

# Are Farm Supply Cooperatives Meeting Farmer Needs?

*A Survey of Farmers and Managers*

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ARE FARM SUPPLY COOPERATIVES  
MEETING FARMER NEEDS?  
A SURVEY OF FARMERS AND MANAGERS

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## INTRODUCTION

Four of every five commercial farmers use cooperatives (farmer owned corporations) to market products, obtain supplies, or procure needed services. The downturn in the agricultural sector earlier this decade, combined with the financial difficulties of many farm credit lenders weakened the position of many cooperatives. Farm supply cooperatives, in particular, faced financial stress during that time due to decreased demand for inputs used in farm production. Simultaneously, there was an increased demand to finance accounts by farmers who were unable to obtain lines of credit from traditional banking institutions. Supply cooperatives were also pressed by non-cooperative type farm input suppliers that were competing effectively for large farm accounts.

Farm supply cooperatives in Oregon face additional problems arising from the unique character of Oregon agriculture. The Oregon State University Extension Service lists 83 different crops with statewide gross sales of greater than one million dollars. Of these, 75 are grown commercially in the Willamette Valley of Western Oregon. Agricultural diversity, while considered a blessing in most respects, challenges farm supply co-ops. Cooperatives must provide the variety of services and products required to serve farmers of all the different crops grown in the area. Less obvious, but perhaps as important, co-ops face the difficulty associated with identifying large and small farmers in terms of input purchases. Identification of farm size is essential in assessing policy decisions with respect to large versus small volume accounts, and to understand causes for nonparticipation in cooperatives.

Agricultural supply cooperative managers and board members are

continually making policy decisions affecting the financial well-being of the cooperative and, in turn, the well-being of their members. However, cooperatives are trying to meet the needs of Oregon's farmers with little marketing information about the attitudes and purchasing habits of their customers. Managers need to know the demographics of their customers and members: are they mainly large or small farmers? young or old? cooperative members or non-members? grass seed growers or sheep ranchers? Furthermore, cooperative leaders need to know whether differences among farmers are significant in a business sense. For example, will large farmers prefer certain policies that smaller farmers will oppose? Will farmers view policies similarly, regardless of farm size, their age, type of farm, etc.

The purpose of this research was to address those types of questions. The major tool of analysis was a survey of Willamette Valley farmers that was conducted in March and April of 1986. (For a complete discussion of the survey see Appendix A.) A separate and slightly different survey was given to agricultural supply cooperative managers. This publication summarizes the results of those surveys. It is organized to present important information on farm size, farmer attitudes toward co-ops, and the patronage of farmers at cooperatives.

#### **HOW SHOULD FARM SIZE BE MEASURED?**

The Bureau of the Census classifies farm size by acreage and by the market value of agricultural products sold. Hence, a decision needed to be made about how to best measure farm size. In areas with little or no agricultural diversity, such as found in the midwest farm belt, both of these provide adequate measures of size. However, in areas such as the

Willamette Valley, where per acre gross revenues vary greatly, the Census's farm size classification scheme is of limited value for questions related to input purchases and sales. Estimated per acre input costs may be a more relevant indicator of farm size for the purpose of this study.

In anticipation of the need to delineate farm size, research was completed on returns and input values for agricultural enterprises in Oregon's Willamette Valley (Hartley & Burt). Using the per acre gross revenue and input costs from that research, total gross revenues and total input costs were calculated for the 674 farmers who returned survey questionnaires. (See Tables B-1 & B-2 in Appendix B for details of per acre gross revenues and per acre input costs for Willamette Valley farm enterprises.) Farm size was then classified using the statistical procedures of regression analysis and discriminant analysis.

Regression analysis showed gross revenue to be a reliable predictor of input costs. Specifically, input costs of the surveyed farmers were, on average, approximately 21% of per acre gross revenues. The analysis showed that most of the variation of input costs can be explained by variations in gross revenues. (See Appendix B for full details and explanation of regression analysis of farm size.)

Discriminant analysis and frequency distributions were used to further test farm size indicators. Farmers were grouped into five classes according to gross revenue, and five different classes according to input costs. It was hypothesized that significantly different group mean responses to subjective statements in the survey would occur if gross revenue and input costs were significantly different indicators of farm size. (See Table 1 on page 5 for a list of the subjective statements.) The results showed no significant differences in group means or

significant gains in explaining the variations of group mean responses under any of the classification schemes. (See appendix B for details of the discriminant analysis and frequency distributions.)

In summary, gross revenue was found to be a good predictor of input cost levels and was, statistically, no less effective than input costs in explaining mean responses to the subjective questions in the survey. Per acre estimates of gross revenue are also more widely available and more commonly accepted measures of farm size. Thus, gross revenue was used in this research to categorize farms by size.

#### **FARMER ATTITUDES TOWARD FARM SUPPLY COOPERATIVES**

If cooperative managers are to make prudent policy decisions, they should understand the perceptions and attitudes of their customers. What are farmer attitudes about prices, service, cooperative principles, or patronage refunds? What do farmers think of their cooperative's management? To this end, farmers were asked to respond to the 26 statements shown in Table 1. Respondents circled one of the following to indicate their feelings: strongly agree, agree, neutral, disagree, strongly disagree.

A score of 1 through 5 was assigned to each response, with strongly agree = 1, agree = 2, neutral = 3, disagree = 4, and strongly disagree = 5. The scoring procedure allowed for the use of analysis of variance techniques to examine farmer responses to the statements. The comparisons included: (1) farmer responses versus manager responses; (2) the responses of farmers grouped by farm size (gross revenue); (3) the responses of farmers grouped by membership status; and (4) farmer responses grouped by age. (Appendix C details the analysis procedures and includes tables of the results.)

TABLE 1. QUESTIONNAIRE STATEMENTS CONTAINED IN THE SURVEYS OF AGRICULTURAL SUPPLY COOPERATIVE MEMBERS AND MANAGERS, WILLAMETTE VALLEY, OREGON, 1986.

- (A) Cooperatives are instrumental in introducing new products and technology to local farmers.
- (B) Cooperatives help their members attain a higher standard of living through increased profits.
- (C) Young farmers should expect to receive as many benefits from cooperatives in the future as others have in the past.
- (D) Cooperatives should discourage large non-member farmers from patronizing the cooperative.
- (E) Members generally benefit by patronage refunds of cooperatives.
- (9) Cooperatives generally are not managed efficiently.
- (G) Farmers would generally pay higher prices for supplies if it were not for competition from cooperatives.
- (H) Cooperatives should encourage patronage by small non-member farmers.
- (I) There are few significant differences between cooperatives and other competing businesses.
- (J) Cooperative prices for services and products should be the same regardless of quantities purchased.
- (K) Generally cooperative members should patronize their cooperatives even if they pay higher prices than at other competing businesses.
- (L) Oregon cooperatives are no longer serving small farmer's needs adequately.
- (M) It would be better to have lower co-op prices instead of:
  - (1) good service;
  - (2) patronage refunds;
  - (3) cooperative principles;
  - (4) easy credit.
- N) Cooperatives would get more patronage if they:
  - (1) located closer to other shopping needs;
  - (2) lowered membership requirements;
  - (3) lowered patronage refund revolve time;
  - (4) had more advertising;
  - (5) hired friendlier personnel;
  - (6) were more competitively priced.
- (O) Cooperatives offer better service than other competing businesses.
- (P) Cooperative managers and board members care more about the cooperative's survival than member's needs.
- (Q) Most cooperative members are not very informed about the operation of their cooperative.
- (R) Cooperatives should seek the membership of large farms over the membership of small farmers.

## SUMMARY OF RESPONSES TO ATTITUDINAL STATEMENTS.

This section reviews the response of farmers and managers to each of the statements listed in Table 1. (Details of the analysis of variance results can be found in Appendix C.) The statements are then grouped and analyzed by the issues they address. The following conventions are used in the subsequent summary of responses:

- (1) Response means are shown inside ().
- (2) The term "significant" implies significance to the .05 level, (i.e., there is less than a 5% chance that the observed differences in response would occur purely by chance.)
- (3) The probability that the group mean response is actually neutral is shown as an "alpha" value. If alpha is less than .05, the response is significantly different from neutral.
- (4) The term "significantly opposite" implies opposite mean responses, both significantly different than neutral.

The analysis as a whole produced some important findings. Managers and farmers had significantly different responses for 13 of the 26 statements, three of these were significantly opposite. Membership status was found to be significant in eight of the statements. Age was also a significant determinant of differing mean response in eight cases. However, farm size was a significant factor for only five of the statements. This reinforces earlier conclusions regarding the insignificance of farm size in determining survey responses. For easy reference, the farm, age, and response categories are repeated at the bottom of each page in this section.

**Statement (A) Cooperatives are instrumental in introducing new products and technology to local farmers.** Cooperative managers (1.46) agreed with this statement significantly more than farmers (2.62). Cooperative members (2.54) were significantly more in agreement than non-members, who nonetheless were significantly different than neutral [ $\alpha=0.0036$ ]. Younger farmers, age group B (2.92), were neutral on the issue, and significantly different than farmers of age groups, D (2.49), E (2.48), and F (2.32). Group C farmers (2.78) showed agreement, but significantly less so than groups E and F. Grouping the farmers by size class (gross revenue) produced no significant differences in group mean response.

**Statement (B) Cooperatives help their members attain a higher standard of living through increased profits.** The null hypothesis (mean responses are neutral (i.e.(3.00)) could not be rejected for managers [(2.62),  $\alpha=0.0544$ ] nor for farmers [(2.94),  $\alpha=0.1397$ ], at the 5% level of significance. Farm size and membership status did not affect farmer's mean responses. Grouping farmers by age, however, produced significant differences. Younger farmers, aged 30-39 (3.43), had a significantly different and opposite mean response than older farmers: ages 50-59 (2.82), ages 60-69 (2.74), and 70 years and older (2.64). The mean response of age group B farmers was also significantly different than the neutral response of farmers of ages 40-49, group C, (2.99).

Farm Size Classes			Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score	
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1	
\$2,500 - \$19,999	2	30-39	B	Agree	2	
\$20,000 - \$39,999	3	40-49	C	Neutral	3	
\$40,000 - \$99,999	4	50-59	D	Disagree	4	
\$100,000+	5	60-69	E	Strongly Disagree	5	
		70 +	F			

**Statement (C) Young farmers should expect to receive as many benefits from cooperatives in the future as others have in the past.** Both farmers (2.55) and managers (2.38) agreed with this statement. Again, farm size and membership status were not significant. Age was an important factor, with younger farmers tending toward neutrality, while older farmers were more in agreement. Younger farmers in Groups B (2.87), and C (2.77), were significantly less in agreement with the statement than the older farmers in groups E (2.36) and F (2.10). The mean response of group B was also significantly different than group D (2.47).

**Statement (D) Cooperatives should discourage large non-member farmers from patronizing the cooperative.** Co-op managers (4.46) strongly disagreed with this statement, while all farmers (3.70) disagreed but significantly less so. Members (3.82) were significantly more in disagreement than non-members (3.56). Grouping farmers by size and age produced no significant differences in mean responses.

**Statement (E) Members generally benefit by patronage refunds of cooperatives.** Farmers (2.70) and managers (2.38) agreed with the statement. Grouping by age showed significant differences in response means. Mean responses of group B (3.08) and Group C (2.89) were neutral and significantly different than the agreement found in the responses of Group D (2.49) and Group E (2.54). Additionally group B was significantly less in agreement than group F (2.51).

Farm Size Classes			Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score	
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1	
\$2,500 - \$19,999	2	30-39	B	Agree	2	
\$20,000 - \$39,999	3	40-49	C	Neutral	3	
\$40,000 - \$99,999	4	50-59	D	Disagree	4	
\$100,000+	5	60-69	E	Strongly Disagree	5	
		70 +	F			

**Statement (F) Cooperatives generally are not managed efficiently.**

Not surprisingly, managers (3.54) disagreed with this statement, while farmers (2.68) took a significantly opposite view. There were no significant differences among farmers, regardless of farm size, membership status, or age.

**Statement (G) Farmers would generally pay higher prices for supplies if it were not for competition from cooperatives.** Managers (2.08) were significantly more in agreement with this statement than farmers (2.81). Older farmers: group D (2.73), group E (2.57), and group F (2.33), were significantly more in agreement with this statement than younger farmers: group B (3.14), and group C (3.01), who tended to be neutral.

**Statement (H) Cooperatives should encourage patronage by small non-member farmers.** Farmers (2.03) and managers (1.69) both strongly agreed with this statement. Cooperative members (2.00) were significantly more in agreement than non-members (2.15). There were no other significant differences found between the various farmer groupings.

**Statement (I) There are few significant differences between cooperatives and other competing businesses.** Co-op managers were neutral [(3.23),  $\alpha=0.4608$ ] on this issue, while farmers (2.56) were significantly more in agreement. All other groupings of farmers were insignificant with regard to this statement.

**Statement (J) Cooperative prices for services and products should be**

Farm Size Classes			Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score	
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1	
\$2,500 - \$19,999	2	30-39	B	Agree	2	
\$20,000 - \$39,999	3	40-49	C	Neutral	3	
\$40,000 - \$99,999	4	50-59	D	Disagree	4	
\$100,000+	5	60-69	E	Strongly Disagree	5	
		70 +	F			

the same regardless of quantities purchased. Farmers (3.19) and managers (4.08) both disagreed with this statement, managers significantly more so. Age difference was a significant factor in farmer's attitudes to this statement. Oldest farmer's responses (2.55) were significantly different than those of all other age groups and were significantly opposite age groups B (3.51) and C (3.41).

**Statement (K) Generally cooperative members should patronize their cooperatives even if they pay higher prices than at other competing businesses.** Farmers (4.01) and managers (2.62) responded significantly opposite each other to this statement. Although farmers of all age groups disagreed with the statement, younger farmers, groups B (4.22) and C (4.17), disagreed significantly more than older farmers, groups E (3.79) and F (3.59).

**Statement (L) Oregon cooperatives are no longer serving small farmer's needs adequately.** This statement evoked significantly opposite responses by farmers (2.85), who agreed, and co-op managers (3.77), who disagreed. Age and farm size groupings showed no significantly different mean responses. Non-members (2.49) however, agreed with the statement, while members (3.00) were neutral.

**Statement (M1) It would be better to have lower co-op prices instead of good service.** Farmers (3.59) and cooperative managers (4.00) both disagreed with this statement. The difference in their responses was not

Farm Size Classes		Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1
\$2,500 - \$19,999	2	30-39	B	Agree	2
\$20,000 - \$39,999	3	40-49	C	Neutral	3
\$40,000 - \$99,999	4	50-59	D	Disagree	4
\$100,000+	5	60-69	E	Strongly Disagree	5
		70 +	F		

significant. Again younger farmers, groups B (3.97) and C (3.65), were significantly more in disagreement with the statement than older farmers, groups D (3.59), E (3.33) and F (3.27). Members of cooperatives (3.69) and non-members (3.43) showed significantly different responses.

**Statement (M2) It would be better to have lower co-op prices instead of patronage refunds.** Cooperative managers (2.62) and farmers (2.54), regardless of age, size class, or membership status, agreed with this statement. All groupings, with the exception of managers [ $\alpha=0.1745$ ] and the youngest farmers [ $\alpha=0.0961$ ], had mean responses significantly different than neutral.

**Statement (M3) It would be better to have lower co-op prices instead of cooperative principles.** Co-op managers (3.69) disagreed with this statement, while farmers (3.06) in general were neutral. Cooperative members (3.10) were significantly different than neutral, but only slightly so. All other groupings of farmers, with the exception of age group D [(3.20),  $\alpha=0.0052$ ] were neutral on this issue.

**Statement (M4) It would be better to have lower co-op prices instead of easy credit.** Cooperative manager's responses (4.00) were significantly different and opposite those of farmers (2.75) on the issue of easy credit. No groupings of farmers showed significantly different mean responses, although the response means of the youngest farmers [(2.62),  $\alpha=0.0857$ ], oldest farmers [(3.13),  $\alpha=0.43$ ], and farmers of size

Farm Size Classes			Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score	
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1	
\$2,500 - \$19,999	2	30-39	B	Agree	2	
\$20,000 - \$39,999	3	40-49	C	Neutral	3	
\$40,000 - \$99,999	4	50-59	D	Disagree	4	
\$100,000+	5	60-69	E	Strongly Disagree	5	
		70 +	F			

class 3 [(2.93),  $\alpha=0.6589$ ], were not significantly different than neutral.

**Statement (N1) Cooperatives would get more patronage if they located closer to other shopping needs.** We could not reject the null hypothesis (mean responses were neutral) for neither managers [(2.54),  $\alpha=0.0821$ ] nor for farmers [(2.93),  $\alpha=0.0595$ ]. There was a significant difference between the smallest farmers (2.77), who agree with the statement, and farmers with revenue up to \$99,999 [(3.15),  $\alpha=0.1391$ ], who were neutral. Non-members (2.77) agreed and were significantly different from members (2.99), who were neutral.

**Statement (N2) Cooperatives would get more patronage if they lowered membership requirements.** Both managers (3.54) and farmers (3.13) disagreed with this statement. Significantly opposite responses were found between cooperative members (3.29) and non-members (2.76). Farmers with lower gross revenues, class 1 (2.94), and class 2 (2.99), were neutral and differed significantly from larger farmers, class 4 (3.32), and class 5 (3.32), who were in disagreement with the statement. There were no significant differences among age classes.

**Statement (N3) Cooperatives would get more patronage if they lowered patronage refund revolve time.** Farmers (2.77) and managers (2.31) agreed with the statement. Agreement of farmers ran across membership status, farm size, and age.

Farm Size Classes		Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1
\$2,500 - \$19,999	2	30-39	B	Agree	2
\$20,000 - \$39,999	3	40-49	C	Neutral	3
\$40,000 - \$99,999	4	50-59	D	Disagree	4
\$100,000+	5	60-69	E	Strongly Disagree	5
		70 +	F		

**Statement (N4) Cooperatives would get more patronage if they had more advertising.** Farmers (2.71) and managers (2.31) both agreed with this statement. The smallest farmers (2.52) were significantly more in agreement than the largest farmers [(2.90),  $\alpha=0.0893$ ]. There were no other significant differences among groups, all were slightly in agreement with the statement.

