[a]	IPM	-.0555	-.1407	.1603
Income[2]	(R= .072)[b]	O	.0112	.0153	-.0265
	(R= .031)[c]	CO	.0085	.0096	-.0181
	(R= .068)[b]	CPRF	.0120	.0138	-.0258
	(R= .040)[c]	IPM	.0066	.0145	-.0211

O - Model Likelihood Ratio=788, R-like=.160, χ^2 =29.00, 4 d.f., p=.0000
CO - Model Likelihood Ratio=747, R-like=.160, χ^2 =27.94, 4 d.f., p=.0000
CPRF - Model Likelihood Ratio=736, R-like=.129, χ^2 =20.61, 4 d.f., p=.0000
IPM - Model Likelihood Ratio=592, R-like=.126, χ^2 =17.62, 4 d.f., p=.0000
1 - "20% More" and "More Than 20% More" were combined.
2 - In tens of thousands of dollars.
a - significant at the .01 level
b - significant at the .05 level
c - significant at the .10 level

Table 7. Ranking of Labels for Likelihood of Paying More From Predicted Probabilities.

	Probabilities (%)	Ranking
Informed		
Organic	58.5	*
Certified Organic	58.1	*
Certified Pesticide Residue-Free	57.2	*
Grown with IPM	48.7	4
Uninformed		
Organic	50.7	*
Certified Organic	50.3	*
Certified Pesticide Residue-Free	51.0	*
Grown with IPM	37.7	4

* The only clear difference is between Grown with IPM and the other three labels.

The Willingness to Pay Question. Respondents were asked to state their willingness to pay (over the price of conventional produce) for each of the labels on a scale of 1 to 5. The categories were; more than 20% more, 20% more, 10% more, 0, and would not purchase. The last answer, "would not purchase," was actually not considered to be part of the scale and was not used in the Logit models[11]. It was included in order to present respondents with the broadest range of answers possible.

Since most respondents answered either 0 or 10% more, it is probable that the real value lies somewhere between 0 and 10%, but is not known because the categories were not small enough to capture it. Perhaps presenting respondents with a larger number of categories would have resulted in a more precise measure of willingness to pay. There is also the issue of whether the choice of more than 20% as the highest category introduced some bias in respondents' valuations. For Organic, at least, premiums of as much as 100% can be found in the marketplace. For respondents who are not familiar with Organic produce, the use of more than 20% as the highest category might have suggested to them that 20% is a very high premium.

[11] The numbers of respondents answering "would not purchase" were, for Organic: 9 out of a total of 483; Certified Organic: 11/450; Certified Pesticide Residue-Free: 21/454; and Grown with IPM: 49/434.

Demographics. Livenow is significant and negative for all of the labels, indicating that, not only are respondents from metropolitan areas more likely to purchase the labels, they are also willing to pay more than are rural or suburban respondents. Advancing age and lower income result in lower willingness to pay more for all of the labels.

Interactions Between Demographics and the Information Variable. Income has a negative interaction with information for both the Certified Pesticide Residue-Free and Grown with IPM labels, indicating that information has less of an effect on consumers with higher incomes for paying more for these labels. However, consumers with higher incomes already have a greater willingness to pay more for the labels whether informed or not. Information geared toward lower income consumers may convince them to be as likely as higher income consumers to pay more for the Certified Pesticide Residue-Free and Grown with IPM labels. However, demand for all produce may be elastic for low income consumers, so it is questionable if receiving information would translate to actual behavior changes with regard to willingness to pay in the marketplace.

Conclusion

The results obtained in the willingness to pay portion of the study show that respondents' answers differed 1) depending on whether or not they were informed and 2) between labels, which indicates that the scale they were presented with was detailed enough to capture those effects. Still, there are the questions of whether presenting them with more categories would have produced better results, and whether, even though the range was open ended (more than 20%), the value of the highest category may have produced some bias as discussed earlier.

Strengths of this study are that the large sample size provides for attaching statistical significance to the results, data were collected over a broad geographical area, there was found to be a statistical difference between the two treatments, i.e., informed and uninformed, and no evidence of bias was found between the groups receiving the treatments. Additionally, the use of the Logit models allowed for investigation of demographic

effects on purchase likelihood and willingness to pay and the interactions between demographics and information.

In order to validate the results of this study, in-store experiments would have to be done in which consumers would be observed choosing between conventional and labeled produce under different pricing scenarios and under conditions of receiving or not receiving information. This study did not address the question of how to inform consumers. For example, would shoppers take time to read the statements at point of purchase or would some other vehicle be necessary, and how could it be verified that they had actually received the information?

Additionally, the question of appearance of the produce would have to be given close attention. In observational studies comparing organic versus conventional produce, appearance has not been controlled for, making it difficult to extend the results of those particular experiments to a general case. For example, in one study of lettuce, the conventional outsold the organic lettuce by a wide margin, but the head size of the organic lettuce was smaller (Cook 1991, personal communication), so there is no way to separate the effect of the Organic label from the effect of head size.

Results of this study can serve as guidelines to those in the produce industry as to whether it is worthwhile to tap into the non-conventional produce market. Since this was not a demand study, no estimates of potential revenues or returns on expenditures for offering produce with the labels, or for information/promotional efforts can be given.

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