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A SUMMARY OF ECONOMIC DATA FROM THE AGRICULTURAL PRACTICES SURVEY, VENICE TOWNSHIP, SENECA COUNTY, OHIO

by

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The purpose of the Agricultural Practices Survey of Venice Township, Seneca County, Ohio, was to gather information on farm management practices, especially those affecting water quality. This was accomplished during the later part of August, and the first half of September, 1976, by Gary Becker, a graduate research associate at the Ohio State University and Anita Russelmann, an undergraduate student at Cornell University. This summary outlines the results of the survey and appraises the appropriateness of gathering the data by survey.

Twenty-seven farmers were surveyed whose total owned and rented acreage was 5,950 acres or 23.65 percent of the total land area for the township. Farm operations visited range in size from 24 acres to 618 acres. The mean farm size is 220.4 acres with a standard deviation of 130.1. According to Ohio Agricultural Statistics, 1975, the average farm size for Seneca County is estimated to be 171 acres (1). However, the discrepancy between these two figures is not surprising. The larger average farm size in the sample is due to the fact that most of the farmers interviewed are full time operators. It is these full time farmers with larger than average farm sizes who have the strongest impact on water quality.

Table 1 compares the proportion of cropland in corn, soybeans, wheat, oats, and hay as found in the Ohio Agricultural Statistics, 1975 (OAS) with those found in the Venice Township Survey (VTS). In Column 1, the total acreage of a specified crop for 1975 is divided by the total acres for all crops grown in Seneca County. In Column 2, total acreage for a specified crop is divided by the total acres as determined by the survey. The results show a relatively small difference between OAS and VTS results. The greatest difference of 4.9 percent was found when the

percent of acres in soybeans as determined by OAS was compared to the percent of acres in soybeans as determined by VTS. Also, the percent of acres as determined by OAS in wheat and that determined by VTS differed by 4.3 percent. However, these differences between OAS and VTS data narrow when only cropland data is compared (Column 1 and Column 3).

Column 3 examines the proportion of cropland planted to the major crops as determined by VTS. Comparisons of Column 1 and Column 3 indicate that OAS and VTS data closely parallel one another. Slight differences between VTS and OAS data could easily be explained by (a) time period difference (OAS is 1975 data and VTS is 1976 data) and (b) location differences (OAS is Seneca County data and VTS is Venice Township data). Thus, secondary data such as OAS appears to be a reasonable source for crop acreage data.

Rotation Schedules

The VTS results indicate that farmers in the township use many different rotation schedules. Three seem to be most prevalent. Many farmers (eight) have a rotation that included two years of corn with some variation of corn, wheat, beans, oats, or hay, the following three years. Another common rotation (used by thirteen farmers) include corn and beans with a variation of corn or beans the following three years. Finally, a third group of farmers (fourteen) use corn, beans, and wheat in the first three years followed by either corn, oats, or hay. Of the 35 different rotations identified, only three plant corn continuously three years or more. Representative rotation might be C-C-B-W-H, C-B-C-B-B, and C-B-W-O-H. Rotations are not rigid and many farmers have shifted to row crops over the past three years. It is hypothesized that the shift in rotations the last two or three years is due to changing output and input price relationships.

TABLE 1. MAJOR CROPS IN SENECA COUNTY AND VENICE TOWNSHIP

Crop	Seneca County, 1975 (Source: Ohio Agricultural Statistics) Percent of Cropland	Venice Township Survey, 1976 Percent of Cropland (Including SPW)	Venice Township Survey, 1976 Percent of Cropland (Without SPW)
Corn	27.1	29.1	32.0
Soybeans	38.7	33.8	37.0
Wheat	22.0	17.7	19.4
Oats	5.5	5.7	6.3
Hay	6.7	4.8	5.3
SPW	----	8.9	----
TOTAL	100.0	100.0	100.0

SPW = Permanent Sod, Pasture, Woods

Survey results are the only source of information concerning rotations. One of the survey benefits is a more accurate estimate of fertilizer usage on rotations using legumes as a nitrogen source. Also, a more accurate estimate of soil loss is possible when crop rotations are known.

Agricultural Activities

This part of the VTS was conducted to determine the months farmers conducted various agricultural activities. These activities and the mode responses are shown in Table 2.