**Statement (N5) Cooperatives would get more patronage if they hired friendlier personnel.** Farmers [(2.90),  $\alpha=0.0059$ ] agreed with the statement, but to a significantly smaller degree, than the agreement shown by co-op managers (2.38). There were no other significant differences among groups.

**Statement (N6) Cooperatives would get more patronage if they were more competitively priced.** Farmers (1.98) and managers (1.92) both agreed with this statement. There was a significant difference between cooperative members (1.92) and non-members (2.14). No other groups varied significantly.

**Statement (O) Cooperatives offer better service than other competing businesses.** Farmers (3.26) disagreed with this statement, while managers [(2.69),  $\alpha=0.3033$ ] were more in agreement, yet statistically neutral nonetheless. Disagreement ran across membership status, and age groups, with the exception that the oldest farmers were neutral [(2.90),  $\alpha=0.4434$ ]. The largest farmers (3.46) disagreed significantly more

Farm Size Classes		Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1
\$2,500 - \$19,999	2	30-39	B	Agree	2
\$20,000 - \$39,999	3	40-49	C	Neutral	3
\$40,000 - \$99,999	4	50-59	D	Disagree	4
\$100,000+	5	60-69	E	Strongly Disagree	5
		70 +	F		

than the neutral smallest farmers (3.06).

**Statement (P) Cooperative managers and board members care more about the cooperative's survival than member's needs.** Farmers (2.60) were significantly more in agreement than neutral managers (3.08). Agreement was widespread among farmers, crossing all groupings.

**Statement (Q) Most cooperative members are not very informed about the operation of their cooperative.** Agreement to this statement was found in all groupings. Managers (2.15) were not significantly different compared to farmers (2.40).

**Statement (R) Cooperatives should seek the membership of large farms over the membership of small farmers.** Managers [(3.31), alpha=0.2643] were neutral on this issue, while farmers (3.84) significantly disagreed. Mid-sized farmers, with gross revenue up to \$39,999 (4.16) were more in disagreement than other size classes, and significantly more so than the largest farmers (3.69). Membership status and age did not produce significantly different responses.

Farm Size Classes		Age Groups		Response Scores	
Gross Revenue	Class	Years	Group	Response	Score
\$0 - \$ 2,499	1	20-29	A	Strongly Agree	1
\$2,500 - \$19,999	2	30-39	B	Agree	2
\$20,000 - \$39,999	3	40-49	C	Neutral	3
\$40,000 - \$99,999	4	50-59	D	Disagree	4
\$100,000+	5	60-69	E	Strongly Disagree	5
		70 +	F		

## SUMMARY OF STATEMENT ISSUES.

In drawing conclusions from the analysis above, we have grouped the statements of Table 1 were grouped into issues as follows:

- (1) Prices: statements G, J, K, M1-M4, & N6.
- (2) Membership issues: statements D, H, N2, Q, & R.
- (3) Service: statements A, L, M1, N5, & O.
- (4) Cooperative management: statements F & P.
- (5) Patronage refunds: statements E, M2, & N3.
- (6) Returns to farmers: statements A, B, C, & E.
- (7) Competitive environment: statements G, I, K, N1, N4, N5, N6,  
& O.
- (8) Cooperative principles: statements I, J, M3, M4, P, & Q.

### PRICES: Statements G, J, K, M1-M4, & N6.

Farmers and managers felt strongly about prices. There were few group mean responses to price statements that were not significantly different from neutral. Farm size was not a significant factor in any of the price statements and membership status was significant in only two of the eight statements in the subject group. A farmer's age was, in most cases, a significant factor in mean response. Generally farmers' and managers' responses were significantly different, and in two cases were opposite.

The mean responses show that farmers wanted lower prices, but not at the expense of good service or cooperative principles. They appeared to be willing to sacrifice patronage refunds and easy credit for lower prices. Older farmers felt that cooperatives were important in keeping prices at competing businesses low, while younger farmers were ambivalent. Younger farmers were less likely to be loyal if cooperative prices were higher, and all farmers disagreed with managers, who felt farmers should

be loyal to the cooperative regardless of higher prices. Importantly, farmers' and managers' responses imply that discounts based on quantity purchased may be acceptable. The oldest farmers took exception to this. In general, farmers responses in all size class farms were consistent on this point.

**MEMBERSHIP ISSUES:** Statements D, H, N2, Q, & R.

Mean responses of all groups of farmers and managers implied that non-members, both large and small, should not be discouraged from patronizing cooperatives. Non-members and small farmers felt that membership requirements could be lower; however members and co-op managers did not believe requirements were too high. All respondents agreed that members are not well informed about the operation of their cooperatives.

**SERVICE:** Statements A, L, M1, N5, & O.

Farmers and managers believed service should not be sacrificed to obtain lower prices; however, farmers did not think cooperatives provide better service than competing businesses. Hiring friendlier personnel would not influence patronage according to farmers, but managers believed this to be important. All groups believed cooperatives were effective in disseminating new technology. Non-members believed service to small farmers was poor.

**COOPERATIVE MANAGEMENT:** Statements F & P.

Farmers of all classes held a critical view of cooperative management. They felt that cooperative management was inefficient and that board members were concerned more with co-op survival than member needs.

PATRONAGE REFUNDS: Statements E, M2, & N3.

Farmers and managers believed patronage refunds to be beneficial, but thought cooperatives could get more business by lowering the revolve time. Farmers and managers would have sacrificed patronage refunds to gain lower prices.

RETURNS TO FARMERS: Statements A, B, C, & E.

Younger farmers were doubtful about the continuing benefits of cooperative membership. They were neutral toward statements regarding technology dissemination, the benefits of patronage refunds; they did not believe cooperatives would bring about higher living standards.

COMPETITIVE ENVIRONMENT: Statements G, I, K, N1, N4, N5, N6, & O.

The farmers indicated that there are few significant differences between cooperatives and proprietary firms. They felt competition from co-ops helps to keep prices lower, and believe cooperatives would get more of their patronage if they were priced even more competitively. They did not feel they should buy at cooperatives if they could pay less elsewhere. The farmers also indicated that cooperatives would get more business if they located closer to other shopping needs and if they did more advertising.

COOPERATIVE PRINCIPLES: Statements I, J, M3, M4, P, & Q.

Farmers did not regard cooperative principles highly, in general, and were neutral when asked if principles should be sacrificed for lower prices. They did not feel there were significant differences between co-ops and proprietary firms, and felt members were poorly informed about the

operations of their cooperatives. These responses may indicate some lack of understanding of cooperative principles among farmers. Farmers would not be loyal to cooperatives if they had to pay higher prices, and seemed to reject egalitarian principles of equal prices and easy credit.

### COOPERATIVE PATRONAGE

Knowledge of the patronage habits of farmers at farm supply cooperatives might enable cooperative leaders to develop policies to enhance their profits and better serve their member and non-member customers. If few farmers are utilizing certain goods and services that are expensive to inventory or to maintain, then it may be better to reallocate the coop's resources into areas that generate greater returns.

The second section of the survey, aimed at learning about the patronage habits of farmers at their cooperatives, listed 23 items commonly available at farm supply cooperatives. Farmers were asked to indicate the percentage of total purchases of each of the supply items made at a farm supply cooperative in 1985.

To simplify the analysis, only non-durable farm production inputs were examined. These were: pesticides, seed, feed, services, diesel for fuel, oil and lubricants, and bagged dry, bulk dry, and liquid fertilizers. Not included were gasoline (under the assumption that most gas purchases were for use in automobiles), animal health products, and grain seed (because of definitional ambiguities). To further simplify the analysis, diesel for fuel and oil/lubricants were averaged to form a single percentage of petroleum purchases. Similarly, a weighted fertilizer percentage was computed by combining bagged, bulk, and liquid fertilizer purchases. Finally, a combined percentage of purchases was calculated for the six classes. This was a weighted average of the

potential purchases as indicated by the enterprise data from the survey and the estimated input costs from Table B-2 in Appendix B. (See Appendix D for details of petroleum and fertilizer averages and for a full explanation of the calculation of the combined input purchase percentage.)

Frequency distributions were examined and analysis of variance was conducted to investigate the effects of membership status, age, and gross revenue on patronage levels. The most significant finding was the bimodal nature of the distributions. A bimodal distribution is one where observations are clustered about two distinct levels; the mode is the most frequently occurring response. Frequency distributions of patronage levels are shown in Tables D-2, D-3, and D-4, and are depicted graphically in Figures D-1 to D-7, all in Appendix D. These kinds of distributions imply that the mean of the average response differs from the mode responses. For example, the mean response of members for petroleum purchases was 38% (Figure D-2), but only nine respondents reported purchases between 30% and 40%. The bimodal distribution of member purchases of petroleum was at either none (0% purchases) or virtually all (90-100% purchases).

Patronage levels of the six different input groups and of the combined inputs varied from 0 to 100%. The mode (most common) response for most input groups was 0% patronage. The only exception was found in pesticide purchases by member farmers, in which case the mode response was 100% patronage. In each case a majority of non-members reported zero purchases from cooperatives. For the input categories of petroleum, pesticides, fertilizers, seed, and feed, the second most frequently occurring purchase level was 100%, setting up a bi-modal distribution pattern.

As one would expect, member patronage was greater than non-member patronage for all input categories. Farmers with high purchase levels at cooperatives could only realize benefits from patronage refunds by becoming

members. Cooperatives held a relatively strong market position in pesticide purchases for both members and non-members. Fertilizers were also purchased at relatively high levels in both cases. Cooperatives held a strong market position in member purchases of petroleum, but a much weaker relative share of non-member purchases. Purchases of seed and feed at cooperatives by both groups were somewhat lower than other input categories, but higher, nonetheless, than the weak share of service-type purchases.

Regression analysis was done to assess the impact of age and gross revenue on farmer's patronage at cooperatives. The analysis showed age and gross revenue were not significant predictors of patronage levels. This was true for all input classes, except feed. Analysis of variance (ANOVA) confirmed these findings.

ANOVA results indicated few differences in mean purchase levels across age classes for any of the input categories. Among all farmers, total input purchase levels were significantly different between 40 year old farmers and 60 year old farmers, with the younger farmers purchasing less than the older farmers. Farmers in the 60-year bracket purchased significantly more petroleum at co-ops than the oldest farmers (70 +) and the younger (40-49) farmers. Non-members in the 20-29 and 40-49 age classes had significantly different mean responses in total input purchases. There were no significant differences across age classes for any of the input groups when only member farmers were compared.

Analysis of variance of purchase levels of farmers grouped by gross revenue showed few significant differences between classes. The smallest farmers (0-\$2499 gross sales) purchased significantly lower percentages of petroleum at co-ops than all other size categories. Farmers in Class 2 (\$2500-\$19,999 gross sales) purchased significantly less of their petroleum than the largest farmers as well. These same differences were noted when

looking at only member farmers. There was a significant difference between non-member small farms (0-\$2,499 gross sales) and larger farms (\$40,000-\$99,999 gross sales). Other differences in non-member patronage levels were found between small farmers and the largest farmers (\$100,000+) for both pesticides and the combined input categories. Feed purchases were at a significantly greater level for the smallest farmers compared to the largest farmers. The same was true when looking at just member farms or at all farmers.

The foregoing analysis led to the following generalizations. Members purchased significantly more than non-members in all input categories. Except for isolated situations, age and gross revenue were not important indicators of purchase percents overall. Finally, supply cooperatives had strong market shares in pesticides and fertilizers and a very weak share of the services market. Relative market shares of petroleum, seed, and feed fell in between these extremes.

### CONCLUSIONS

Agricultural supply cooperatives need information about both their member and non-member customers. This research examined the importance of farm size, age, and cooperative membership status as determinants of farmer's attitudes toward and patronage of farm supply cooperatives. General findings of the study included:

- (1) Gross revenue was an adequate measure of farm size. This appeared to be true even when considering the diversity of crops in the Willamette Valley and the differences in input costs across the different enterprises.
- (2) Farm size did not appear to be overly significant in determining the attitudes and perceptions of farmers toward cooperatives. Nor

does farm size seem to affect the patronage level of farmers at cooperatives.

- (3) A farmer's age did not appear to affect attitudes toward supply cooperatives including purchasing habits.
- (4) Farmers felt cooperatives need to offer lower prices to stay competitive.
- (5) Discounts for large purchases were acceptable to farmers of all sizes.
- (6) Farmers wanted their cooperatives to offer good service. However, they did not appear to be willing to purchase services.
- (7) Farmers wanted to see their cooperative leaders become more concerned with member needs.
- (8) Patronage dividends were important, but farmers were willing to sacrifice them for lower prices.
- (9) Cooperative principles did not appear to be important to farmers. They would sacrifice those principles to achieve lower prices.
- (10) Farmers would also sacrifice easy credit for lower prices.
- (11) Farmers purchased relatively high percentages of pesticides and fertilizers at cooperatives. Services were purchased in relatively small amounts.

#### POSSIBLE IMPLICATIONS OF THE STUDY

Farmers frequently want lower prices; they may be willing to sacrifice cooperative principles, easy credit, and patronage refunds to get them. Service, however, may still be very important. Instituting discounts for volume sales might be an immediate way for patrons to realize lower prices. Tightening credit policies might also result in savings, that could eventually be passed on to customers in the form of lower prices. Similarly,

lower prices could be offered if members would accept lower patronage refunds.

Another, and perhaps more creative way to reduce prices to all farmers might be to sell farmers a package consisting of all necessary inputs for a given crop. This conceptually would include all services and technical help. If these were offered at lower prices compared to separate purchases, even smaller farmers could realize gains. In addition to benefiting farmers by lowering prices a package could lock in sales and result in further savings for the cooperative.

Even though the foregoing approach might help, it appears most important that cooperatives maintain a high level of awareness about the needs of their customers. Significant differences between coop manager perceptions and member perceptions may be an indication of problem areas. To avoid this, databases containing customer information might be made available enabling co-op personnel to tailor goods and services specifically to individual needs. Such a data bank should contain current farm enterprise information and addresses and locations of farm land and outbuildings, etc. The bank might also contain information about the farmer's attitudes and perceptions. These data might be taken from customer surveys similar in nature to the one used in this study.

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## APPENDICES

## Appendix A: THE SURVEY

The data for this study were collected through a mailed questionnaire. Three groups were surveyed: farm supply cooperative managers, cooperative member farmers, and non-member farmers. The first mailing was sent on March 12, 1986. On April 2, 1986, a second questionnaire was mailed to those that had not yet responded. Each mailing included a cover letter explaining the purpose of the study and a pre-stamped, addressed envelope for return.

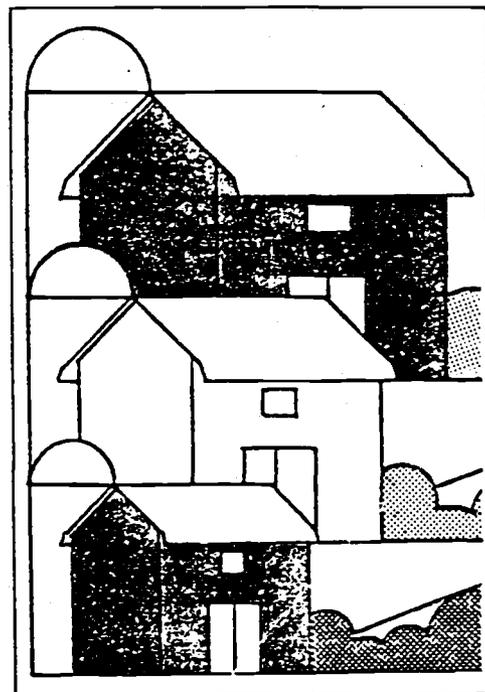
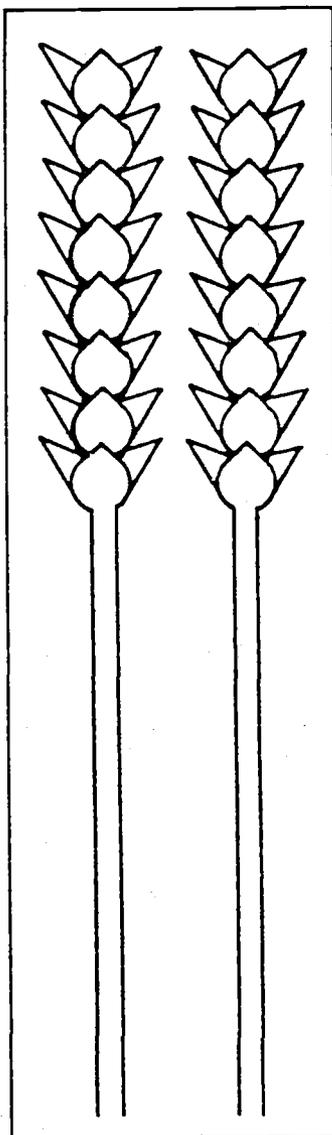
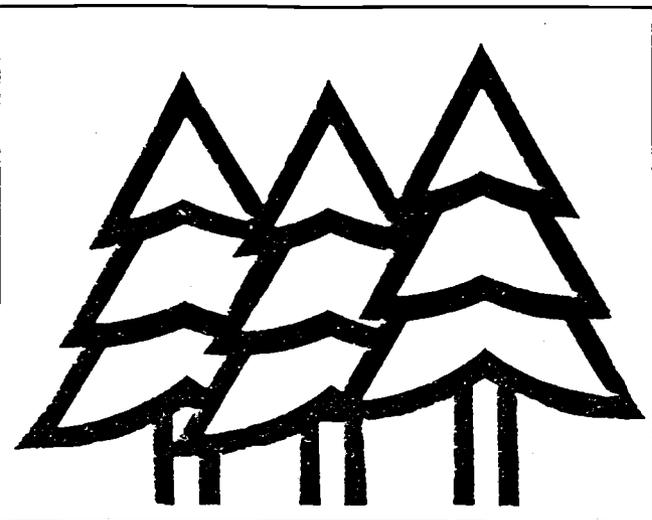
The questionnaire for farmers was divided into four sections. The first questions requested information on the farmers' cooperative membership status. The next section asked respondents to indicate the percentage of total purchases of various supply items made from farm cooperatives in 1985. There were 23 different supply items identified that could have been purchased from a cooperative. Each respondent circled the percentage of each purchased from cooperatives in 1985. The third section of the questionnaire asked farmers to respond to 26 statements about farm supply cooperatives and to indicate whether they strongly agreed, agreed, were neutral, disagreed, or strongly disagreed. The last section asked respondents to detail the enterprises they operated in 1985, to estimate farm income and expenditures, and to give their ages and years of farming experience.

