Identification of Market Potential for Pasture-Raised Pork in the Mississippi Delta of Arkansas—1998

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Traditional row crops—such as cotton, rice, and soybeans produced on large-scale farms—dominate agriculture in the Mississippi Delta of Arkansas. Many limited-resource farmers engaged in the production of these row crops are finding it very difficult to operate efficiently and to compete in the marketplace because they lack the necessary resources to achieve economies of scale in production. It is, therefore, essential that they consider diversifying into some form of sustainable alternative agriculture to significantly improve their performance and income potential (Brown, Dagher, and McDowell, 1992). Unfortunately, limited-resource farmers in the Delta area of Arkansas lack knowledge of feasible alternative enterprises, markets, production practices, and financial resources necessary to bring about a desired change (Rogers and Dagher, 1989). As global competition for row crops increases and consumer food preferences change, limited-resource farmers will need knowledge on how to compete in the production and marketing of market-driven, ecologically friendly products that require less resources and can improve their incomes.

One of their products is pasture-raised pork, a value-added product that has sparked a market niche in Minnesota (Cramer, 1990). Some of these pork products have been marketed under the USDA-approved "Pastureland Farms" label (that is, the meat comes from pigs that are free to roam about on pasture, without sub-therapeutic levels of antibiotics and sulfa drugs). These pasture-raised pork operations have transformed the rural communities where they are located and can serve as models for other communities. The impact of pasture-raised pork on rural development is, therefore, a critical issue to sustainable agriculture and could expand economic opportunities for limited-resource farmers in rural communities of eastern Arkansas.

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Program was used to select limited-resource farmers and to train them to diversify into an alternative pork production system suitable for their farms and the region. These systems were designed to provide alternative, pasture-based approaches for producing swine on marginal cropland that would provide these farms with supplemental income. Presently, these swine producers are using conventional markets, however, alternative markets need to be identified and developed to assist these farmers as the number of conventional markets decline.

As with many new food items, the market for pasture-raised pork is confined to niches and is not widely known in the Delta area. This is, perhaps, a result of supply. However, these limited-resource farmers will continue to adopt or allocate their production resources to the pasture-raised production system only if there is market potential for their pork products. They want to know, among other things, how Delta consumers will perceive their pasture-raised pork. Might a "pasture-raised" label discourage Delta consumers from buying the pork? Will Delta consumers buy their pasture-raised pork? What are the characteristics of Delta consumers who will buy pasture-raised pork? Will Delta consumers pay a premium for pasture-raised pork? This study assesses the market potential for pasture-raised pork in the Mississippi Delta of Arkansas by examining the relationships between Delta consumers' willingness to buy and pay premium prices for pasture-raised pork and consumer perceptions and acceptance of pasture-raised pork in the Delta area.

While this study examined the market potential for pasture-raised pork, the authors believe the preferences and willingness of Delta consumers to purchase and consume pasture-raised pork are likely to be influenced by their perceptions and attitudes toward it as a healthy food source. There have been many previous studies on the characteristics influencing consumer's choice and preferences of various fresh and processed meats (Schupp, Gillespie, and Reed, 1998a; Erikson et al., 1998), but none of them examined the factors that influence con-

sumer preferences for pasture-raised pork. The authors are unaware of any previous research on socioeconomic and behavioral factors influencing Delta consumers' choices or preferences of pasture-raised pork over conventional-grown pork. In addition, the term "pasture-raised pork" has not been clearly defined in the literature or in marketing cycles and could refer to a large variety of pork characteristics. Pasture-raised pork products are relatively new in the Delta area. This may complicate the development or identification of markets for pasture-raised pork. Other studies have also examined consumers' usage of labels on processed fresh meat (Piedra, Schupp, and Montgomery, 1996; Schupp, Gillespie, and Reed 1998b), but none of these studies specifically evaluated consumers' usage of labels on pasture-raised pork.

In order to determine whether Delta consumers considered conventional and pasture-raised pork as environmentally sound healthy food products, the project investigators proposed the following relationships:

- Choice of pork purchase may differ by socioeconomic characteristics of respondents in the Delta area. This hypothesis is based on the previous research that shows the relationship of socioeconomic characteristics to consumer purchase decisions (Lin, 1995; Nayga, 1997).