Few surprises are shown in the timeliness of agricultural practices. The occurance of various activities determined by the crop grown and the cultural practices used. Thus, surveying the timeliness of various practices is a redundant question except in the case of land preparation. Future surveys need only ask the farmer which crops are grown (e.g. corn, soybeans, etc.) and cultural practices are used (fall plowing, spring plowing, discing, planting, etc.).

Fertilizer Usage

Fertilizer usage, the third section of this survey, was divided into four parts. The first section asked for the grade of fertilizer used; the second, pounds per acre applied; the third, its commercial name; and the fourth, the amount of manure applied. For the purposes of this analysis, only the first, second and fourth have merit.

Responses from twenty-one farmers indicate that the mean amounts of nitrogen, phosphorous, and potash applied to corn is 103.57, 84.24, and 103.80. Their standard deviations are 67.41, 43.25, and 55.23, respectively. One farmer claims that he does not apply any fertilizer to his corn except for a solution in which he soaks his seeds. On the other hand, one farmer applies 200 pounds of each element. The modal value for nitrogen applied is 150 pounds; for phosphate 100 pounds; and for potash 180 pounds per acre. Three observations were recorded in each case.

TABLE 2. TYPICAL AGRICULTURAL ACTIVITIES IN VENICE TOWNSHIP

Activities	Modal Months	Comment
Spring Plow	April, May	Most farmers indicate that they use a moldboard plow. Some farmers indicate that they do all their plowing in April only.
Disc & Harrow	April, May	
Spring Planting	April, May	Some farmers indicate that they perform this operation in June also.
Fertilizer Application	April, May, September, October	
Herbicide Application	April, May, June	
Insecticide Application	April, May	Only eleven farmers indicate that they apply any insecticide to their field.
Oats and Wheat Harvesting	July	
Corn Harvesting	September, October, November	
Fall Plow	October, November	Some farmers indicate that if they had a wet fall, they might still be in the field until November.
Fall Planting	September	
Spring Harvest		Only seven responses were made. The majority took place during March, April, and May.
Ditch Maintenance		Eleven of the nineteen responses indicate that this job was performed whenever they had spare time.
Surface Wetness	May	Most farmers indicate that they took care of this during the spring months.

Twenty-two observations for wheat fertilization were recorded. One farmer applies as much as 172 pounds of nitrogen, 104 pounds of phosphate, and 104 pounds of potassium. Another farmer claims that he applies nothing. The mean amount of nitrogen applied to the land is 45.48 pounds, phosphate 70.68 pounds and potash 69.50 pounds. Their standard deviations are 37.54, 21.26 and 25.42 respectively. The modal amounts applied are 100 pounds for phosphate and 180 pounds for potash.

As could be expected, most of the farmers (22 out of 25) applied no nitrogen to their soybeans. As a legume, it can fix adequate amounts of atmospheric nitrogen, and it has been shown through research that added nitrogen doesn't produce any significant yield increases (2).

Of the thirteen farmers who grow hay, none apply any nitrogen, nine apply no phosphate, and ten apply no potash.

Ten farmers noted that they applied fertilizer to their oats; however, the amounts applied vary significantly. The mean amount of nitrogen applied was 31.70, phosphate 58.3 and potash 55.70 pounds per acre. Standard deviations are 23.61, 18.41 and 23.45 respectively. If nitrogen is applied during the spring, farmers applying this amount should expect yields of approximately 90 bu/acre (2). The VTS mean oat yield is 83.42 with a standard deviation of 25.71. A similar comparison could not be done for phosphate or potash because soil test values are not available for each specific site.

Fertilizer application rates for various crops grown must be obtained from survey data. No comparable data exists from secondary sources.

Livestock Numbers

According to Ohio Agricultural Statistics, there are approximately 20,000 animals listed as "all cattle and calves" in Seneca County (1). The mean number of animals per acre of land is .0586 head.

In the Venice Township Survey, the average number of cattle and calves per acre is .1376. This figure is more than twice the average number as that reported. However, if the largest of the eight enterprises is excluded from the sum, the surveyed cattle and calves per acre is .0872. These results demonstrate that livestock enterprises in the watershed tend to be concentrated with a few producers. It is unlikely that a small sample survey yields highly reliable data in this situation.