The questionnaire was mailed to both cooperative members and non-members. The cooperative member list was compiled from membership roles of the five major farm supply cooperatives in the Willamette Valley. All respondents were verified cooperative members. Non-member's names were obtained from county extension service lists of farmers. These lists contained cooperative members as well as non-members. The mailing lists were compared to be sure that verified cooperative members did not appear on the non-member list. There were 650 names randomly selected from each of the two lists to create the final mailing list of 1300. There were 840 farmers who returned the questionnaires. Of those, 674 were complete, a usable return rate of 52 percent.

Farm supply cooperative managers in Oregon were sent similar questionnaires. In all, 13 of 19 managers completed and returned the survey. A second survey was sent to co-op managers in August 1986 to gather information on fertilizer and petroleum sales.

A note of caution on the non-members: (1) The non-member list was not representative of all the farmers in the district; only those that had some type of contact with the County Extension Service were included. Some counties had more complete lists than others. (2) County Extension Agents were asked to identify commercial operations rather than backyard hobbyists. This was done to reduce the need to over sample the population of non-members to achieve a large enough sample of commercial size farms. The cost of over sampling to achieve enough commercial farms for statistical analysis was too great.

The entire questionnaire is presented in Appendix A. It is followed by the cover letter, the reminder post card, and the cover letter for the second mailing of the questionnaire to non-respondents. The survey sent to managers is also included.



A 1986 effort to determine if the needs of Willamette Valley agricultural producers are being fulfilled by farm supply cooperatives is underway. Are prices competitive? quality products? reliable service? qualified management?

Please answer all of the questions. If you wish to comment on any questions or qualify your answers, please use the margins or a separate sheet of paper.

This research is sponsored by the Oregon State University Department of Agricultural and Resource Economics.

Return this questionnaire to:  
Agricultural and Resource  
Economics Department  
Oregon State University  
Corvallis, Oregon 97331

# ARE FARM SUPPLY COOPERATIVES MEETING PRODUCER'S NEEDS IN THE WILLAMETTE VALLEY?

**ARE FARM SUPPLY COOPERATIVES MEETING PRODUCERS' NEEDS  
IN THE WILLAMETTE VALLEY?**

**AN OREGON STATE UNIVERSITY SURVEY**

Please answer all eleven questions.

1. Are you a member of a farm supply cooperative? (Circle one number)

1. NO (SKIP TO QUESTION 2)

2. YES

→1a. How many farm supply cooperatives do you belong to? (Circle one number)

- 1 ONE
- 2 TWO
- 3 THREE
- 4 MORE THAN THREE

2. Generally, members and non-members can purchase supplies from a farm supply cooperative. For the following supplies, please indicate the percentage of your total purchases of each supply item that you made at a farm supply cooperative in 1985. (Please circle one number for each item)

ITEM	PERCENTAGE												
	0	5	10	20	30	40	50	60	70	80	90	95	100
a) GASOLINE.....	0	5	10	20	30	40	50	60	70	80	90	95	100
b) DIESEL (FOR FUEL).....	0	5	10	20	30	40	50	60	70	80	90	95	100
c) DIESEL (FOR HEATING).....	0	5	10	20	30	40	50	60	70	80	90	95	100
d) OIL AND GREASE.....	0	5	10	20	30	40	50	60	70	80	90	95	100
e) AUTOMOTIVE.....	0	5	10	20	30	40	50	60	70	80	90	95	100
f) LAWN/GARDEN SEEDS, TOOLS & SUPPLIES .....	0	5	10	20	30	40	50	60	70	80	90	95	100
g) CLOTHING AND HOUSEHOLD .	0	5	10	20	30	40	50	60	70	80	90	95	100
h) ANIMAL HEALTH.....	0	5	10	20	30	40	50	60	70	80	90	95	100
i) GENERAL HARDWARE (NAILS, PAINT, ETC.).....	0	5	10	20	30	40	50	60	70	80	90	95	100
j) HEAVY HARDWARE (FENCING, BALING, ETC.).....	0	5	10	20	30	40	50	60	70	80	90	95	100
k) POWER EQUIPMENT.....	0	5	10	20	30	40	50	60	70	80	90	95	100
l) FEED .....	0	5	10	20	30	40	50	60	70	80	90	95	100
m) SEED .....	0	5	10	20	30	40	50	60	70	80	90	95	100

(PLEASE TURN THE PAGE )

ITEM	PERCENTAGE													
n) GRAIN SEED.....	0	5	10	20	30	40	50	60	70	80	90	95	100	
o) DRY FERTILIZER (BULK).....	0	5	10	20	30	40	50	60	70	80	90	95	100	
p) DRY FERTILIZER (BAGGED) ..	0	5	10	20	30	40	50	60	70	80	90	95	100	
q) LIQUID FERTILIZER.....	0	5	10	20	30	40	50	60	70	80	90	95	100	
r) PESTICIDES.....	0	5	10	20	30	40	50	60	70	80	90	95	100	
s) OTHER CHEMICALS (SURFACTANTS, ETC.) .....	0	5	10	20	30	40	50	60	70	80	90	95	100	
t) LABOR/SERVICES .....	0	5	10	20	30	40	50	60	70	80	90	95	100	
u) FARM EQUIPMENT RENTAL... ..	0	5	10	20	30	40	50	60	70	80	90	95	100	
v) FARM MACHINERY .....	0	5	10	20	30	40	50	60	70	80	90	95	100	
w) IRRIGATION EQUIPMENT.....	0	5	10	20	30	40	50	60	70	80	90	95	100	

3. There are many reasons why farmers might divide their purchases between supply cooperatives and private businesses. Please read the following statements about farm supply cooperatives and indicate whether you: strongly agree (SA), agree (A), don't know or neither agree nor disagree (N), disagree (D), or strongly disagree (SD). (Please circle one answer for each statement)

a) Cooperatives are instrumental in introducing new products and technology to local farmers. ....	SA	A	N	D	SD
b) Cooperatives help their members attain a higher standard of living through increased profits. ....	SA	A	N	D	SD
c) Young farmers should expect to receive as many benefits from cooperatives in the future as others have in the past. ....	SA	A	N	D	SD
d) Cooperatives should discourage large non-member farmers from patronizing the cooperative. ....	SA	A	N	D	SD
e) Members generally benefit by patronage refund of cooperatives. ....	SA	A	N	D	SD
f) Cooperatives generally are not managed efficiently. ....	SA	A	N	D	SD
g) Farmers would generally pay higher prices for supplies if it were not for competition from cooperatives. ....	SA	A	N	D	SD
h) Cooperatives should encourage patronage by small non-member farmers. ....	SA	A	N	D	SD
i) There are few significant differences between cooperatives and other competing businesses. ....	SA	A	N	D	SD

( PLEASE GO ON TO NEXT PAGE )

Please indicate whether you: strongly agree (SA), agree (A), don't know or neither agree nor disagree (N), disagree (D), or strongly disagree (SD).

j) Cooperative prices for services and products should be the same regardless of quantities purchased. ....	SA	A	N	D	SD
k) Generally cooperative members should patronize their cooperatives even if they pay higher prices than at other competing businesses. ....	SA	A	N	D	SD
l) Oregon cooperatives are no longer serving small farmers needs adequately. ....	SA	A	N	D	SD
m) It would be better to have lower coop prices instead of:					
1) good service .....	SA	A	N	D	SD
2) patronage refunds .....	SA	A	N	D	SD
3) cooperative principles .....	SA	A	N	D	SD
4) easy credit .....	SA	A	N	D	SD
n) Cooperatives would get more patronage if they:					
1) located closer to other shopping needs .....	SA	A	N	D	SD
2) lowered membership requirements .....	SA	A	N	D	SD
3) lowered patronage refund revolve time .....	SA	A	N	D	SD
4) had more advertising .....	SA	A	N	D	SD
5) hired friendlier personnel .....	SA	A	N	D	SD
6) were more competitively priced .....	SA	A	N	D	SD
o) Cooperatives offer better service than other competing businesses. ....	SA	A	N	D	SD
p) Cooperative managers and board members care more about the cooperatives' survival than members needs. ....	SA	A	N	D	SD
q) Most cooperative members are not very informed about the operation of their cooperative. ....	SA	A	N	D	SD
r) Cooperatives should seek the membership of large farmers over the membership of small farmers. ....	SA	A	N	D	SD

( PLEASE TURN THE PAGE )

Finally, we would like to ask a few questions about yourself for statistical purposes.

4. How many years have you been farming?  
\_\_\_\_\_YEARS

5. Which crops and how many acres of each did you grow in 1985?

CROP	# ACRES	CROP	# ACRES
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

6. Please give the numbers of each kind of livestock raised in 1985, if any.

- a. BEEF CATTLE..... \_\_\_\_\_
- b. DAIRY CATTLE ..... \_\_\_\_\_
- c. POULTRY ..... \_\_\_\_\_
- d. SHEEP ..... \_\_\_\_\_
- e. SWINE ..... \_\_\_\_\_
- OTHER (PLEASE LIST)
- f. \_\_\_\_\_ .....
- g. \_\_\_\_\_ .....

7. What was your approximate gross household income from all sources, before taxes, in 1985; (Circle the number that most closely approximates your income)

- 1 LESS THAN \$2,500
- 2 \$2,501 - \$40,000
- 3 \$40,001 - \$100,000
- 4 \$100,001 - \$250,000
- 5 GREATER THAN \$250,001

8. Of your 1985 income, what percent was used to purchase farm supplies?  
\_\_\_\_\_PERCENT

9. And, about what percent of your 1985 income was derived from farming?  
\_\_\_\_\_PERCENT

10. What is your present age?  
\_\_\_\_\_ YEARS

( PLEASE GO ON TO NEXT PAGE )

11. Is there anything else you would like to tell us about how farm supply cooperatives could serve you better? If so, please use this space for that purpose. Also, any comments you wish to make that you think may help us in future efforts to understand what needs Oregon farmers have from their farm supply sources will be appreciated, either here or in a separate letter.

*Your contribution to this effort is very greatly appreciated. If you would like a summary of results, please print your name and address on the back of the return envelope NOT on this questionnaire. We will see that you get it.*

**THANK YOU!**

## SECOND SURVEY OF COOPERATIVE MANAGERS.

This questionnaire is a simplified version of one you may have received earlier. We are interested in classifying purchases of commodities at your co-op by farm size and co-op membership status. Farm size categories are delineated as follows: 1) Hobby or home gardener; gross sales less than \$2,500/year. 2) Very small farm; gross sales from \$2,500 to \$19,999/year. 3) Small farm; gross sales from \$20,000 to \$39,999/year. 4) Medium farm; gross sales from \$40,000 to \$99,999/year. 5) Large farm; gross sales from \$100,000 and up.

Please answer each question to the best of your knowledge. Use figures from 1985.

DIRECTIONS	For items in this section, please indicate the percent of gross sales you perceive each farm size category purchased at your co-op in 1985						For each commodity, please indicate percent of gross sales by members/non-members.			
	Less than \$2,500	\$2,500 to \$19,999	\$20,000 to \$39,999	\$40,000 to \$99,999	Greater than \$100,000	= 100%	MEMBER	NON-MEMBER	= 100%	TOTAL SALES (\$1,000)
EXAMPLE:	5	15	20	25	35	= 100%	67	33	= 100%	400
PETROLEUM (Diesel, oil, lubricants) for farm use)						= 100%			= 100%	
FERTILIZER (Total sales of all grades and types.)						= 100%			= 100%	
PESTICIDES (Including insecticides & other chemicals)						= 100%			= 100%	
BULK DRY FERTILIZER						= 100%			= 100%	
BAGGED FERTILIZER						= 100%			= 100%	
LIQUID FERTILIZER						= 100%			= 100%	
FEED						= 100%			= 100%	
SEED						= 100%			= 100%	

## Appendix B: FARM SIZE

Farm size was calculated using the data in Table B-1. The figures in the table are from an earlier study on returns and input values for agricultural enterprises in Oregon's Willamette valley. Table B-2, which follows shows the break-down of input costs into six categories.

TABLE B-1. ESTIMATED PER ACRE (HEAD) REVENUE AND INPUT COSTS FOR DISTRICT 1 ENTERPRISES.

#	CROP	GROSS REVENUE	INPUT COSTS
1.1	Truck Garden	\$2,684.82	\$149.61
1.2	Processing Vegetables	\$960.43	\$290.28
2.0	Snap Beans	\$983.92	\$270.02
3.0	Beets	\$1,371.22	\$408.80
3.1	Beets, processing	\$1,282.25	NA
3.2	Beets, fresh market	\$4,515.00	NA
4.0	Broccoli	\$1,833.87	\$347.32
4.1	Broccoli, processing	\$1,686.24	NA
4.2	Broccoli, fresh market	\$2,677.50	NA
5.0	Cabbage	\$3,218.46	\$533.05
6.0	Carrots	\$2,922.82	\$421.51
6.1	Carrots, processing	\$1,244.96	NA
6.2	Carrots, fresh market	\$8,839.50	NA
7.0	Cauliflower	\$2,002.73	\$431.35
7.1	Cauliflower, processing	\$1,675.62	NA
7.2	Cauliflower, fresh market	\$3,855.40	NA
8.0	Cucumbers	\$2,196.42	\$293.58
8.1	Cucumbers, processing	\$2,074.00	NA
8.2	Cucumbers, fresh market	\$3,339.00	NA
9.0	Garden	\$1,000.00	\$154.37
10.0	Onions	\$1,580.00	\$419.46
11.0	Peas	\$386.23	\$157.72
11.1	Green peas	\$536.50	\$215.99
11.2	Austrian peas	\$182.40	\$89.47
12.0	Potatoes	\$1,156.00	\$705.94
13.0	Garlic	\$1,550.00	\$412.75
14.0	Winter Squash	\$2,142.92	\$294.35
15.0	Sweet Corn	\$701.61	\$285.49
15.1	Sweet Corn, processing	\$653.20	NA
15.2	Sweet corn, fresh market	\$1,592.85	NA
16.0	Flower Seed (primrose)	\$750.00	\$219.86
17.0	Garden Seed	\$1,020.00	\$448.25
18.0	Squash Seed	\$1,350.00	\$402.41
19.0	Sugar Beet Seed	\$1,314.00	\$557.07
20.0	Vegetable Seed	\$1,020.00	\$448.25
21.0	Barley	\$158.36	\$150.47
22.0	Bentgrass Seed	\$434.73	NA
22.1	Bentgrass, Colonial	\$315.65	\$79.51
22.2	Bentgrass, Creeping	\$1,475.40	NA

(Table continued on next page.)

Table B-1 (cont.). ESTIMATED PER ACRE (HEAD) REVENUE AND INPUT COSTS FOR DISTRICT 1 ENTERPRISES.

#	CROP	GROSS REVENUE	INPUT COSTS
23.0	Clover Seed	\$384.83	\$121.75
23.1	Red clover seed	\$400.68	\$123.65
23.2	Crimson clover seed	\$342.67	\$115.31
23.3	Arrowleaf clover seed	\$516.84	\$123.65
23.4	White and Ladino clover	\$361.30	\$123.65
24.0	Fescue	\$373.02	\$127.09
24.1	Fescue, Tall	\$401.25	\$121.20
24.2	Fescue, Red	\$334.10	\$135.78
24.3	Fescue, Chewings	\$329.64	\$135.78
25.0	Grass seed	\$443.79	\$156.04
25.1	Orchardgrass seed	\$357.28	\$154.55
25.2	Kentucky Bluegrass seed	\$783.15	\$161.87
26.0	Grain	\$226.20	\$131.91
27.0	Milo	\$261.44	\$131.91
28.0	Oats and Vetch	\$134.00	\$126.86
28.1	Oats	\$134.64	NA
28.2	Common vetch	\$123.76	NA
28.3	Hairy vetch	\$124.25	NA
29.0	Soybeans	\$243.74	\$169.91
30.0	Rape	\$294.81	\$94.14
31.0	Ryegrass	\$294.81	\$112.41
31.1	Ryegrass, perennial	\$412.58	\$93.46
31.2	Ryegrass, Annual	\$231.40	\$147.59
32.0	Wheat	\$261.44	\$131.91
33.0	Berries	\$2,311.09	\$403.96
34.0	Blackberries	\$3,707.05	\$249.00
35.0	Blueberries	\$3,292.82	\$813.32
36.0	Boysenberries	\$2,719.38	NA
37.0	Loganberries	\$1,386.38	\$196.97
38.0	Marion berries	\$3,343.24	\$342.46
39.0	Raspberries	\$1,876.76	\$456.45
39.1	Black Raspberries	\$1,803.36	\$536.26
39.2	Red Raspberries	\$1,913.28	\$306.94
40.0	Strawberries	\$1,886.45	\$402.09
41.0	Fruit	\$1,092.53	\$342.43
42.0	Apples	\$1,542.90	\$562.59
43.0	Cherries	\$904.67	\$381.98
43.1	Cherries, Sweet	\$799.40	NA
43.2	Cherries, Tart	\$1,431.00	NA
44.0	Bartlett Pears	\$2,569.60	\$472.50
45.0	Italian Prunes	\$737.00	\$152.57
45.5	Peaches	\$2,529.00	NA
46.0	Wine Grapes	\$1,433.07	\$331.47
47.0	Nuts	\$653.35	\$181.35
48.0	Filberts	\$683.40	\$182.54
49.0	Walnuts	\$306.80	\$167.63
50.0	Alfalfa Hay	\$335.10	\$143.19

(Table continued on next page.)

Table B-1 (cont.). ESTIMATED PER ACRE (HEAD) REVENUE AND INPUT COSTS  
FOR DISTRICT 1 ENTERPRISES.