- Preferences for pasture-raised pork may differ by behavioral characteristics of Delta consumers. Based on this, the investigators proposed that health-conscious urban consumers in the Delta may prefer pasture-raised pork to conventionally (confined) produced pork. This is based on the fact that pasture-raised pork is naturally produced without antibiotics.

- If Delta consumers view pasture-raised pork products as lean and of high quality, they may pay a premium for them over conventionally raised pork products.

The project investigators believe that testing these hypotheses may provide a means or assist in determining the extent of market potential for pasture-raised pork in the Delta area of Arkansas. The extent of this market may also provide guid-

ance for limited-resource farmers who are considering raising hogs on pasture.

Methods

The hypotheses were derived through a market survey conducted during 1998. The project investigators believed that an accurate description of market opportunities and consumer preferences for pasture-raised pork must precede thoughtful research analysis; therefore, the focus of the market survey was both descriptive and analytical. The study randomly selected a sample of 1,200 households from 12 agricultural districts in the Mississippi Delta area of Arkansas for mail and personal interviews. Two cities—Little Rock and Memphis—were also included in the sample because they possess households with diverse socioeconomic backgrounds, have large markets for lean meat, and are, therefore, potential markets for pasture-raised pork. The 12 agricultural districts selected were Clay, Crittenden, Cross, Craighead, Greene, Mississippi, Monroe, Lee, Poinsett, Phillips, Randolph, and St. Francis counties. The study employed a stratified random sampling procedure whereby the number of surveys conducted was higher in districts with higher populations.

Following Dillman's (1991) survey design, a mail questionnaire was designed and distributed to the sampled population. Nonrespondent households were followed up with telephone interviews. Respondents were provided with a lottery ticket for a chance to win one of three-$100 gift certificates as an incentive to participate. Approximately 45 percent of both the surveys and the personal interviews were returned, and 40 percent were usable. The authors believe that awarding the gift certificate may have influenced the high response rate although the impact was not verified during the research.

In assessing the extent of market opportunity and preference for pasture-raised pork, respondents provided a "Yes" or "No" answer to questions about whether they would buy and eat pasture-raised pork and whether they would pay a few cents per pound more for pasture-raised pork over conventional pork. In analyzing these choices, we used a maximum likelihood logit estimation, which is based on the cumulative logistic probability function.

$$(1) \quad P_i = F(Z_i) = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\alpha + \beta X_i)}} \text{'},$$

where P_i is the probability that the ith household will make a certain choice, given the observed level of X_i. The maximum likelihood model assures consistency and asymptotic normality of parameter estimates for large samples (Capps and Kramer, 1985). While the parameter estimates from the maximum likelihood analysis only indicate a direction of influence on probability, the actual changes in the probability are provided by the magnitude of the marginal probability effects (Maddala, 1988). An appropriate regression estimate of equation 1, given (0,1) dependent variables is the logarithm estimate of the odds that a choice P_i will be made given X_i (Pindyck and Rubinfeld, 1991). This can be shown as:

$$(2) \quad \log\frac{P_i}{1 - P_i} = Z_i = \alpha + \beta X_i .$$

The cumulative logistic probability model that can estimate the log of the odds that a particular decision will be made yields large sample properties of consistency and asymptotic normality of the parameter estimates, allowing conventional tests of significance to be applied. In this scenario, the likelihood of a household buying pasture-raised pork and or paying a premium price for pasture-raised pork over conventionally produced pork were chosen as functions of a set of predetermined variables.

In analyzing consumer answers "Yes" or "No" (1 or 0) to whether they will buy and pay a premium price for pasture-raised pork over conventional-grown pork, (CHS) and (PAY) dependent variables were used as functions of household behavior and socioeconomic characteristics in these model specifications:

$$(3)\ CHS = \beta_0 + \sum_{k=1}^{n} \beta_k \mathbf{BehVar} + \sum_{k=1}^{n} \beta_k \mathbf{SocVar}.$$

$$(4)\ PAY = \beta_0 + \sum_{k=1}^{n} \beta_k \mathbf{BehVar} + \sum_{k=1}^{n} \beta_k \mathbf{SocVar}.$$

BehVar represents consumer behavior variables toward pasture-raised pork and SocVar represents consumer socioeconomic variables. The explana-tory behavior and socioeconomic variables that were hypothesized to influence equations 3 and 4 are defined in Table 1. All the variables are binary with the exception of age (AGE), which is treated as continuous.