Almost four times the number of hogs are reported to be on an acre of land in the VTS as compared to OAS. VTS results show .271 hogs and pigs per acre while OAS shows .078 hogs and pigs per acre. Again, only eight of 27 farmers interviewed raise hogs on their farms. However, two of the eight hog farmers raise 56 percent of the hogs. If these two are not included, there are .12 hogs per acre. Eight responses do not provide adequate sample size for a meaningful statistical analysis.

Finally, the results for sheep obtained from VTS are very similiar to those reported by OAS. In Seneca County during 1975, there were .463 sheep per acre of land (1). In Venice Township there are .36 sheep per acre of land. The deviation between the two figures is relatively small as compared to that of cattle and hogs. However, only two farmers out of 27 raised sheep. Again, this is much too small a sample for a meaningful comparison.

Table 3 identifies the types of animals raised on farms in Venice Township. Runoff of manure would be minimal since most animals are confined indoors with manure spread on fields at moderate rates.

One item of importance is that 3.6 percent of the total number of animals identified were not fenced from streams. This could mean that anywhere from zero to approximately 4000 pounds of raw manure is entering those effected streams daily (3).

39 dairy cows and bulls = 3518 pounds raw manure per day

42 swine sows and boars = 546 pounds raw manure per day

TABLE 3. LIVESTOCK NUMBERS AND LIVESTOCK MANAGEMENT PRACTICES, VENICE TOWNSHIP

Livestock Type	Total Number	Housing System			Access to Stream		Manure Handling		Manure Application Rate (Acres per Head of Livestock)
		Confined to Barn or Lot (%)	Confinement Winter, Pasture Summer (%)	Pasture (%)	No Access (%)	Access (%)	Stored Under Roof and Later Put on Field (%)	Applied Directly to Field (%)	
ɛf Feeder	767	96	0	4	100	0	54	46	1.59
ɛf Cows and Bulls	13	16	46	38	100	0	61	39	2.86
ine Feeders	1015	100	0	0	100	0	100	0	1.47
ine - Sows and Boars	598	50	7	43	93	7	56	44	1.89
ɛep	215	60	0	40	100	0	60	40	1.56
iry Cows and Bulls	39	0	100	0	0	100	100	0	.93

The majority of the manure applied had been stored under a roof and later applied to a field. With this type of storage only about 70 percent of the nitrogen is remaining after storage and spreading (3).

Livestock numbers are available also from OAS and the Census of Agriculture (5). However, housing and manure management practices are available only by way of survey.

Livestock Manure Application

Survey results indicate moderate rates of applying livestock manure to the land in Venice Township farms. The last column of Table 3 shows the applications of rate in terms of the acres over which the manure from the livestock is spread. The land area used for manure disposal varies from .93 acres per head for dairy to 2.86 acres per head for beef cows.

Using the mean concentration of nitrogen, phosphate and potash in livestock manure (3), computations can be made of the annual nutrient application rates from livestock sources. Table 4 contains estimates of these nutrient application rates as well as estimates of the proportion of land receiving livestock manure. Generally, these application rates are low and would not affect water quality. The rate of nitrogen from manure applied to cropland is less than 50 pounds per acre on all farms surveyed except one. This farm, which has the dairy cows shown in Table 4, is applying 209 pounds of nitrogen per acre. Similarly, the rates of phosphate and potash application is moderate with all farms except one applying less than 42 pounds per acre of phosphate and 48 pounds per acre of potash.

Livestock manure application rates are available only from survey data. No secondary sources would provide reasonable estimates of these rates.