#	CROP	GROSS REVENUE	INPUT COSTS
51.0	Red Clover Hay	\$237.60	\$170.36
52.0	Oat Hay	\$132.72	\$55.50
53.0	Other Hay	\$132.72	\$55.50
54.0	Pasture	\$0.00	\$86.21
55.0	Silage Corn	\$494.05	\$254.23
56.0	Doug.Fir Christmas Trees	\$1,425.60	\$195.54
58.0	Container Nursery stock	\$40,592.97	\$1,635.01
59.0	Hops	\$2,962.12	\$426.39
60.0	Mint	\$762.20	\$400.37
61.0	Field Nursery Stock	\$6,241.16	\$584.64
62.0	Timber	\$83.02	\$4.66
63.0	Bees	\$28.02	\$0.00
64.0	Beef Cattle	\$157.37	\$8.06
65.0	Dairy Cows	\$1,394.91	\$301.75
66.0	Goats	\$82.76	\$10.37
67.0	Horses	\$67.24	\$329.06
68.1	Farm Poultry	\$4.16	\$2.56
68.2	Integrated Poultry	\$1.48	NA
69.0	Sheep	\$25.40	\$4.07
70.0	Swine	\$69.68	\$68.76
71.0	Rabbits	\$2.40	\$2.75
72.0	Trout (per 1000)	\$100.00	\$5.35
73.0	Mink	\$21.07	\$2.32

TABLE B-2. INPUT COSTS PER ACRE OF DISTRICT 1 ENTERPRISES (1985 DOLLARS).

#	CROP	PETROLEUM	PESTICIDES	FERTILIZERS	SERVICES	SEED	FEED	TOTAL
1.0	Vegetables	NA	NA	NA	NA	NA	NA	NA
1.1	Truck Garden	\$12.08	\$10.19	\$15.28	\$10.19	\$101.88	\$0.00	\$149.61
1.2	Processing Vegetables	\$60.60	\$56.61	\$99.09	\$27.82	\$46.16	\$0.00	\$290.28
2.0	Snap Beans	\$59.53	\$60.13	\$70.23	\$8.57	\$71.56	\$0.00	\$270.02
3.0	Beets	\$98.77	\$105.94	\$204.09	\$0.00	\$0.00	\$0.00	\$408.80
3.1	Beets; processing	NA	NA	NA	NA	NA	NA	NA
3.2	Beets; fresh market	NA	NA	NA	NA	NA	NA	NA
4.0	Broccoli	\$35.00	\$56.50	\$122.72	\$64.11	\$69.00	\$0.00	\$347.32
4.1	Broccoli; processing	NA	NA	NA	NA	NA	NA	NA
4.2	Broccoli; fresh market	NA	NA	NA	NA	NA	NA	NA
5.0	Cabbage	\$174.36	\$9.16	\$213.37	\$125.18	\$10.99	\$0.00	\$533.05
6.0	Carrots	\$58.48	\$60.28	\$92.43	\$8.57	\$201.74	\$0.00	\$421.51
6.1	Carrots; processing	NA	NA	NA	NA	NA	NA	NA
6.2	Carrots; fresh market	NA	NA	NA	NA	NA	NA	NA
7.0	Cauliflower	\$175.00	\$41.92	\$120.01	\$44.73	\$49.70	\$0.00	\$431.35
7.1	Cauliflower; processing	NA	NA	NA	NA	NA	NA	NA
7.2	Cauliflower; fresh market	NA	NA	NA	NA	NA	NA	NA
8.0	Cucumbers	\$50.45	\$47.34	\$132.60	\$26.56	\$36.63	\$0.00	\$293.58
8.1	Cucumbers; processing	NA	NA	NA	NA	NA	NA	NA
8.2	Cucumbers; fresh market	NA	NA	NA	NA	NA	NA	NA
9.0	Garden	\$4.67	\$11.09	\$16.63	\$11.09	\$110.88	\$0.00	\$154.37
10.0	Onions	\$80.30	\$67.11	\$0.00	\$202.48	\$69.57	\$0.00	\$419.46
11.0	Peas	\$20.23	\$13.49	\$32.56	\$28.19	\$63.24	\$0.00	\$157.72
11.1	Green peas	\$16.60	\$3.67	\$39.02	\$52.26	\$104.44	\$0.00	\$215.99
11.2	Austrian peas	\$24.47	\$25.00	\$25.00	\$0.00	\$15.00	\$0.00	\$89.47
12.0	Potatoes	\$30.06	\$124.59	\$262.67	\$101.75	\$186.88	\$0.00	\$705.94
13.0	Garlic	\$80.30	\$60.40	\$0.00	\$202.48	\$69.57	\$0.00	\$412.75
14.0	Winter Squash	\$80.99	\$16.48	\$86.81	\$36.81	\$73.26	\$0.00	\$294.35
15.0	Sweet Corn	\$54.94	\$64.47	\$127.82	\$17.14	\$21.12	\$0.00	\$285.49
15.1	Sweet Corn; processing	NA	NA	NA	NA	NA	NA	NA
15.2	Sweet corn; fresh market	NA	NA	NA	NA	NA	NA	NA
16.0	Flower Seed (primrose)	\$77.36	\$53.50	\$70.00	\$9.00	\$10.00	\$0.00	\$219.86
17.0	Garden Seed	\$163.00	\$152.81	\$122.25	\$0.00	\$10.19	\$0.00	\$448.25
18.0	Squash Seed	\$234.31	\$71.31	\$81.50	\$0.00	\$15.28	\$0.00	\$402.41
19.0	Sugar Beet Seed	\$49.28	\$108.91	\$163.83	\$57.88	\$177.17	\$0.00	\$557.07
20.0	Vegetable Seed	\$163.00	\$152.81	\$122.25	\$0.00	\$10.19	\$0.00	\$448.25
21.0	Barley	\$33.71	\$0.86	\$19.05	\$79.70	\$17.16	\$0.00	\$150.47
22.0	Bentgrass Seed	NA	NA	NA	NA	NA	NA	NA
22.1	Bentgrass; Colonial	\$23.79	\$17.56	\$28.49	\$9.28	\$0.40	\$0.00	\$79.51
22.2	Bentgrass; Creeping	NA	NA	NA	NA	NA	NA	NA
23.0	Clover Seed	\$38.26	\$0.47	\$8.53	\$60.43	\$14.05	\$0.00	\$121.75
23.1	Red clover seed	\$37.09	\$0.00	\$8.58	\$67.17	\$10.81	\$0.00	\$123.65
23.2	Crimson clover seed	\$42.25	\$2.06	\$8.37	\$37.58	\$25.05	\$0.00	\$115.31
23.3	Arrowleaf clover seed	\$37.09	\$0.00	\$8.58	\$67.17	\$10.81	\$0.00	\$123.65
23.4	White clover and Ladino	\$37.09	\$0.00	\$8.58	\$67.17	\$10.81	\$0.00	\$123.65
24.0	Fescue	\$30.32	\$7.13	\$43.08	\$45.11	\$1.45	\$0.00	\$127.09
24.1	Fescue; Tall	\$19.67	\$11.97	\$70.33	\$18.16	\$1.08	\$0.00	\$121.20
24.2	Fescue: Red	\$46.02	\$0.00	\$2.92	\$84.84	\$2.00	\$0.00	\$135.78
24.3	Fescue; Chewings	\$46.02	\$0.00	\$2.92	\$84.84	\$2.00	\$0.00	\$135.78

(Table continued on next page.)

TABLE B-2 (cont.). INPUT COSTS PER ACRE OF DISTRICT 1 CROPS (1985 DOLLARS).

#	CROP	PETROLEUM	PESTICIDES	FERTILIZERS	SERVICES	SEED	FEED	TOTAL
25.0	Other Grass seed	\$24.72	\$1.35	\$3.28	\$123.38	\$3.30	\$0.00	\$156.04
25.1	Orchardgrass seed	\$24.77	\$1.00	\$3.22	\$121.56	\$4.00	\$0.00	\$154.55
25.2	Kentucky Bluegrass seed	\$24.53	\$2.74	\$3.51	\$130.53	\$0.56	\$0.00	\$161.87
26.0	Grain	\$23.10	\$5.78	\$16.03	\$76.43	\$10.58	\$0.00	\$131.91
27.0	Milo (See Wheat)	\$23.10	\$5.78	\$16.03	\$76.43	\$10.58	\$0.00	\$131.91
28.0	Oats and Vetch	\$24.51	\$0.86	\$19.05	\$65.29	\$17.16	\$0.00	\$126.86
28.1	Oats	NA	NA	NA	NA	NA	NA	NA
28.2	Common vetch	NA	NA	NA	NA	NA	NA	NA
28.3	Hairy vetch	NA	NA	NA	NA	NA	NA	NA
29.0	Soybeans	\$27.29	\$33.01	\$66.83	\$3.67	\$39.12	\$0.00	\$169.91
30.0	Rape (See Ryegrass)	\$21.06	\$7.48	\$43.60	\$16.00	\$6.00	\$0.00	\$94.14
31.0	Ryegrass	\$22.67	\$21.88	\$50.40	\$10.40	\$7.05	\$0.00	\$112.41
31.1	Ryegrass; perennial	\$21.06	\$6.80	\$43.60	\$16.00	\$6.00	\$0.00	\$93.46
31.2	Ryegrass; Annual	\$25.66	\$49.90	\$63.03	\$0.00	\$9.00	\$0.00	\$147.59
32.0	Wheat	\$23.10	\$5.78	\$16.03	\$76.43	\$10.58	\$0.00	\$131.91
33.0	Berries	\$109.83	\$129.85	\$76.92	\$17.21	\$70.16	\$0.00	\$403.96
34.0	Blackberries	\$70.94	\$74.72	\$64.47	\$22.26	\$16.60	\$0.00	\$249.00
35.0	Blueberries	\$204.84	\$193.45	\$334.99	\$9.66	\$70.39	\$0.00	\$813.32
36.0	Boysenberries	NA	NA	NA	NA	NA	NA	NA
37.0	Loganberries	\$79.99	\$57.74	\$8.22	\$15.77	\$35.25	\$0.00	\$196.97
38.0	Marion Berries	\$155.61	\$99.10	\$60.10	\$11.07	\$16.59	\$0.00	\$342.46
39.0	Raspberries	\$174.91	\$143.35	\$59.58	\$22.22	\$56.40	\$0.00	\$456.45
39.1	Black Raspberries	\$233.03	\$149.89	\$68.74	\$27.00	\$57.60	\$0.00	\$536.26
39.2	Red Raspberries	\$66.04	\$131.10	\$42.41	\$13.25	\$54.14	\$0.00	\$306.94
40.0	Strawberries	\$58.42	\$140.96	\$72.93	\$15.57	\$114.20	\$0.00	\$402.09
41.0	Fruit	\$111.59	\$171.31	\$45.44	\$0.00	\$14.09	\$0.00	\$342.43
42.0	Apples	\$202.27	\$275.42	\$52.30	\$0.00	\$32.60	\$0.00	\$562.59
43.0	Cherries	\$107.34	\$203.48	\$53.47	\$0.00	\$17.69	\$0.00	\$381.98
43.1	Cherries; Sweet	NA	NA	NA	NA	NA	NA	NA
43.2	Cherries; Tart	NA	NA	NA	NA	NA	NA	NA
44.0	Bartlett Pears	\$160.65	\$269.60	\$42.25	\$0.00	\$0.00	\$0.00	\$472.50
45.0	Italian Prunes	\$80.21	\$47.46	\$24.90	\$0.00	\$0.00	\$0.00	\$152.57
45.5	Peaches	NA	NA	NA	NA	NA	NA	NA
46.0	Wine Grapes	\$180.05	\$80.46	\$69.16	\$1.80	\$0.00	\$0.00	\$331.47
47.0	Nuts	\$87.74	\$43.86	\$48.07	\$0.00	\$1.68	\$0.00	\$181.35
48.0	Filberts	\$87.27	\$45.47	\$49.80	\$0.00	\$0.00	\$0.00	\$182.54
49.0	Walnuts	\$93.16	\$25.29	\$28.10	\$0.00	\$21.08	\$0.00	\$167.63
50.0	Alfalfa Hay	\$18.51	\$0.00	\$8.27	\$106.49	\$9.92	\$0.00	\$143.19
51.0	Red Clover Hay	\$28.49	\$0.00	\$8.58	\$122.48	\$10.81	\$0.00	\$170.36
52.0	Hay (not alfalfa/clover)	\$9.35	\$0.00	\$25.64	\$0.00	\$20.51	\$0.00	\$55.50
53.0	Oat Hay (Same as #52)	\$9.35	\$0.00	\$25.64	\$0.00	\$20.51	\$0.00	\$55.50
54.0	Pasture	\$5.30	\$0.86	\$53.09	\$24.44	\$2.52	\$0.00	\$86.21
55.0	Corn Silage	\$79.49	\$0.00	\$69.43	\$87.20	\$18.11	\$0.00	\$254.23
56.0	Doug. Fir Christmas Trees	\$7.35	\$113.65	\$35.83	\$10.23	\$28.48	\$0.00	\$195.54
58.0	Container Nursery	\$363.92	\$168.71	\$1,102.38	\$0.00	\$0.00	\$0.00	\$1,635.01
59.0	Hops	\$102.63	\$85.96	\$157.35	\$46.40	\$34.07	\$0.00	\$426.39
60.0	Mint	\$69.51	\$0.00	\$142.13	\$135.73	\$53.01	\$0.00	\$400.37
61.0	Field Nursery	\$354.88	\$155.60	\$36.34	\$25.28	\$12.54	\$0.00	\$584.64
62.0	Timber	\$4.66	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4.66

(Table continued on next page.)

TABLE B-2 (cont.). INPUT COSTS PER ACRE OF DISTRICT 1 CROPS (1985 DOLLARS).

#	CROP	PETROLEUM	PESTICIDES	FERTILIZERS	SERVICES	SEED	FEED	TOTAL
63.0	Bees	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
64.0	Beef Cattle	\$2.96	\$0.00	\$0.00	\$0.00	\$0.00	\$5.10	\$8.06
65.0	Dairy Cows	\$36.99	\$0.00	\$0.00	\$0.00	\$0.00	\$264.76	\$301.75
66.0	Goats	\$0.00	\$7.99	\$0.00	\$0.00	\$0.00	\$2.39	\$10.37
67.0	Horses	\$0.00	\$84.56	\$0.00	\$0.00	\$0.00	\$244.50	\$329.06
68.0	Poultry	NA	NA	NA	NA	NA	NA	NA
68.1	Farm Poultry	\$0.00	\$0.06	\$0.00	\$0.00	\$0.00	\$2.50	\$2.56
68.2	Integrated Poultry	NA	NA	NA	NA	NA	NA	NA
69.0	Sheep	\$0.00	\$1.10	\$0.00	\$0.00	\$0.00	\$2.96	\$4.07
70.0	Swine	\$1.02	\$1.20	\$0.00	\$0.00	\$0.00	\$66.55	\$68.76
71.0	Rabbits	\$0.01	\$0.03	\$0.00	\$0.00	\$0.00	\$2.71	\$2.75
72.0	Trout (1000)	\$0.00	\$0.40	\$0.00	\$0.00	\$0.00	\$4.95	\$5.35
73.0	Mink	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$2.32	\$2.32

Two measures of farm size were examined: gross revenue and input costs. From survey questions 5 & 6 (Appendix A), each crop and livestock enterprise cited by farmers was coded. Per acre (per head) gross revenue and input costs were then calculated for each enterprise. Only input costs for those items generally available at farm supply cooperatives were included. Inputs were grouped into six categories: petroleum, pesticides, fertilizers, services, seed, and feed. The estimates of input cost did not include labor, farm machinery purchases, general hardware items (fencing, nails, etc.), depreciation, or capital expenses.

The farmers reported enterprises with varying degrees of specificity. For example, some farmers reported growing vegetables, grain, grass seed, etc., while others were more specific, citing bush beans, processing carrots, tall fescue, etc. Also included in the study were livestock enterprises.

Each respondent's gross revenue and input costs were calculated using the following formulas: Gross Revenue = Acres x Per Acre Gross Revenue.

Input Costs = Acres x Per Acre Input Costs.

An example response to survey questions 5 & 6 is shown below. The farmer's gross revenue and input cost computations are shown in Table B-3.

5. Which crops and how many acres of each did you grow in 1985?

CROP	# ACRES	CROP	# ACRES
<u>Snap Beans</u>	<u>40</u>	<u>Broccoli</u>	<u>15</u>
<u>Sweet Corn</u>	<u>100</u>	_____	_____
<u>Pasture</u>	<u>100</u>	_____	_____
<u>Flower Seed</u>	<u>15</u>	_____	_____

6. Please give the numbers of each kind of livestock raised in 1985, if any.

- a. BEEF CATTLE ..... 100
- b. DAIRY CATTLE..... \_\_\_\_\_
- c. POULTRY..... \_\_\_\_\_
- d. SHEEP..... \_\_\_\_\_
- e. SWINE..... \_\_\_\_\_
- OTHER (PLEASE LIST) \_\_\_\_\_
- f. \_\_\_\_\_
- g. \_\_\_\_\_

TABLE B-3. CALCULATIONS OF EXAMPLE FARMERS GROSS REVENUE AND INPUT COSTS.

#	CROP	ACRES	PER ACRE GROSS REVENUE	PER CROP GROSS REVENUE	PER ACRE INPUT COSTS	PER CROP INPUT COSTS
2.0	Snap Beans	40	\$983.92	\$39,356.80	\$270.02	\$10,800.80
15.0	Sweet Corn	100	\$701.61	\$70,161.00	\$285.49	\$28,549.00
54.0	Pasture	100	\$0.00	\$0.00	\$86.21	\$8,621.00
16.0	Flower Seed	15	\$750.00	\$11,250.00	\$219.86	\$3,297.90
4.0	Broccoli	15	\$1,833.87	\$27,508.05	\$347.32	\$5,209.80
64.0	Beef Cattle	100 (head)	\$157.73	\$15,737.00	\$8.06	\$806.00
	TOTALS			\$164,719.25		\$57,412.90

Statistical analysis of gross revenue and input costs was completed to determine which was a more effective measure of farm size when classifying farmer responses. The hypotheses tested were:

- (1) Gross revenue and input costs are highly correlated.
- (2) Both measures are equally effective in grouping respondents attitudes and purchasing patterns.