Preliminary runs were made to evaluate the impact of various independent variables in the behavior and socioeconomic groupings to establish their rate of influences on the dependent variables (CHS and PAY). The description of base independent variables and omitted variable categories in the CHS and PAY models are shown in Table 2.

Results

The extent of the predictive accuracy for both CHS and PAY models are shown in Table 3. While 74 percent of the respondents were correctly classified as either will buy and eat pasture-raised pork or will not buy and eat pasture-raised pork, approximately 69 percent of the respondents were correctly classified as will pay more or will not pay more for pasture-raised pork over conventionally grown pork.

Results of the logit analysis for the CHS and PAY models are presented in Table 4. The Chi-squared statistics in Table 4 indicate that both models are significant at the 0.10 level. The variable URBAN (which equaled 1 if the household lived in towns of 20,000 people) was estimated with a positive sign and was significant at the 0.05 level in the CHS model. This indicates that consumers who lived in urban areas of the Delta were 28 percent more likely to buy and eat pasture-raised pork. The URBAN variable is significant at the 0.10 level in the PAY model, indicating that consumers in the urban areas of the Delta who will buy and eat pasture-raised pork were also 23 percent more likely to pay more for it over conventionally grown pork. In the CHS model, only 7 percent of the households living in rural areas of the Delta were more likely to buy and eat pasture-raised pork. In the PAY model, however, the sign of RURAL changed. This suggests that, although some rural households were likely to buy and eat pasture-raised pork, they were less willing than urban households to pay more for it. The implication is that a potential market exists for pasture-raised pork among urban consumers in the Delta.

Table 1. Explanatory Behavior and Socioeconomic Variables.

Variable	Description (Definition)
Dependent Variables	
CHS	I would buy and eat pasture-raised pork. 1=yes; 0=no.
PAY	I would pay more per pound for pasture-raised pork. 1=yes; 0=no.
Socioeconomic Variables (SocVar)	
Urban (URBAN)	Population >20,000 =1; otherwise = 0; Base = Rural (RURAL).
Gender (FEMALE)	Respondent is female = 1; otherwise = 0.
Education (LHSCH)	Less than high school = 1; otherwise = 0; Base= Less than high school.
	(HSCH) High school = 1; otherwise = 0; Base = Less than high school.
	(PHSCH) Post high school = 1; otherwise = 0; Base = Less than high school.
Age (AGE)	Age of respondent in years.
Marital (MRTL)	Respondent is married = 1; otherwise = 0.
Job (JOB)	Respondent works = 1; otherwise = 0.
Low Income (LIn)	Family Income less than $25,000 =1; otherwise 0; Base =$25,000<income<$50,000.
High Income (HIn)	Family Income greater than $50,000 =1; otherwise 0;
	Base=$25,000<income<$50,000.
Household (HOUSE)	Household has one or more child = 1; otherwise = 0.
Behavioral Variables	
Aware (AWR)	Respondent has heard of pasture-raised pork = 1; otherwise = 0.
Prefer (PREF)	Pasture-raised pork is preferred over conventionally produced pork = 1; otherwise = 0.
Quality (QLTY)	Quality is important in buying pork = 1; otherwise = 0.
Local (LOCL)	Locally produced pork is preferred = 1; otherwise = 0.
Label (LABEL)	Label is useful in buying pork = 1; otherwise = 0.
Lean (LEAN)	Respondent considers pasture-raised pork lean = 1; otherwise = 0.
Healthy (HLTY)	Respondent views pasture-raised pork healthy =1; otherwise = 0.

Table 2. Frequencies and Description Variables.