Conservation Practices

Management practices for the purposes of this survey include those techniques used for soil conservation. The purpose is to identify those

TABLE 4. ESTIMATED NUTRIENT APPLICATION RATES FROM LIVESTOCK MANURE, VENICE [illegible]

Livestock Type	Number	Annual Application Rate of Nutrients From Manure (lb./acre)				Acres Manure Is Applied	
		Nitrogen		Phosphate Applied	Potash Applied		
		Total Applied[a]	Total Available to Crop[b]				
Beef Feeder	767	48	16	42	48	[illegible]	[illegible]
Beef Cow	13	27	9	25	29	[illegible]	[illegible]
Swine Feeder	1015	10	3	11	11	[illegible]	[illegible]
Swine Sows and Boars	598	14	5	13	14	[illegible]	[illegible]
Sheep	215	6	2	2	6	[illegible]	[illegible]
Dairy Cow	39	210	69	102	193	[illegible]	[illegible]
Total						3037	[illegible]0

[a]Total nitrogen applied (Nitrogen Produced and Stored) (% Remaining After Storage and Spreading) + (Nitrogen Applied Directly)

[b]Total nitrogen available to crop = (Total Nitrogen Applied) (Proportion Available)

most commonly used techniques and where each is located.

No one in the Township indicates use of ridge planting, contour planting, or terracing. On the other hand, nearly 50 percent of the farmers (13) state that they have at least one grassed waterway, and these 13 farmers use a total of 28 grass waterways. Three farmers use a total of s seven sod filter strips. One individual practices critical area seeding along the Honey Creek where every spring he plants oats. Four of the 27 farmers incorporate stream buffer strips.

Hedgerows and runoff detention basins are seen rarely. One farmer has a hedgerow. Another has three runoff detention basins.

Tile outlet protection is some device such as a screen which prevents animals from entering tile mains. Also, it includes concrete or rocks which are molded around the outlet for more efficient drainage. Five farmers indicate that they provide 16 tile mains with outlet protection.

The management practices obtained from VTS are useful information in determining the use of practices which abate soil erosion. This information is not available from secondary sources and a survey is necessary to uncover it.

Crop Yields

Twenty-one of the 27 farmers reported corn yields on the VTS. One farmer is producing only 50 bushels of corn per acre while another is producing 165 bushels of corn per acre. The mean yield for these 21 respondents is 110.67 with a standard deviation of 23.11.

Because crop yield is related to fertilizer input, a regression analysis was performed to estimate the relationship between yield and nutrient application rate. When corn yield and amount of nitrogen, phosphate, and potash were related, an R-squared value of .455 was calculated and Beta values of -.219, .133, and .338 were determined for nitrogen, phosphate, and potash.

An R^2 value of .455 indicates there is a moderately strong correlation between yield and fertilizer inputs; however, a negative Beta value for nitrogen indicates there is an inverse relationship between that and crop yield. This leads one to doubt the accuracy of the equation.

Many things can cause such poor results as that indicated. The primary cause may be the exclusion of types of tillage practices, manure application, rain fall, and time of fertilizer application from the model. However, it is felt that the probable cause for such a relationship is due to the fact that the independent variables are not well dispersed. Also, the independent variables are strongly correlated which leads to estimation errors.

Similar results were found for wheat, beans, oats, and hay as seen in Table 5.

The results illustrate the weakness of using survey data to estimate fertilizer production functions. However, an estimate of the production function is needed if changes in fertilization rates are considered as a method of affecting water quality. Generally, research results from experimental plots or secondary data must be used to estimate these relationships.

Labor

Farmers were asked in the VTS the number of hours they work on their farm each week. The purpose of this was to identify the labor input and relate this to farm size.

Some farmers find this extremely difficult to estimate because of seasonal variations from year to year. The number of hours which are worked on the surveyed farms in six time periods of the year are shown in Table 6. Operator, family, and hired labor are included in the estimates.

TABLE 5. PARAMETER ESTIMATES FOR CROP PRODUCTION FUNCTIONS

Dependent Variable	Independent Variable	Beta Value	R-Square
Wheat Yield	Nitrogen	.2527	.5698
	Phosphorous P_2O_5	.2259	
	Potassium K_2O	-.3205	
Bean Yield	Nitrogen	-.2117	.1030
	Phosphorous P_2O_5	-.0880	
	Potassium K_2O	.0408	
Hay Yield	Nitrogen	0.0	.3356
	Phorphorous P_2O_5	.0038	
	Potassium K_2O	.0238	
Oat Yield	Nitrogen	-0.0161	.1110
	Phosphorous P_2O_5	-0.8652	
	Potassium K_2O	1.009	

Regression analyses were performed to relate hours worked per week and farm size. The regression model used is the following:

$HRS(t) = b_0 + b_1 SIZ + b_2 DUMMY$
where
$HRS(t)$ = hours worked per week in the t^{th} time period
SIZ = acres operated
DUMMY = 0 if farm has livestock; 1 if no livestock

This equation does a poor job in explaining the hours worked per week. Generally, the estimate of b_1 and b_2 are insignificant and often the sign of b_1 is negative. Since farm operators have varying degrees of labor efficiency, it is hypothesized that the surveyed farmers estimated the hours available rather than hours worked. Since most of the surveyed farms are operated on a full time basis by the owner, it is not surprising that farm size does a relatively poor job of estimating hours available.