To test the first hypothesis, the correlation coefficients between gross revenue and input costs of surveyed farmers were checked. Input costs were then regressed on gross revenue to see how well gross revenue predicted input costs. The regression results are shown in Table B-4.

TABLE B-4. REGRESSION ANALYSIS OF GROSS REVENUE ON INPUT COSTS.

MODEL: INPUT COST = Beta x GROSS REVENUE  
INTERCEPT SET = 0

CORRELATION COEFFICIENT:	0.8101
R-SQUARE:	0.7009
PARAMETER COEFFICIENT (Beta):	0.2130
T-STATISTIC:	38.425

The correlation coefficient (0.8101) indicated high correlation between gross revenue and input costs. The R-square statistic showed that 70% of the variation in total input costs were explained by the variation in gross revenues. The parameter coefficient, Beta, relates gross revenue to input costs. It implies input costs were approximately 21% of gross revenue. The t-statistic tests the null hypothesis that Beta = 0. If the null hypothesis cannot be rejected, correlation between the dependent and independent variable may be small. T-statistics greater than 2.54 are significant at the 5% level. Thus, a t-statistic of 38.425 indicates it was highly unlikely that Beta was actually 0. These results indicated that gross revenue and input costs were, as hypothesized, highly correlated measures of farm size.

To test whether gross revenue was a better measure of farm size than the input costs, farms were divided into size groups. Statistical analysis was then used to show if the grouping of farms by size or the input costs was significant when categorizing farmer's responses to the statements in the third section of the questionnaire. The groupings for gross revenue were similar to groupings used by the 1982 Census of Agriculture [U.S Dept. of Commerce].

#### BUREAU OF CENSUS GROUPINGS

<u>Gross Revenue</u>	<u>Group</u>
\$0 - \$ 2,499	1
\$2,500 - \$19,999	2
\$20,000 - \$39,999	3
\$40,000 - \$99,999	4
\$100,000 +	5

The example farmer on page B-7, with gross revenue of \$164,719.25, would be classified into group 5.

Two groupings were made for input costs. The first followed exactly the group ranges for gross revenue. In this case, lower marginal members of each gross revenue group would most likely be classified into a lower input cost group. In the second case, the size classes were adjusted downward to reflect the generally lower inputs as shown in the regression analysis above. The lower bound of each of the gross revenue classes was multiplied by 0.2130 (the regression coefficient Beta) to generate the new classifications. For example, the lower bound of the second gross revenue group is \$2,500. Thus,  $\$2,500 \times 0.2130 = \$533$ , the lower bound of the second input cost class. The two different input cost classification schemes are shown below:

<u>Input Costs (1)</u>	<u>Group</u>	<u>Input Costs (2)</u>	<u>Group</u>
\$0 - \$ 2,499	1	\$0 - \$ 532	1
\$2,500 - \$19,999	2	\$533 - \$ 4,259	2
\$20,000 - \$39,999	3	\$4,260 - \$ 8,519	3
\$40,000 - \$99,999	4	\$8,520 - \$21,299	4
\$100,000	5	Greater than \$21,300	5

The example farmer, with input costs of \$57,412.90 would be classified into group 4 using the first system and group 5 using the second.

The first classification scheme for input costs clearly moves farmers into lower groups. Frequency distributions of both input cost groupings and the gross revenue groupings are shown in Table B-5 below. Fifteen percent more farms fell into the smallest category using the first measure of input costs, rather than gross revenue. Thus, 16.5% fewer farms were classified in the largest size group. The second scheme for categorizing farms by input costs yields a frequency distribution more like gross revenue. This measure tends to move farms with relatively high input-to-revenue ratios into higher groups and those with low ratios into lower groups.

TABLE B-5. FREQUENCY DISTRIBUTIONS OF FARM SIZE OF SURVEYED FARMERS

MEASURE: SIZE CLASS	GROSS REVENUE		INPUT COST(1)		INPUT COST(2)	
	#	%	#	%	#	%
1	143	21.2%	247	36.6%	118	17.5%
2	195	28.9%	190	28.2%	184	27.3%
3	58	8.6%	55	8.2%	76	11.3%
4	82	12.2%	97	14.4%	66	9.8%
5	196	29.1%	85	12.6%	230	34.1%

Discriminant analysis was performed to further check the usefulness and validity of the classifications. Discriminant analysis [Morrison, 1974] scores the responses to the independent variables (in this case responses to survey questions), and places each observation in the most likely group. The determination of the most likely group is based on the prior probability of being in that group and the generalized squared distance between the groups. If the classification system in use is effective, then few observations will be placed in different groups by discriminant analysis. The discriminant

analysis was implemented by comparing survey responses of farms classified into corresponding size categories, by each of the three measuring schemes. That is, all farms grouped into a size class (eg. large farms--class 5) by the gross revenue measure were compared with all farms grouped into the same class by each of the input cost measures. The results showed that none of the classification schemes used were consistently effective in categorizing the observations over all five size groups.

Discriminant analysis was also conducted within each of the three size classification schemes to indicate how well the farmers grouped responses to the statements from the third section of the survey. The results showed little significant change in the groupings, implying that farm size may not be an important factor in assessing farmer's response to statements about farm supply cooperatives. These results were confirmed by later analysis of variance used to compare response means of farms grouped by gross revenues.

## Appendix C: STATISTICAL ANALYSIS OF FARMER'S ATTITUDES.

Responses were analyzed for the subjective statements in the survey. These are listed in Table C-1.

TABLE C-1. QUESTIONNAIRE STATEMENTS.

- (A) Cooperatives are instrumental in introducing new products and technology to local farmers.
- (B) Cooperatives help their members attain a higher standard of living through increased profits.
- (C) Young farmers should expect to receive as many benefits from cooperatives in the future as others have in the past.
- (D) Cooperatives should discourage large non-member farmers from patronizing the cooperative.
- (E) Members generally benefit by patronage refunds of cooperatives.
- (F) Cooperatives generally are not managed efficiently.
- (G) Farmers would generally pay higher prices for supplies if it were not for competition from cooperatives.
- (H) Cooperatives should encourage patronage by small non-member farmers.
- (I) There are few significant differences between cooperatives and other competing businesses.
- (J) Cooperative prices for services and products should be the same regardless of quantities purchased.
- (K) Generally cooperative members should patronize their cooperatives even if they pay higher prices than at other competing businesses.
- (L) Oregon cooperatives are no longer serving small farmer's needs adequately.
- (M) It would be better to have lower co-op prices instead of:
  - (1) good service.
  - (2) patronage refunds.
  - (3) cooperative principles.
  - (4) easy credit.
- (N) Cooperatives would get more patronage if they:
  - (1) located closer to other shopping needs.
  - (2) lowered membership requirements.
  - (3) lowered patronage refund revolve time.
  - (4) had more advertising.
  - (5) hired friendlier personnel.
  - (6) were more competitively priced.
- (O) Cooperatives offer better service than other competing businesses.
- (P) Cooperative managers and board members care more about the cooperative's survival than member's needs.
- (Q) Most cooperative members are not very informed about the operation of their cooperative.
- (R) Cooperatives should seek the membership of large farms over the membership of small farmers.

Managers' responses were compared with farmers'. Farmers were grouped by age, cooperative membership status, and farm size. Mean responses were calculated. In addition an analysis of variance (ANOVA) was conducted using Tukey's studentized range test to discover differences in mean response between groups. Tukey's test controls the type 1 experiment error rate (i.e., the false rejection of the null hypothesis (mean responses are equal) [Morrison, 1967]). Tables C-2, C-3, C-4, and C-5 show the ANOVA results. Each table lists mean responses to the statements in Table C-1. The number of observations in each group is shown below the group heading. The tables also show the probability of the true mean being neutral (i.e., 3), had a large enough sample been used. The probabilities are derived from T-statistics reflecting the standard deviation and the number of respondents. Probabilities less than .05 are considered significantly different from neutral. The tables also note significant differences and opposite mean responses between groups. Answers were considered opposites if one or more of the groups showed opposite mean responses significantly different than neutral.

TABLE C-2. MEAN RESPONSES OF CO-OP MANAGERS AND ALL FARMERS.

Statement	MANAGERS N=13		FARMERS N=674		Significant Difference Between Groups	Opposites
	Mean	Prob.	Mean	Prob.		
A	1.46	0.0001	2.62	0.0001	Yes	
B	2.62	0.0544	2.94	0.1397		
C	2.38	0.0876	2.55	0.0001		
D	4.46	0.0001	3.70	0.0001	Yes	
E	2.38	0.0550	2.70	0.0001		
F	3.54	0.0279	2.68	0.0001	Yes	Yes
G	2.08	0.0160	2.81	0.0001	Yes	
H	1.69	0.0001	2.03	0.0001		
I	3.23	0.4608	2.56	0.0001	Yes	
J	4.08	0.0028	3.19	0.0001	Yes	
K	2.62	0.0961	4.01	0.0001	Yes	
L	3.77	0.0001	2.85	0.0001	Yes	Yes
M1	4.00	0.0003	3.59	0.0001		
M2	2.62	0.1745	2.54	0.0001		
M3	3.69	0.0128	3.06	0.1344	Yes	
M4	4.00	0.0255	2.75	0.0001	Yes	Yes
N1	2.54	0.0821	2.93	0.0595		
N2	3.54	0.0279	3.13	0.0002		
N3	2.31	0.0061	2.77	0.0001		
N4	2.31	0.0002	2.71	0.0001		
N5	2.38	0.0136	2.90	0.0059	Yes	
N6	1.92	0.0001	1.98	0.0001		
O	2.69	0.3033	3.26	0.0001	Yes	
P	3.08	0.7533	2.60	0.0001		
Q	2.15	0.0053	2.40	0.0001		
R	3.31	0.2643	3.84	0.0001	Yes	

TABLE C-3. MEAN RESPONSES OF MEMBER FARMERS AND NON-MEMBER FARMERS.

Statement	Non-members N=186		Members N=449		Significant Difference Between Groups	Opposites
	Mean	Prob.	Mean	Prob.		
A	2.81	0.0036	2.54	0.0001	Yes	
B	2.98	0.8203	2.93	0.1418		
C	2.66	0.0001	2.51	0.0001		
D	3.56	0.0001	3.82	0.0001	Yes	
E	2.68	0.0001	2.70	0.0001		
F	2.65	0.0001	2.70	0.0001	Yes	
G	2.86	0.0604	2.76	0.0001	Yes	
H	2.15	0.0001	2.00	0.0001		
I	2.50	0.0001	2.57	0.0001	Yes	
J	3.13	0.1294	3.21	0.0004	Yes	
K	3.97	0.0001	4.00	0.0001	Yes	
L	2.49	0.0001	3.00	0.9635	Yes	
M1	3.43	0.0001	3.69	0.0001		
M2	2.49	0.0001	2.57	0.0001		
M3	2.96	0.5945	3.10	0.0456	Yes	
M4	2.69	0.0001	2.77	0.0001	Yes	
N1	2.78	0.0007	2.99	0.7536		
N2	2.76	0.0001	3.29	0.0001		Yes
N3	2.74	0.0001	2.80	0.0001		
N4	2.71	0.0001	2.71	0.0001		
N5	2.91	0.1805	2.89	0.0229	Yes	
N6	2.14	0.0001	1.92	0.0001		
O	3.33	0.0001	3.22	0.0001	Yes	
P	2.54	0.0001	2.62	0.0001		
Q	2.46	0.0001	2.39	0.0001		
R	3.74	0.0001	3.88	0.0001	Yes	

TABLE C-4. MEAN RESPONSES OF FARMERS GROUPED BY FARM SIZE (GROSS REVENUE).

Statement	--Class 1-- N=143		--Class 2-- N=195		--Class 3-- N=58		--Class 4-- N=82		--Class 5-- N=196		Significant Difference Between Groups	Opposites <sup>1</sup>
	Mean	Prob.	Mean	Prob.	Mean	Prob.	Mean	Prob.	Mean	Prob.		
A	2.55	0.0001	2.53	0.0001	2.66	0.0125	2.64	0.0010	2.75	0.0004		
B	2.79	0.0074	2.80	0.0055	2.95	0.6997	3.17	0.1455	3.09	0.2706		
C	2.52	0.0001	2.40	0.0001	2.63	0.0153	2.62	0.0033	2.66	0.0001		
D	3.57	0.0001	3.63	0.0001	3.59	0.0001	3.69	0.0001	3.91	0.0001		
E	2.65	0.0001	2.62	0.0001	2.59	0.0024	2.89	0.3080	2.76	0.0021		
F	2.74	0.0009	2.74	0.0003	2.71	0.0410	2.70	0.0072	2.57	0.0001		
G	2.63	0.0001	2.71	0.0004	2.83	0.2419	2.94	0.6218	2.97	0.7291		
H	1.91	0.0001	2.01	0.0001	2.05	0.0001	2.07	0.0001	2.12	0.0001		
I	2.63	0.0001	2.58	0.0001	2.45	0.0001	2.47	0.0001	2.57	0.0001		
J	3.15	0.1601	3.17	0.0495	2.76	0.1547	3.38	0.0039	3.30	0.0009		
K	3.87	0.0001	4.01	0.0001	3.98	0.0001	4.04	0.0001	4.10	0.0001		
L	2.77	0.0020	2.72	0.0003	2.68	0.0378	2.80	0.0845	3.09	0.2151		
M1	3.61	0.0001	3.54	0.0001	3.64	0.0001	3.51	0.0001	3.66	0.0001		
M2	2.52	0.0001	2.50	0.0001	2.65	0.0338	2.43	0.0001	2.59	0.0001		
M3	3.02	0.8535	3.02	0.7666	3.20	0.1468	3.08	0.4344	3.07	0.3157		
M4	2.68	0.0009	2.72	0.0027	2.93	0.6589	2.76	0.0803	2.75	0.0036		
N1	2.77	0.0027	2.87	0.0733	3.04	0.7883	3.15	0.1391	2.98	0.8040	1-4	
N2	2.94	0.4163	2.99	0.9345	3.11	0.4277	3.32	0.0006	3.32	0.0001	1-4; 1-5; 2-4; 2-5	
N3	2.77	0.0022	2.78	0.0011	2.67	0.0147	2.84	0.1528	2.76	0.0003		
N4	2.52	0.0001	2.65	0.0001	2.63	0.0097	2.81	0.0609	2.90	0.0893	1-5	
N5	2.92	0.2451	2.89	0.1231	2.79	0.1680	3.14	0.1807	2.82	0.0092		
N6	2.04	0.0001	1.96	0.0001	1.98	0.0001	2.02	0.0001	1.95	0.0001		
O	3.06	0.4635	3.23	0.0015	3.02	0.9116	3.37	0.0003	3.47	0.0001	1-5	
P	2.56	0.0001	2.60	0.0001	2.52	0.0005	2.57	0.0001	2.65	0.0001		
Q	2.42	0.0001	2.32	0.0001	2.30	0.0001	2.55	0.0001	2.44	0.0001		
R	3.80	0.0001	3.93	0.0001	4.16	0.0001	3.86	0.0001	3.69	0.0001	3-5	

Farm size (gross revenue) classes:

Class 1: \$0 - \$ 2,499

Class 2: \$2,500 - \$19,999

Class 3: \$20,000 - \$39,999

Class 4: \$40,000 - \$99,999

Class 5: greater than \$100,000

<sup>1</sup>There were no farm size groups with significantly opposite means.

TABLE C-5. MEAN RESPONSES OF FARMERS GROUPED BY AGE.