Variables		Response	Frequency	Percentage	Std. Dev
Would you choose/buy pasture-raised pork over conventional pork (CHS)?		Yes	331	0.69	0.4833
		No	149	0.31	0.4833
Would you pay more for pasture-raised pork over conventional pork (PAY)?		Yes	282	0.59	0.4356
		No	198	0.41	0.4356
Independent Socioeconomic Variables (SocVar)					
Respondent Community		Urban	287	0.60	0.5009
		Rural[a]	193	0.40	0.5009
Respondent Gender		Female	303	0.63	0.4795
		Male[a]	177	0.37	0.4795
Education (EDUC)	(PHSCH)	Post High School Edu	251	0.52	0.4123
	(HSCH)	High School	166	0.35	0.4622
		Less than High School[a]	63	0.13	0.4126
Respondents Age (AGE)		Less than 30 years[a]	138	0.29	0.4731
		30 or more years	342	0.71	0.4731
Marital Status (MRTL)	MRD	Married	307	0.64	0.5002
	SNGL	Single	122	0.25	0.3184
		Widow/Divorced[a]	51	0.11	0.4792
Employment (JOB)		Employed/Retired	423	0.88	0.4891
		Unemployed[a]	57	0.12	0.4891
Household Income	INCOME1	(LIn)< $25,000[a]	67	0.14	0.3104
	INCOME2	$25,000<(MIn)<$50,000	137	0.29	0.4872
	INCOME3	(HIn)>$50,000	276	0.57	0.4533
Respondents' Behavior Variables (BehVar)					
Aware of pasture-raised pork (AWARE)?		Yes	277	0.58	0.3928
		No[a]	203	0.42	0.3928
Prefer pasture-raised pork over conventional produced pork (PREF)?		Yes	313	0.65	0.4153
		No[a]	167	0.35	0.4153
Prefer local pasture-raised pork to non-local produced pork LOCAL?		Local Area	271	0.56	0.3606
		Outside local area[a]	209	0.44	0.3606
Will pasture-raised label be useful in your buying decisions (LABEL)?		Yes	332	0.69	0.3122
		No[a]	148	0.31	0.3122
Do you consider pasture-raised pork leaner than conventional pork (LEAN)?		Yes	321	0.67	0.3609
		No[a]	159	0.33	0.3609
Do you consider pasture-raised pork healthier than conventional pork (HLTY)?		Yes	296	0.62	0.2143
		No[a]	184	0.38	0.2143
What will you consider as important when buying pastureland?		Quality (QUALITY)	298	0.62	0.4991
		No Antibiotic/Hormone (AN/HM) raised pork	139	0.29	0.3493
		Animal right[a] (RGHT)	43	0.09	0.4091

[a] Omitted from analysis.

Table 3. Predictive Accuracy of Household Survey.

		Buy and Eat CHS[a]		Pay More PAY[b]	
		0	1	0	1
Actual	0	16	43	22	54
	1	90	331	102	302

[a] Number of correct predictions—333; percentage—74%.
[b] Number of correct predictions—353; percentage—69%.

Table 4. Logit Model Estimates of Pasture-Raised Pork Market in the Delta, 1998.

Variables	Select and Buy (CHS)[a]			Pay More (PAY)[b]		
	Estimate	Marginal Probability	Standard Error	Estimate	Marginal Probability	Standard Error
Socioeconomic (SocVar)						
CONSTANT	-1.2133*	-0.7435	0.6374	-0.7273	-0.1325	0.7301
URBAN	1.3922**	0.2834	0.7124	0.4913*	0.2342	0.2938
RURAL	0.2682	0.0768	0.3278	-0.4324*	-0.1724	0.2331
FEMALE	0.3225	0.1133	0.3423	0.2644	0.0916	0.4211
EDUC PHSCH	1.1251**	0.3725	0.5336	0.7123*	0.1435	0.3779
EDUC HSCH	0.0344	0.0827	0.4318	0.0672	-0.1135	0.4437
AGE	0.4411*	0.2842	0.5016	0.0325	0.0711	0.5128
MARITAL MRD	0.0572	0.0938	0.4539	0.4432	0.0518	0.4623
JOB	0.4327*	0.1414	0.2952	0.1011*	0.1713	0.0546
INCOME2	0.0637	0.0081	0.3916	-0.0122	-0.1048	0.4549
INCOME3	0.3413**	0.2711	0.1465	0.3314**	0.1964	0.1439
HOUSE	0.0871	0.0932	0.4221	-0.0342	0.0157	0.5137
Behavior (BehVar)						
AWARE	0.0526	0.0416	0.4185	0.0074	-0.0046	0.4469
PREF	0.0711	0.0684	0.4278	0.0682	0.0093	0.3823
LOCAL	1.0126*	0.3214	0.0592	0.7528*	0.1253	0.3816
LABEL	0.6278**	0.1132	0.2948	0.3144**	0.0927	0.1476
LEAN	0.0514	0.0785	0.4323	0.0487	0.0094	0.5271
QUALITY	0.5735**	0.1864	0.2492	0.4932*	0.1063	0.2709
AN/HM	-0.7193*	-0.2133	0.3663	-0.5126*	-0.1976	0.2134