Efficiency of Field Operations

Each farmer was asked the efficiency of various activities in terms of acres per hour. A summary of these results are in Table 7. When these results are compared to those obtained from a recent University of Minnesota study, the efficiency results from the survey appear reasonable for many field operations.

A regression analysis was performed on the various activities where the efficiency of a particular practice is used as the dependent variable and farm size, the independent variable. For those activities where farm size significantly affects efficiency, Table 7 provides estimates of the change in efficiency as farm size increases one acre.

Conclusions

The survey of agricultural practices in Venice Township was a costly method of gathering information. The interviewers time consisted of over 120 hours. Additional costs were incurred in travel expenses, preparation of the survey instrument, and consulting time with professionals. The benefits included a complete set of agricultural practices from 27 farms.

TABLE 6. NUMBER OF HOURS WORKED PER WEEK
IN SIX TIME PERIODS OF THE YEAR, VENICE TOWNSHIP

Time	Hours Worked Per Week	Standard Deviation
First Two Months	30.7	18.7
Second Two Months	63.8	24.3
Third Two Months	80.5	28.4
Fourth Two Months	63.7	28.2
Fifth Two Months	70.4	25.5
Sixth Two Months	50.5	22.1

TABLE 7. EFFICIENCIES OF AGRICULTURAL ACTIVITIES, VENICE TOWNSHIP

Operation	Frequency	Mean Hours Per Acre	Standard Deviation of Hours Per Acre	b_1 Value[a]
Moldboard Plow	22	3.36	1.73	.006
Chisel Plow	9	5.44	1.42	.0138
Discing	22	5.818	2.94	.0213
Field Cultivating	21	6.809	4.09	
Rotary Hoe	17	9.706	5.34	
Harrow	19	5.684	2.809	
Planting Corn	24	4.500	1.693	.0041
Planting Beans	23	4.478	1.620	.0053
Cultivating	21	4.238	1.670	.0042
Fertilizer Application	11	9.727	4.606	
Harvest Corn	23	3.608	4.793	.0079
Harvest Beans	22	3.363	1.890	.0075
Baling	14	1.785	1.121	
Mowing	13	2.154	.987	
Chopping Stalks	10	2.600	.966	
Discing Stalks	6	5.833	2.041	
Cutting Silage	5	2.200	2.683	

[a]For Equation: Acres Per Hour = $b_o + b_1$ (Acres Operated)

The survey in its present form is too costly for the value of the information obtained. Some of the information needed for an economic analysis of a watershed is available only from a survey. Therefore, it is suggested that future surveys gather only that information which is not available from secondary sources. With the reduced time requirement for each interview, the sample size could be increased to yield more accurate information.

Information which future surveys should seek include

a. crop rotations,

b. fertilizer application rates on various crops,

c. livestock housing and manure,

d. manure application rates,

e. soil conservation practices, and

f. efficiency measures of various practices.

Information concerning crop acreage, livestock numbers, crop yields, estimates of fertilizer response functions, labor availability, and timeliness of agricultural practices are largely redundant since they can be obtained from other sources.

References

(1) Ohio Crop Reporting Service. Ohio Agricultural Statistics, 1975.

(2) Cooperative Extension Service, The Ohio State University, 1976-1977 Agronomy Guide, 1976.

(3) Cooperative Extension Service, The Ohio State University, Ohio Livestock Waste Management Guide, 1975, p. 4.

(4) Buckmae, Harry O., and Brady, NYLEC., The Nature and Properties of Soils, 1969, p. 570-571.

(5) U. S. Department of Commerce, 1974 Census of Agriculture.