Statement	A < 30 Years N = 32		B 30-39 Yrs N = 121		C 40-49 Yrs N = 146		D 50-59 Yrs N = 165		E 60-69 Yrs N = 150		F 70 Years N = 60		Significant Difference Between Groups
	Mean	Prob.	Mean	Prob.									
<u>Opposites</u>													
A	2.76	0.1474	2.92	0.3194	2.78	0.0041	2.49	0.0001	2.48	0.0001	2.32	0.0001	BD BE BF CD CE
B	3.14	0.4424	3.42	0.0001	2.99	0.8625	2.82	0.0241	2.74	0.0018	2.64	0.0154	BC BD BE BF
C	2.45	0.0088	2.87	0.2111	2.77	0.0116	2.47	0.0001	2.36	0.0001	2.10	0.0001	BD BE BF CE CF
D	3.69	0.0013	3.87	0.0001	3.71	0.0001	3.75	0.0001	3.66	0.0001	3.32	0.0154	
E	2.52	0.0008	3.08	0.3553	2.89	0.1864	2.49	0.0001	2.54	0.0001	2.51	0.0002	BD BE BF CD CE
F	2.90	0.6303	2.64	0.0002	2.67	0.0001	2.65	0.0001	2.66	0.0001	2.90	0.4356	
G	3.07	0.7303	3.14	0.1703	3.01	0.8903	2.73	0.0028	2.57	0.0001	2.33	0.0001	BD BE BF CF
H	2.07	0.0001	2.08	0.0001	2.05	0.0001	2.04	0.0001	2.04	0.0001	1.85	0.0001	
I	2.48	0.0008	2.61	0.0001	2.61	0.0001	2.66	0.0001	2.42	0.0001	2.46	0.0001	
J	2.93	0.7381	3.59	0.0001	3.41	0.0001	3.15	0.1217	3.03	0.7956	2.55	0.0051	BE BF CF DF EF
K	4.10	0.0001	4.22	0.0001	4.17	0.0001	4.04	0.0001	3.79	0.0001	3.59	0.0001	BE BF CE CF
L	2.83	0.3784	2.83	0.0911	2.70	0.0010	2.89	0.1554	2.94	0.4716	2.88	0.3114	
M1	3.74	0.0001	3.97	0.0001	3.65	0.0001	3.59	0.0001	3.33	0.0006	3.27	0.0581	BD BE BF CE CF
M2	2.66	0.0961	2.58	0.0001	2.42	0.0001	2.68	0.0005	2.46	0.0001	2.47	0.0002	
M3	2.96	0.8392	3.06	0.5049	3.00	1.0000	3.20	0.0052	2.99	0.9302	3.00	1.0000	
M4	2.62	0.0857	2.76	0.0282	2.66	0.0006	2.77	0.0136	2.66	0.0013	3.13	0.4301	
N1	3.04	0.8017	3.08	0.3728	2.94	0.4596	2.94	0.3785	2.84	0.0580	2.74	0.0217	
N2	3.30	0.0296	3.28	0.0002	3.09	0.2425	3.18	0.0121	3.02	0.7789	2.95	0.6515	
N3	2.68	0.0474	2.95	0.5247	2.83	0.0253	2.63	0.0001	2.79	0.0079	2.62	0.0031	
N4	2.43	0.0001	2.75	0.0029	2.68	0.0001	2.79	0.0032	2.72	0.0009	2.64	0.0045	
N5	2.89	0.4773	2.91	0.2940	3.02	0.7642	2.95	0.5263	2.80	0.0191	2.65	0.0207	
N6	1.90	0.0001	1.87	0.0001	1.96	0.0001	1.99	0.0001	2.09	0.0001	2.07	0.0001	
O	3.34	0.0572	3.41	0.0001	3.36	0.0001	3.27	0.0005	3.18	0.0286	2.90	0.4434	
P	2.45	0.0020	2.63	0.0001	2.52	0.0001	2.61	0.0001	2.62	0.0001	2.70	0.0083	
Q	2.38	0.0006	2.41	0.0001	2.34	0.0001	2.42	0.0001	2.46	0.0001	2.35	0.0001	
R	3.79	0.0005	3.81	0.0001	3.76	0.0001	3.84	0.0001	3.95	0.0001	3.88	0.0001	

## Appendix D: STATISTICAL ANALYSIS OF CO-OP PATRONAGE

## CALCULATION OF PETROLEUM, FERTILIZER AND COMBINED INPUT PERCENTAGES.

Diesel for fuel and oil/lubricants were weighted according to the use proportions outlined in "The Cost of Owning and Operating Farm Machinery" [Washington State University Cooperative Extension]. Specifically, oil and lubricants were assumed to be 13% of total petroleum use. For example, assume a farmer reports purchasing 45% of the farm's diesel fuel and 80% of its oil and lubricants at the co-op. The percentage of total petroleum purchases would be computed as follows:

$$\begin{aligned} (\text{Diesel} \times \text{proportion}) + (\text{oil} \times \text{proportion}) &= \text{PETROL}\%. \\ (.45 \times .87) + (.80 \times .13) &= 49.6\% \end{aligned}$$

Farm size was assumed to dictate the proportions of bagged dry, bulk dry, and liquid fertilizers used. Smaller farms would utilize higher proportions of bagged (bg) fertilizers, while larger farms would use more bulk dry (bu) and liquid (l) fertilizers. To validate the assumptions, and quantify proportions, a second questionnaire was mailed to cooperative managers in July 1986 (Appendix A). Managers were asked to list dollar amounts of each type of fertilizer sold, and to estimate the percentages purchased by farmers in different size categories. The formula for the fertilizer proportions was:

$$W_{ij} = \frac{S_{ij}}{\text{Sum of } S_{ij}} : \begin{array}{l} i = \text{fertilizer type \{bg, bu, l\}} \\ j = \text{farm size \{1, 2, 3, 4, 5\}} \end{array}$$

For example, the weight assigned to bagged fertilizer for gross revenue class 1 equals the estimated co-op sales of bagged fertilizer to class 1, farms divided by the total of co-op fertilizer sales to class 1. The estimated sales of the three types of fertilizers for surveyed cooperatives for each gross revenue class, and the computed proportions are shown in Table D-1.

TABLE D-1. ESTIMATED FERTILIZER SALES OF SURVEYED COOPERATIVES (\$1,000).

Type of Fertilizer	Class 1		Class 2		Class 3		Class 4		Class 5	
	Sales	Weight	Sales	Weight	Sales	Weight	Sales	Weight	Sales	Weight
Bagged Dry	316.50	72.09%	310.00	43.65%	334.70	25.84%	282.70	12.19%	152.10	3.28%
Bulk Dry	115.90	26.40%	345.42	48.64%	744.72	57.49%	1,660.00	71.56%	3,588.96	77.41%
Liquid	6.65	1.51%	54.79	7.71%	215.94	16.67%	377.01	16.25%	895.52	19.31%
All Fertilizer	439.05	100.00%	710.21	100.00%	1,295.36	100.00%	2,319.71	100.00%	4,636.58	100.00%

Using these weights the percentage of fertilizer purchased at cooperatives was calculated for each of the surveyed farmers as follows:

$$\text{FERT}\% = (P_{bg} \times W_{bgj}) + (P_{bu} \times W_{buj}) + (P_l \times W_{lj})$$

where the P(s) are percents of fertilizer types purchased at co-ops by the individual. For example: assume a farmer stated purchases of 70%, 100%, and 10% respectively, for bagged, bulk, and liquid fertilizers. Further assume the farmers estimated gross revenue was \$57,074. The farm would be classified as Class 4, and employ the fertilizer use proportions from the fifth column of table D-1. Therefore the farmers fertilizer % would be calculated as follows:

$$\begin{aligned} (P_{bg} \times W_{bgj}) + (P_{bu} \times W_{buj}) + (P_l \times W_{lj}) &= \text{FERT}\% \\ (.70 \times .122) + (1.0 \times .716) + (.10 \times .163) &= 81.8\% \end{aligned}$$

Combined input purchases were computed using a weighted average of stated patronage percents. The formula was:

$$I = [\text{sum}(P_i * C_i)] / \text{sum } C_i, \text{ where } i = \{\text{petroleum, fertilizer, ..., feed}\}$$

Thus, the combined input percent equals the stated purchase percents multiplied by the potential costs, summed over the six input types. All this is then divided by the total potential input cost. Potential input purchases were calculated from per acre estimates in Table B-2 for each crop reported.

## FREQUENCY DISTRIBUTIONS AND HISTOGRAMS OF CO-OP PATRONAGE

TABLE D-2. FREQUENCIES OF ALL FARMERS PURCHASES OF INPUTS AT GIVEN LEVELS.

PURCHASE LEVEL	PETROLEUM		PESTICIDES		FERTILIZER		SERVICES		SEED		FEED		ALL INPUTS	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0%	381	59.2%	219	34.0%	277	43.0%	555	86.2%	367	57.0%	398	61.8%	176	29.1%
10%	52	8.1%	69	10.7%	34	5.3%	36	5.6%	60	9.3%	60	9.3%	69	11.4%
20%	7	1.1%	23	3.6%	35	5.4%	14	2.2%	35	5.4%	15	2.3%	84	13.9%
30%	4	0.6%	21	3.3%	23	3.6%	5	0.8%	13	2.0%	19	3.0%	70	11.6%
40%	8	1.2%	7	1.1%	66	10.2%	5	0.8%	8	1.2%	9	1.4%	49	8.1%
50%	8	1.2%	53	8.2%	30	4.7%	16	2.5%	35	5.4%	29	4.5%	35	5.8%
60%	6	0.9%	7	1.1%	11	1.7%	0	0.0%	5	0.8%	9	1.4%	46	7.6%
70%	5	0.8%	7	1.1%	36	5.6%	1	0.2%	9	1.4%	10	1.6%	36	6.0%
80%	12	1.9%	34	5.3%	35	5.4%	6	0.9%	12	1.9%	7	1.1%	18	3.0%
90%	65	10.1%	20	3.1%	31	4.8%	2	0.3%	16	2.5%	12	1.9%	17	2.8%
100%	96	14.9%	184	28.6%	66	10.2%	4	0.6%	84	13.0%	76	11.8%	4	0.7%

TABLE D-3. FREQUENCIES OF NON-MEMBER PURCHASES OF INPUTS AT GIVEN LEVELS.

PURCHASE LEVEL	PETROLEUM		PESTICIDES		FERTILIZER		SERVICES		SEED		FEED		ALL INPUTS	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0%	145	87.9%	97	58.8%	105	63.6%	158	95.8%	125	75.8%	119	72.1%	85	56.7%
10%	8	4.8%	16	9.7%	8	4.8%	1	0.6%	8	4.8%	13	7.9%	14	9.3%
20%	0	0.0%	5	3.0%	8	4.8%	1	0.6%	7	4.2%	1	0.6%	14	9.3%
30%	1	0.6%	1	0.6%	3	1.8%	0	0.0%	1	0.6%	5	3.0%	11	7.3%
40%	0	0.0%	0	0.0%	10	6.1%	1	0.6%	2	1.2%	3	1.8%	9	6.0%
50%	1	0.6%	7	4.2%	7	4.2%	3	1.8%	7	4.2%	10	6.1%	4	2.7%
60%	1	0.6%	0	0.0%	3	1.8%	0	0.0%	1	0.6%	1	0.6%	7	4.7%
70%	1	0.6%	1	0.6%	8	4.8%	0	0.0%	0	0.0%	1	0.6%	3	2.0%
80%	1	0.6%	4	2.4%	5	3.0%	0	0.0%	1	0.6%	0	0.0%	1	0.7%
90%	5	3.0%	3	1.8%	4	2.4%	0	0.0%	2	1.2%	3	1.8%	1	0.7%
100%	2	1.2%	31	18.8%	4	2.4%	1	0.6%	11	6.7%	9	5.5%	1	0.7%

TABLE D-4. FREQUENCIES OF MEMBER PURCHASES OF INPUTS AT GIVEN LEVELS.

PURCHASE LEVEL	PETROLEUM		PESTICIDES		FERTILIZER		SERVICES		SEED		FEED		ALL INPUTS	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0%	209	47.4%	107	24.3%	153	34.7%	363	82.3%	218	49.4%	255	57.8%	82	19.5%
10%	43	9.8%	49	11.1%	25	5.7%	32	7.3%	48	10.9%	45	10.2%	51	12.1%
20%	6	1.4%	17	3.9%	26	5.9%	13	2.9%	28	6.3%	14	3.2%	66	15.7%
30%	2	0.5%	18	4.1%	20	4.5%	5	1.1%	9	2.0%	13	2.9%	56	13.3%
40%	7	1.6%	7	1.6%	49	11.1%	4	0.9%	6	1.4%	6	1.4%	35	8.3%
50%	7	1.6%	43	9.8%	22	5.0%	13	2.9%	27	6.1%	16	3.6%	26	6.2%
60%	5	1.1%	7	1.6%	8	1.8%	0	0.0%	4	0.9%	7	1.6%	39	9.3%
70%	4	0.9%	6	1.4%	25	5.7%	1	0.2%	9	2.0%	9	2.0%	31	7.4%
80%	11	2.5%	25	5.7%	28	6.3%	5	1.1%	11	2.5%	7	1.6%	17	4.0%
90%	58	13.2%	17	3.9%	24	5.4%	2	0.5%	12	2.7%	7	1.6%	15	3.6%
100%	89	20.2%	145	32.9%	61	13.8%	3	0.7%	69	15.6%	62	14.1%	3	0.7%

Figure D-1: Frequency distributions of combined purchases of all inputs.

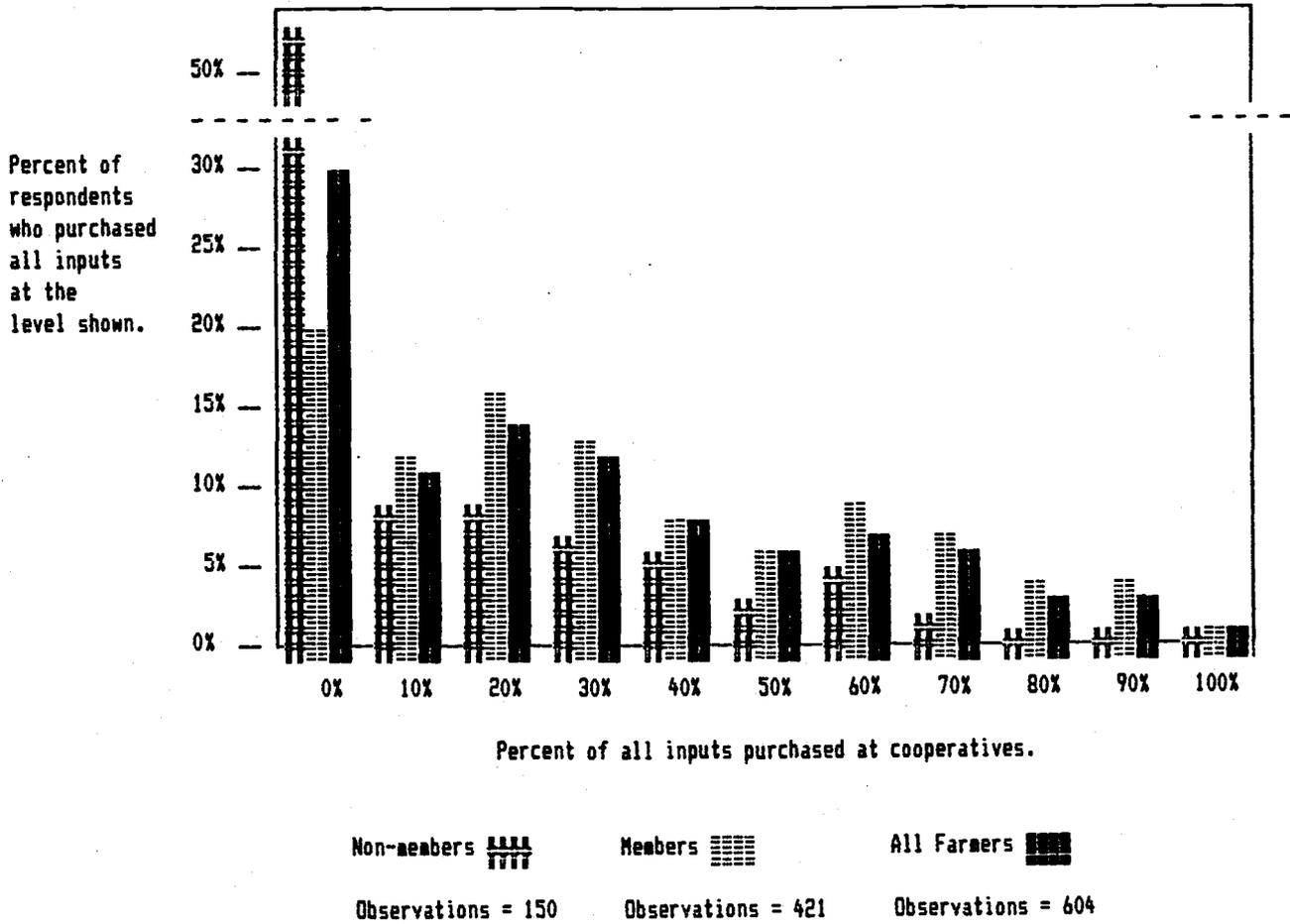


Figure D-2: Frequency distributions of reported petroleum purchases.

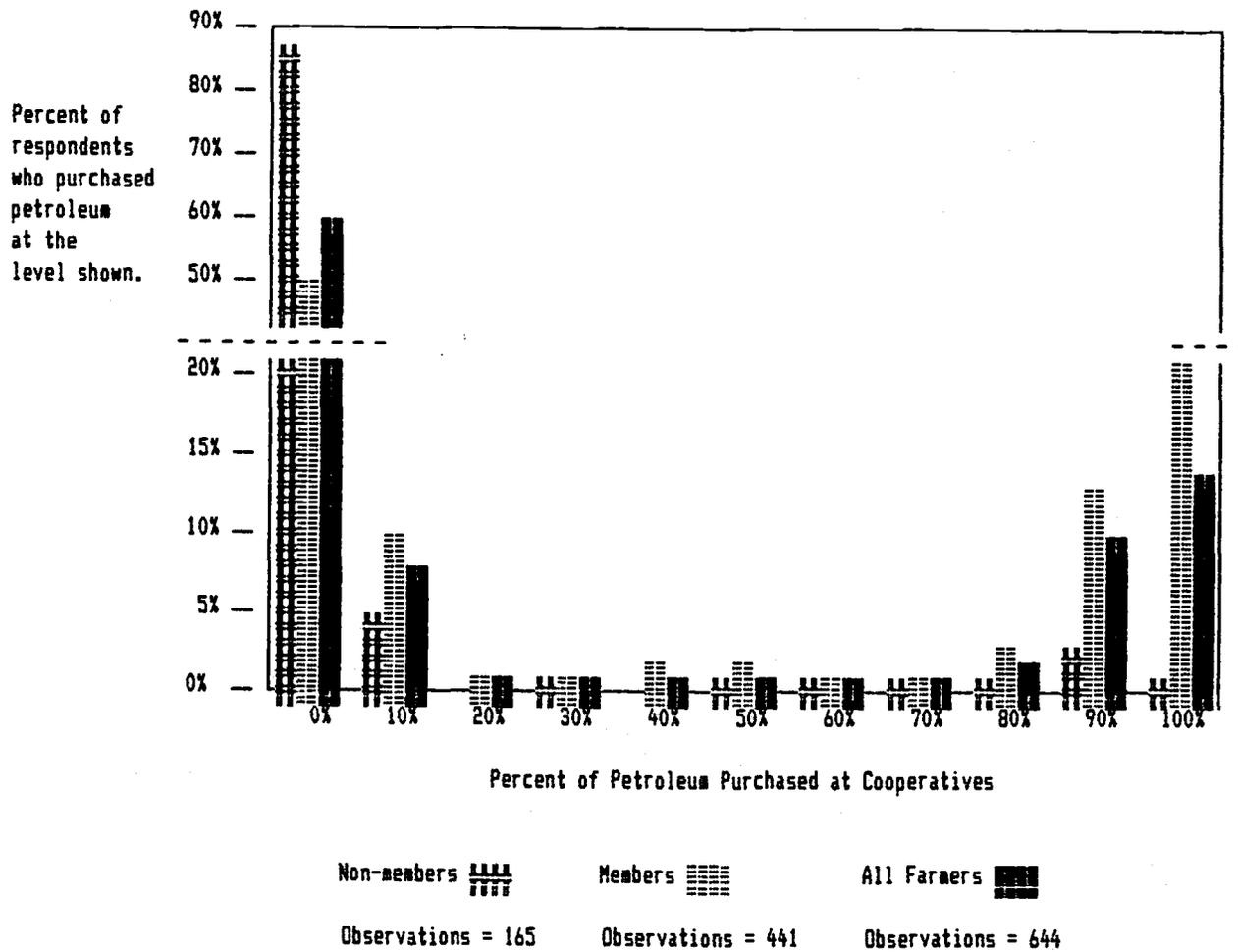


Figure D-3: Frequency distributions of reported pesticide purchases.