** denotes statistical significance at the 0.05 level.
* denotes significance at the 0.10 level.

[a] Restricted log likelihood model=-335.32; Chi=squared=31.41.

[b] Restricted log likelihood model=-315.78; Chi=squared=30.14.

The age (AGE) variable was significant and positive in the CHS model but insignificant in the PAY model. This indicates that Delta consumers who are older than 30 were 28 percent more likely than younger consumers to buy and eat pasture-raised pork, but they were only 7 percent more likely to pay more for it over conventionally grown pork. A possible explanation for the positive sign is that consumers who are older than 30 and living in urban areas of the Delta are concerned with health and environmental problems resulting from conventional-grown pork.

The base education category was the group with less than high school education. The variable PHSCH (for consumers with post-high school education) was significant in both the CHS and PAY models, but the variable HSCH (for consumers with high school education) was not significant in either model. The PHSCH had a positive sign in the CHS model, indicating that the post-high school group (PHSCH) was 37 percent more likely to buy and eat pasture-raised pork than the base group was. In the PAY model, highly educated Delta consumers (PHSCH) were 14 percent more likely to pay a premium for pasture-raised pork than were those with less than a high school education.

The JOB variable is significant at 0.01 level with the hypothesized positive sign, indicating that Delta consumers who were employed were 14 percent more likely to buy and eat pasture-raised pork and 17 percent more likely to pay more for it than were their unemployed counterparts.

The INCOME3 variable (the highest income households) had positive signs and were significant at the 0.05 level in both CHS and PAY models. The indication is that households with income greater than $50,000 were 27 percent more likely to buy and eat pasture-raised pork and 19 percent more likely than those with the lowest incomes to pay a premium for it over conventionally grown pork. This is likely the result of the consciousness that wealthy consumers have concerning their diet and health— they tend to prefer and pay more for natural and healthy food products. This result is consistent with intuition and may support previous studies on meat nutrition, which indicate that high-income consumers are more likely to read meat labels for nutrition and health facts than low-income consumers are (Piedra, Schupp, and Montgomery, 1996).

We had expected married households to buy and pay more for pasture-raised pork. We also expected households with children to provide home meals that were healthy, containing fewer hormones, fat, and other similar nutrients (Gutherie et al., 1995; Schupp, Gillespie, and Reed, 1998b). The MRD (married consumers) and HOUSE (households with one or more child) variables were insignificant in both the CHS and PAY models.

The variable QUALITY was significant at the 0.10 and 0.05 levels in the CHS and PAY models, respectively. The marginal probability results for the QUALITY variable showed that surveyed Delta consumers were 18 percent more likely to buy and eat and 10 more likely to pay more for pasture-raised pork over conventionally grown pork because they considered pasture-raised pork to be of higher quality than conventionally grown pork.

The variable AN/HM (consumers who do not like antibiotics and hormones) was negative and significant in both CHS and PAY models. The marginal probability results for the AN/HM variable showed that surveyed Delta households were 21 percent less likely to buy and eat pasture-raised pork containing antibiotics and hormones. They were also 19 percent less likely to pay more for pasture-raised pork over conventionally grown pork that contains antibiotics and hormones. The LABEL variable (label useful in buying decision) was positive and significant at the 0.05 level for both the CHS and PAY models. This indicates that Delta consumers were 11 percent more likely to buy and eat, and 9 percent more likely to pay more for pork labeled as pasture-raised over conventionally grown pork.