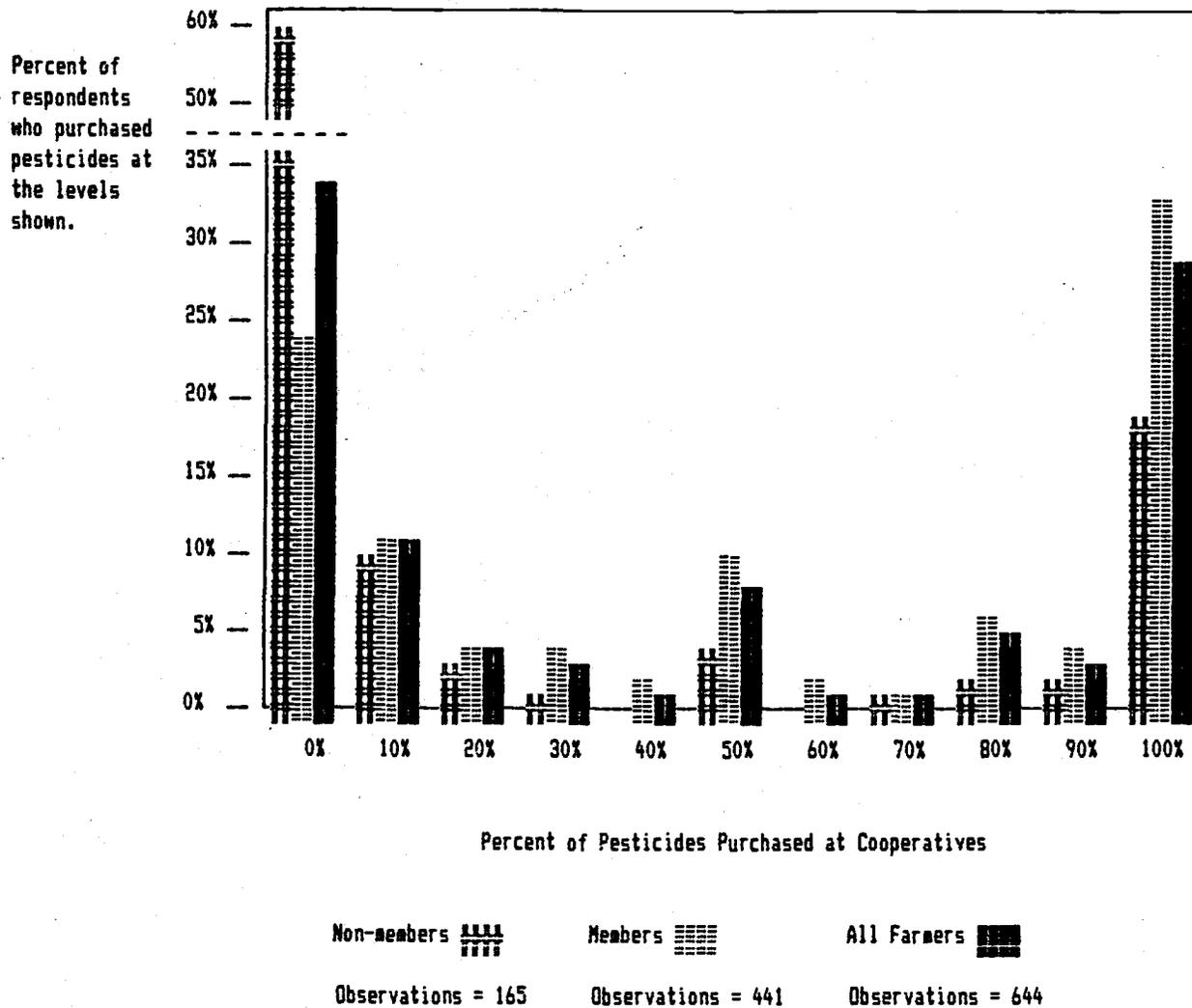


Figure D-4: Frequency distributions of reported fertilizer purchases.

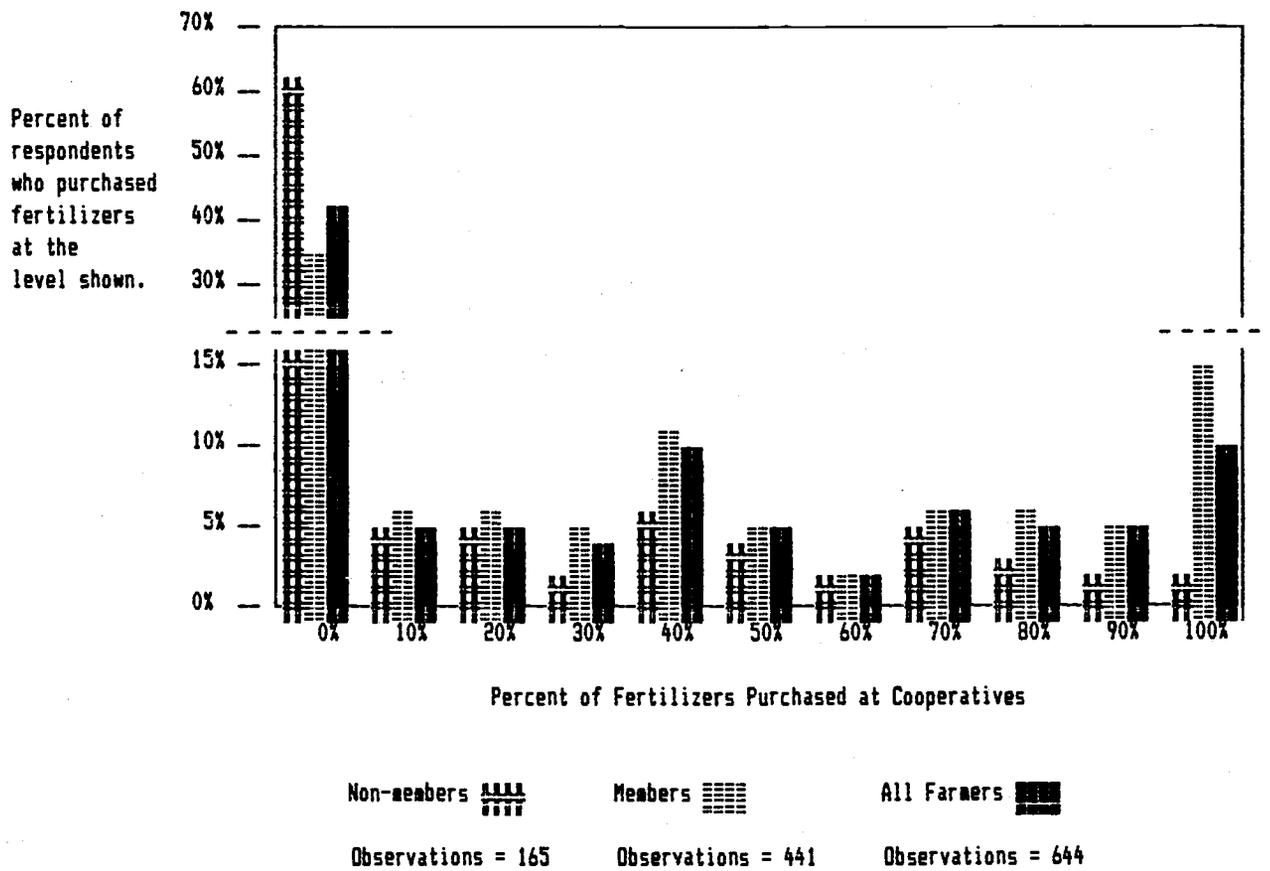


Figure D-5: Frequency distributions of reported service purchases.

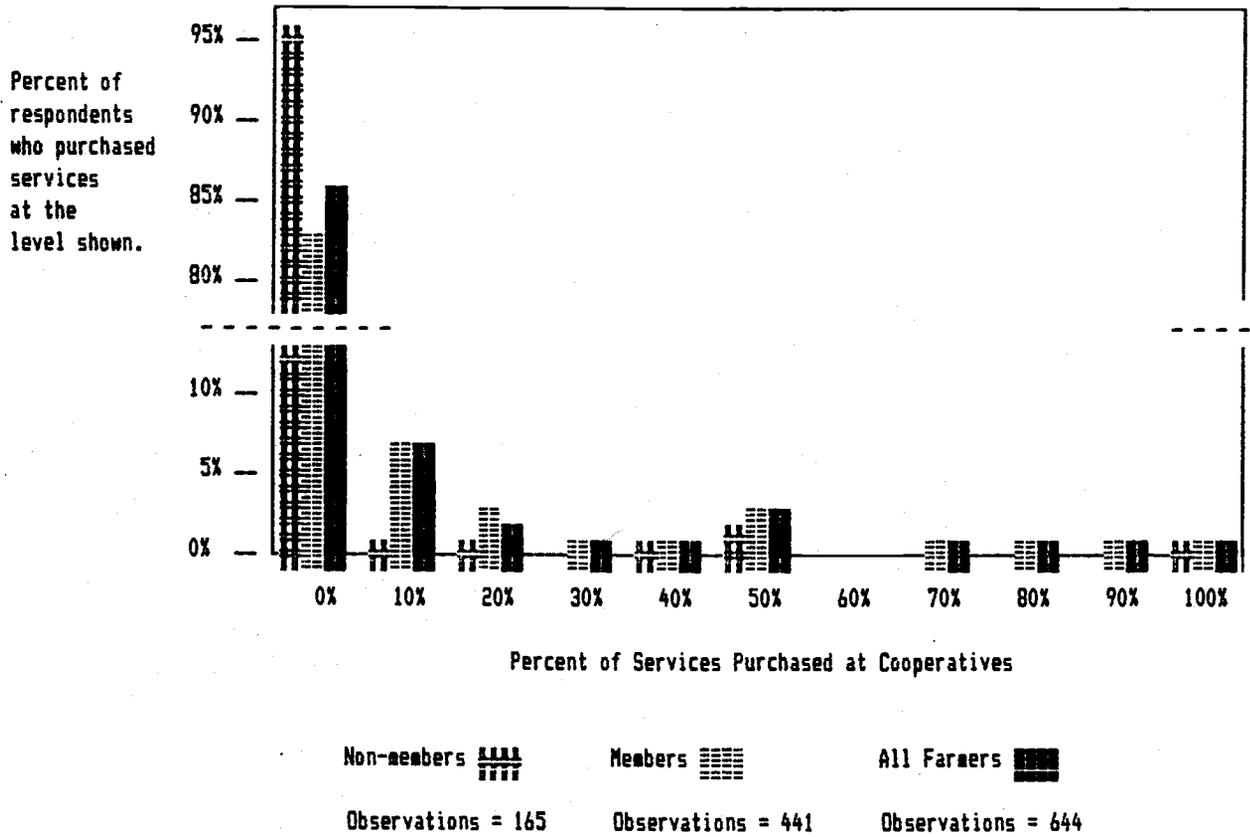


Figure D-6: Frequency distributions of reported seed purchases.

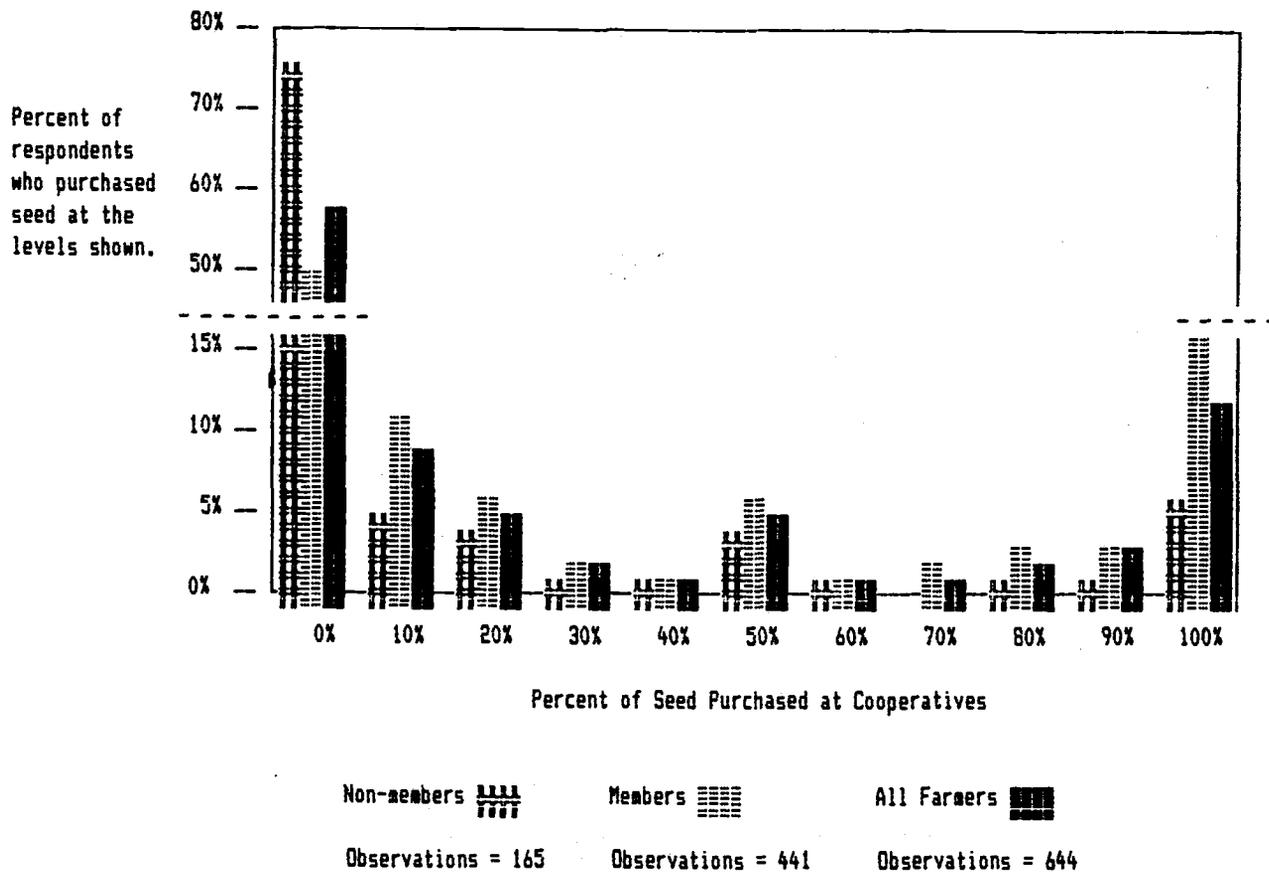
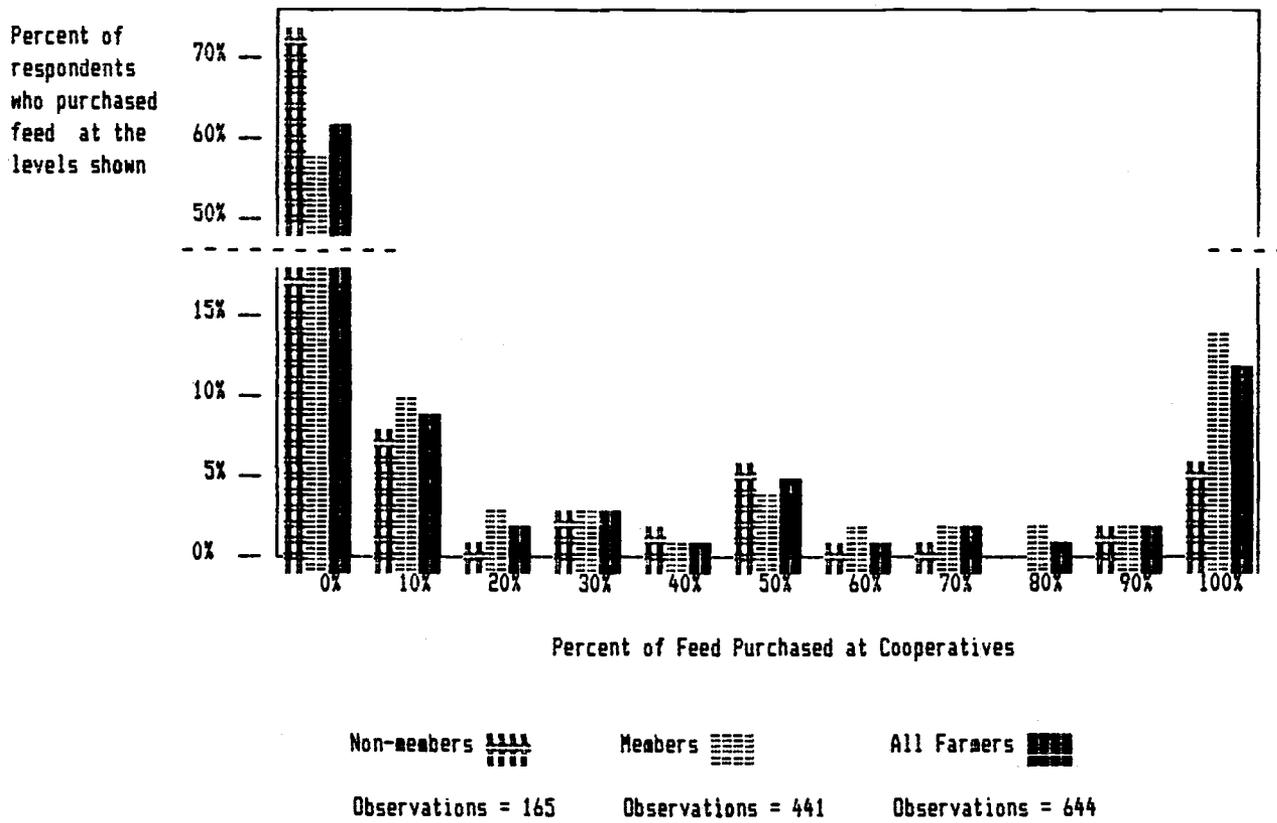


Figure D-7: Frequency distributions of reported feed purchases.



## REGRESSION ANALYSIS OF PATRONAGE LEVELS

Regression analysis was used to examine the effects of age and gross revenue differences among farmers. A summary of the analysis is found in Table D-6. Regression analysis was performed on transformed percentages to correct for estimation bias. A logit transformation of the form was used:

$$TP_{ij} = \ln(P_{ij}/1-P_{ij}), \quad i = \{\text{TOTAL, PETROLEUM, \dots, FEED}\} \text{ and } j = \{\text{farmers}\},$$

where the  $TP_i$ 's are the transformed percentage values.

The models estimated were of the form:

$$TP_i = \text{Beta}_1 + \text{Beta}_2 (\text{Membership}) + \text{Beta}_3 (\text{Age}) + \text{Beta}_4 (\text{Gross Revenue}\backslash\$1,000) + v_i.$$

Predicted values may be transformed to percentages as follows:

$$P_i = 1/(1+e^{-X(\text{Theta})}), \text{ where } X(\text{Theta}) = \text{Beta}_1 + \text{Beta}_2 (\text{Membership}) + \text{Beta}_3 (\text{Age}) + \text{Beta}_4 (\text{Gross Revenue}\backslash1000).$$

The following should also be noted:

- (1) Age and gross revenue were not classified into groups as was done in other analyses.
- (2) Gross revenue was scaled to \$1,000's.
- (3) Probability greater than the probability of the Beta's being different from zero, are given in parentheses below the coefficients. Probabilities less than .05 were considered to be significant.
- (4) The R-Square value in the right column, shows the effectiveness of the models. R-square is calculated dividing the regression sum of squares by total sum of squares. Models with high R-squares explain more of the variation in the dependent variables.

The regression coefficients were difficult to interpret because of the data transformations required for regression analysis on percentage figures. The signs on the regression coefficients are, however, easily interpreted. Positive coefficients indicate that an increase in the independent variable will produce a higher predicted level of patronage. Increasing an independent variable with a corresponding negative coefficient will decrease the predicted purchase percentage.

TABLE 0-6. REGRESSION ANALYSIS OF FARMER'S PURCHASE PERCENTS.

PERCENT OF PURCHASES MADE AT CO-OPS	REGRESSION COEFFICIENTS				REGRES. SUM OF SQUARES	ERROR SUM OF SQUARES	TOTAL SUM OF SQUARES	R-SQUARE
	Beta <sub>1</sub> INTERCEPT	Beta <sub>2</sub> MEMBERSHIP STATUS	Beta <sub>3</sub> AGE OF FARMER	Beta <sub>4</sub> GROSS REVENUE				
TOTAL	-6.2490 (0.0001)	3.7858 (0.0001)	0.0155 (0.2066)	-0.0005 (0.1859)	1649.82	7892.99	9542.80	0.1729
PETROLEUM	-8.8375 (0.0001)	5.0065 (0.0001)	-0.0114 (0.5285)	0.0000 (0.9415)	2744.58	16952.89	19697.47	0.1393
PESTICIDES	-7.7670 (0.0001)	3.7677 (0.0001)	0.0211 (0.2173)	-0.0004 (0.4647)	1655.41	15236.28	16891.69	0.0980
FERTILIZER	-8.2540 (0.0001)	3.8305 (0.0001)	0.0322 (0.1018)	-0.0006 (0.3254)	1805.37	20232.10	22038.37	0.0819
SERVICES	-10.1418 (0.0001)	1.2961 (0.0002)	-0.0174 (0.1363)	0.0000 (0.9596)	202.37	7110.29	7312.66	0.0277
SEED	-8.0665 (0.0001)	2.8210 (0.0001)	-0.0112 (0.5281)	-0.0008 (0.1221)	931.64	16428.59	17360.23	0.0537
FEED	-6.1517 (0.0001)	1.5680 (0.0023)	-0.0387 (0.0279)	-0.0015 (0.0048)	593.99	16093.01	16687.00	0.0356

Prior to regression analysis, the intercept terms were expected to be insignificant. In addition positive coefficients were expected for membership status and age, whereas a negative coefficient was expected for gross revenue. These expectations arose from hypotheses about the significance of membership status, the loyalty of older farmers, and ability and willingness of larger farmers to find and acquire lower prices for large quantity purchases.

The results of the regressions were not entirely as expected. The intercept terms were negative and highly significant in all seven models. This may be interpreted as evidence of the failings of the regressors (membership, age, and gross revenue) to explain much of the variability in the patronage levels. The significance and negativity of the sign may be partially explained by the large numbers of farmers reporting no patronage at the cooperatives. The models also exhibited very low  $R^2$  statistics for each of the input class models. Clustering about a zero response may account for this.

The coefficient on membership status was, as expected, positive and highly significant in all cases. Coefficients on age and gross revenue were not significantly different from zero in most cases. The exception was in feed purchases. Because of the apparent lack of significance of

age and gross revenue in predicting patronage levels, interpretation of the coefficient's sign was unnecessary. In the case of feed purchase percentages, all regressors were found to be significant at the .05 level. The feed model as a whole however performed quite poorly, explaining only 3% of the variation of the patronage levels ( $R^2 = 0.0356$ ).

#### ANALYSIS OF VARIANCE

Analysis of variance (ANOVA) and pair-wise comparisons were used to examine mean patronage levels for inputs and to examine the effects of membership status on patronage. Table D-7 lists the mean patronage levels of all farmers, and non-members and members separately, for the six input categories. Table D-7 also shows analysis of variance results testing the hypothesis that patronage levels for non-members and members were no different.

TABLE D-7. MEANS OF ALL FARMERS PURCHASE PERCENTS AND ANOVA BETWEEN MEMBERS AND NON-MEMBERS.

PERCENT OF PURCHASES MADE AT CO-OPS	ALL FARMERS N=606 MEAN	NON MEMBERS N=165 MEAN	MEMBERS N=441 MEAN	ANALYSIS OF VARIANCE				
				MODEL SUM OF SQUARES	ERROR SUM OF SQUARES	TOTAL SUM OF SQUARES	F-VALUE	PROB GTR THAN F
TOTAL	0.28	0.15	0.33	3.5642	37.3314	40.8956	54.33	0.0001
PETROLEUM	0.29	0.06	0.38	12.0376	88.2081	100.2456	77.65	0.0002
PESTICIDES	0.44	0.26	0.51	5.9371	101.3859	107.3230	33.32	0.0001
FERTILIZER	0.34	0.18	0.39	4.5839	73.3284	77.9123	35.57	0.0001
SERVICES	0.05	0.02	0.05	0.1130	12.8801	12.9932	4.99	0.0258
SEED	0.24	0.13	0.28	2.2028	75.0963	77.2991	16.69	0.0001
FEED	0.21	0.13	0.24	1.0300	71.6712	72.7011	8.19	0.0044

The 'F-VALUE' and 'PROB Greater than F' indicate how well the model explains variations in patronage levels. In this model, an F-VALUE greater than 3.9 will yield a PROB Greater than F smaller than 0.05, indicating the independent variable (membership status) explains a significant amount of the variation in patronage levels.

Analysis of variance results in Table D-7 indicated all mean patronage percents were significantly different from zero at the .05 level. ANOVA also allowed rejection of the null hypothesis of equal mean patronage levels between members and non-members. As expected for all input categories, member patronage was greater than non-member patronage. Farmers with high purchase levels at cooperatives could only realize benefits from patronage refunds by becoming members.

Pair-wise comparisons of the means, shown in Table D-8, used t-tests to determine whether the patronage levels for each input group were significantly different from other inputs for a given membership status. The table shows most differences between means for both members and non-members to be significant at the .05 level. Exceptions were found only when comparing the mean patronage level of seed and feed for non-members, and between petroleum and fertilizer for members.

From Tables D-7 & D-8, one can conclude that cooperatives held a relatively strong market position in pesticides for both members and non-members. Fertilizers were also purchased at relatively high levels in both cases. Cooperatives held a strong market position in member purchases of petroleum, but a much weaker relative share of non-member purchases. Purchases of seed and feed at cooperatives by both groups, were somewhat lower than other input groups, but none-the-less higher than the weak share of service purchases.

TABLE D-8. PAIR-WISE COMPARISONS OF MEAN PATRONAGE LEVELS BETWEEN INPUT GROUPS.

PAIR-WISE COMPARISON BETWEEN INPUT GROUPS		NON-MEMBERS N=186			MEMBERS N=449		
		MEAN <sup>1</sup> DIFFERENCE	T-STAT	PROB > T	MEAN <sup>1</sup> DIFFERENCE	T-STAT	PROB > T
PETROLEUM	PESTICIDES	0.20	6.30	0.0001	0.13	5.12	0.0001
PETROLEUM	FERTILIZER	0.12	4.82	0.0001	0.01	0.54	0.5891
PETROLEUM	SERVICES	0.04	2.51	0.0130	0.33	15.37	0.0001
PETROLEUM	SEED	0.06	2.49	0.0137	0.10	3.91	0.0001
PETROLEUM	FEED	0.07	2.80	0.0058	0.14	5.54	0.0001
PESTICIDES	FERTILIZER	0.08	3.64	0.0004	0.12	7.07	0.0001
PESTICIDES	SERVICES	0.24	7.78	0.0001	0.45	22.15	0.0001
PESTICIDES	SEED	0.14	4.30	0.0001	0.23	10.35	0.0001
PESTICIDES	FEED	0.13	4.44	0.0001	0.27	11.33	0.0001
FERTILIZER	SERVICES	0.17	7.31	0.0001	0.34	19.01	0.0001
FERTILIZER	SEED	0.06	2.41	0.0171	0.11	5.52	0.0001
FERTILIZER	FEED	0.05	2.13	0.0346	0.16	6.99	0.0001
SERVICES	SEED	0.11	4.77	0.0001	0.23	12.00	0.0001
SERVICES	FEED	0.11	5.16	0.0001	0.18	9.90	0.0001
SEED	FEED	0.01	0.28	0.7770	0.05	2.26	0.0241

<sup>1</sup>Figures listed are absolute values of the difference between means.

Further analyses of variance (ANOVA) were conducted to investigate the effects of age and gross revenue on patronage levels. Tukey's studentized range test was used to evaluate differences among means. Tukey's test controls type I experimental error when comparing differences among more than one mean simultaneously.

Farmers were grouped into the same age and gross revenue classes as was described previously. Separate analyses were done for all farmers and for farmers separated by membership status. Tables D-9, D-10, and D-11 summarize the ANOVA results by age groups. Tables D-12, D-13, and D-14 summarize the ANOVA results by revenue class.

Few differences in mean responses across age classes were found in any of the input categories. Among all farmers (Table D-9), total input purchase levels were significantly different between 40 year old farmers and 60 year old farmers, with the younger farmers purchasing less than the older farmers. Farmers in the 60 year bracket purchased significantly more petroleum at co-ops than the oldest farmers (70 +) and the younger (40-49) farmers. Non-members in the 20-29 and 40-49 age classes had significantly different mean responses in total input purchases (Table D-10). There were no significant differences across age classes for any of the input groups when only member farmers were compared (Table D-11).

Analysis of variance of purchase levels of farmers grouped by gross revenue showed few significant differences between classes. Table D-12 shows that the smallest farmers (Class 1) purchased significantly lower percentages of petroleum at co-ops than all other size categories. Farmers in Class 2 as well, purchased significantly less of their petroleum than the largest farmers. These same differences were noted when looking at member farmers only (Table D-14). Non-member farmers' (Table D-13) petroleum purchases were significantly different between the smallest farmers (Class 1) and large farms (Class 4). Other differences in non-member patronage levels were found between small farmers (Class 2) and the largest farmers (Class 5) for both pesticides and the combined input categories. Feed purchases were at a significantly greater level for the smallest farmers than for the largest farmers when looking at member farms and all farmers as well.

TABLE D-9. ANALYSIS OF VARIANCE (ANOVA) BY AGE CLASS OF ALL FARMERS' PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	20-29	30-39	40-49	50-59	60-69	70 +	SIGNIFICANT	
	N=29 Mean	N=113 Mean	N=133 Mean	N=149 Mean	N=131 Mean	N=51 Mean	DIFFERENCES BETWEEN MEANS	
TOTAL	0.32	0.25	0.22	0.31	0.34	0.24	40-49	60-69
PETROLEUM	0.33	0.36	0.22	0.30	0.35	0.19	40-49	60-69 70+
PESTICIDES	0.45	0.40	0.38	0.49	0.49	0.41	NONE	
FERTILIZERS	0.34	0.27	0.32	0.40	0.34	0.30	NONE	
SERVICES	0.09	0.04	0.03	0.06	0.03	0.05	NONE	
SEED	0.22	0.21	0.24	0.24	0.27	0.23	NONE	
FEED	0.24	0.24	0.18	0.21	0.22	0.17	NONE	

TABLE D-10. ANALYSIS OF VARIANCE BY AGE CLASS OF NON-MEMBER FARMERS' PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	20-29	30-39	40-49	50-59	60-69	70 +	SIGNIFICANT	
	N=7 Mean	N=34 Mean	N=44 Mean	N=33 Mean	N=35 Mean	N=12 Mean	DIFFERENCES BETWEEN MEANS	
TOTAL	0.37*	0.14	0.08	0.19	0.19	0.08	20-29	40-49
PETROLEUM	0.27*	0.11	0.04*	0.05*	0.03*	0.00*	NONE	
PESTICIDES	0.39*	0.30	0.12	0.35	0.32	0.22*	NONE	
FERTILIZERS	0.15*	0.12	0.12	0.29	0.25	0.14	NONE	
SERVICES	0.00*	0.02*	0.00*	0.04*	0.03*	0.00*	NONE	
SEED	0.14*	0.08	0.11	0.10	0.20	0.17*	NONE	
FEED	0.06*	0.20	0.07*	0.14	0.16	0.10*	NONE	

TABLE D-11. ANALYSIS OF VARIANCE BY AGE CLASS OF MEMBER FARMERS' PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	20-29	30-39	40-49	50-59	60-69	70 +	SIGNIFICANT	
	N=22 Mean	N=79 Mean	N=116 Mean	N=96 Mean	N=391 Mean	N=12 Mean	DIFFERENCES BETWEEN MEANS	
TOTAL	0.30	0.29	0.30	0.34	0.39	0.28	NONE	
PETROLEUM	0.34	0.46	0.30	0.37	0.46	0.25	NONE	
PESTICIDES	0.47	0.44	0.52	0.53	0.56	0.47	NONE	
FERTILIZERS	0.40	0.33	0.42	0.43	0.38	0.35	NONE	
SERVICES	0.12	0.05	0.04	0.07	0.04	0.07	NONE	
SEED	0.25	0.26	0.31	0.28	0.30	0.25	NONE	
FEED	0.30	0.25	0.23	0.23	0.24	0.20	NONE	

\* Indicates mean is not significantly different from zero at the .05 level.

TABLE D-12. ANALYSIS OF VARIANCE BY GROSS REVENUE<sup>2</sup> OF ALL FARMERS' PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	Class 1 N=125 Mean	Class 2 N=171 Mean	Class 3 N=57 Mean	Class 4 N=73 Mean	Class 5 N=180 Mean	SIGNIFICANT DIFFERENCE BETWEEN MEANS
TOTAL	0.28	0.28	0.29	0.30	0.27	NONE
PETROLEUM	0.10	0.25	0.31	0.36	0.44	1-2; 1-3; 1-4; 1-5; 2-5
PESTICIDES	0.36	0.48	0.52	0.48	0.42	NONE
FERTILIZERS	0.31	0.34	0.31	0.30	0.37	NONE
SERVICES	0.04	0.04	0.03*	0.05	0.06	NONE
SEED	0.24	0.26	0.23	0.24	0.22	NONE
FEED	0.25	0.22	0.24	0.20	0.16	1-5

TABLE D-13. ANALYSIS OF VARIANCE BY GROSS REVENUE OF NON-MEMBER PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	Class 1 N=46 Mean	Class 2 N=46 Mean	Class 3 N=13 Mean	Class 4 N=23 Mean	Class 5 N=37 Mean	SIGNIFICANT DIFFERENCE BETWEEN MEANS
TOTAL	0.15	0.21	0.16	0.16	0.06	2-5
PETROLEUM	0.04*	0.05*	0.02*	0.16	0.07	1-4
PESTICIDES	0.18	0.42	0.31	0.32	0.12	2-5
FERTILIZERS	0.18	0.25	0.25	0.16	0.10	NONE
SERVICES	0.01*	0.03*	0.00*	0.02*	0.03*	NONE
SEED	0.14	0.19	0.07*	0.10*	0.07	NONE
FEED	0.09	0.23	0.15*	0.08*	0.08	NONE

TABLE D-14. ANALYSIS OF VARIANCE BY GROSS REVENUE OF MEMBER FARMERS' PURCHASE PERCENTS.

PURCHASE PERCENT AT COOPERATIVES	Class 1 N=79 Mean	Class 2 N=125 Mean	Class 3 N=44 Mean	Class 4 N=50 Mean	Class 5 N=143 Mean	SIGNIFICANT DIFFERENCE BETWEEN MEANS
TOTAL	0.35	0.31	0.33	0.36	0.32	NONE
PETROLEUM	0.13	0.32	0.39	0.45	0.54	1-2; 1-3; 1-4; 1-5; 2-5
PESTICIDES	0.47	0.51	0.58	0.56	0.50	NONE
FERTILIZERS	0.39	0.37	0.33	0.37	0.44	NONE
SERVICES	0.05	0.04	0.04	0.06	0.07	NONE
SEED	0.31	0.29	0.28	0.31	0.26	NONE
FEED	0.34	0.22	0.26	0.26	0.18	1-5

<sup>2</sup> Class 1 - \$0-\$2,499; Class 2 - \$2,500-\$19,999; Class 3 - \$20,000-\$39,999.  
Class 4 - \$40,000-\$99,999; Class 5 - \$100,000 +.

\* Indicates mean is not significantly different from zero at the .05 level.