The implication for the AN/HM and LABEL results is that Delta respondents consider fat, antibiotics, hormones, etc., to be important attributes of the pork that they buy. This supports previous studies, which show that health and diet-conscious consumers consider it important that fat content, antibiotic use, and hormone use are included on food nutrient labels (Guthrie et al., 1995; Moutou and Breste, 1998; Morreale and Schwartz, 1995; Schupp, Gillespie, and Reed, 1998b; Nayga, 1996).

The variable LOCAL was based on the survey question that asked if respondents would buy and pay more for locally produced pasture-raised pork than they would for non-locally produced

pork. LOCAL had positive signs and was significant at the 0.10 level in both the CHS and PAY models, indicating that Delta consumers who would consume pasture-raised pork were 32 percent more likely to buy locally produced product than they were to buy non-locally produced pork product. Similarly, Delta consumers who would consume pasture-raised pork were 12 percent more likely to pay a premium for the locally produced product than for the non-locally produced product. As shown by previous studies, the potential reason that Delta consumers are more likely to buy and pay more for locally produced product over others is that they may believe that locally produced, pasture-raised pork is fresh or that they want to patronize local producers (Govindasamy, Italia, and Thatch, 1998).

Summary and Implications

This market survey did not provide cost-benefit analysis information to help prospective farmers determine the minimum number of hogs, acreage, methods, and inputs needed to viably evaluate the potential of the alternative "pasture-fed" hog production practices. However, it has provided the baseline information about the type of consumers that will buy pasture-raised pork and their concerns and preferences for pasture-raised pork in the Delta area.

The market policy implication from the survey results is that the market for pasture-raised pork in the Mississippi Delta of Arkansas would be driven by consumer preferences. The health-conscious urban consumers in this niche market are prepared to pay a premium over conventionally grown pork if they can get the pasture-raised pork that they want. Therefore, to expand into pasture-raised pork production enterprises, limited-resource farmers must produce the pork product that will meet the preferences of the identified niche market. Such enterprises can help these farmers to produce value-added agricultural products that can offer premium value and thereby improve their incomes.

Male respondents with less than high school education, younger respondents, households with no children, those residing in rural areas of the Delta and households with low annual incomes (less than $50,000) were less likely to buy or pay high prices for pasture-raised pork over conventionally grown pork. Delta consumers who are more likely to purchase pasture-raised pork are also more likely to exhibit socioeconomic characteristics of higher income and education levels and to live in urban areas. Delta consumers reporting concerns about health and use of antibiotics and hormones in commercially produced pork are more likely to purchase pasture-raised pork. These findings also suggest that pasture-raised pork producers must adopt a unique niche-marketing strategy that targets high-income, health-conscious, urban consumers.

While this study can be replicated for other farming communities, the implication of the findings for other mono-cultural agricultural areas is clear. A budding market exists in the Delta area of Arkansas for locally-produced, environmentally friendly hog products. Limited-resource farmers who can convert portions of their farmland to pasture-raised pork will have an assured market, receive high prices, and provide positive economic impacts or revitalize their rural economies.

While the market potential for pasture-raised pork with its related economic multipliers can improve the incomes of limited-resource farmers, only limited growth has taken place in the Delta area. The results of this study support a market for pasture-raised pork, but further research on consumer perceptions and preferences toward pasture-raised pork is also needed as well as research into the following:

- development of other value-added pasture-raised pork products for this identified urban consumer market;

- analysis of competitive aspects of pasture-raised pork relative to conventional grown pork in the Mississippi Delta of Arkansas;

- development of recommendations for market penetration strategies for the target markets; and

- analysis of the profitability of production and processing practices that will be used for the preferred pasture-fed pork, etc.

These areas of future research could provide the necessary information on how to produce, the extent of the market for pasture-raised pork, and how to ignite the production of pasture-raised pork among limited-resource farmers in the Delta area.

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