"AGRICULTURE AND WATER POLLUTION - AN ASSESSMENT OF THE PRACTICES AND ATTITUDES OF ONTARIO FARMERS"

Garth E. Bangay
Environmental Control Branch
Environmental Protection Service, Ontario Region
Environment Canada
Toronto, Ontario.

February, 1979

DISCLAIMER

The study discussed in this document was carried out as part of the efforts of the Pollution from Land Use Activities Reference Group, an organization of the International Joint Commission, established under the Canada-U.S. Great Lakes Water Quality Agreement of 1972. Funding was provided by Fisheries and Environment Canada.

Findings and conclusions are those of the author and do not necessarily reflect the views of the Reference Group or its recommendations to the Commission.

The survey was conducted across the entire Province of Ontario and thus the results should not be construed as being purely representative of farmers living within the hydrologic boundary of the Great Lakes Basin.

ACKNOWLEDGEMENTS

The author wishes to thank the members of the Reference Group and especially Kim Shikaze, Martin Wood and Ed Brubaker who supported the concept of the survey. Thanks are also directed to all those persons who were involved in the review of questionnaire design.

Special thanks are directed to Mr. W.L. Porteous, Director Agriculture Division and Phil Stevens, Lora Chapman Smith, Frank Gallagher, Special Surveys Co-ordination, Bryan V. West, Special Projects Field Division and especially Dominique Serrurier and Mary Lou Storai of the Institutional and Agriculture Survey Methods Division of Statistic Canada for their assistance in the design and successful implementation of the survey.

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SUMMARY

SURVEY PURPOSE

As a part of the overall study of the Pollution from Land Use Activities Reference Group (PLUARG), this survey was conducted to assist the Reference Group in the formulation of remedial measure recommendations which were presented to the International Joint Commission in July 1978.The Reference Group, which was charged with the responsibility of studying pollution of the Great Lakes from land use activities, had in the early stages of the study identified urban and agricultural land use activities as being of prime concern. Realizing that the successful implementation of remedial measures, especially in agriculture, would to a large extent rely on the voluntary cooperation of farmers; the Reference Group undertook this survey to provide them with much needed information on the agricultural community.

The survey was undertaken in the summer of 1977 and through the selection of a stratified random sample of Ontario farmers, interviewers were able to visit some 1755 farms and complete 1484 valid records. The study concentrated on gathering information in three different areas. Two of these dealt with specific problem associated with agriculture - erosion and sedimentation and livestock manure and the third was directed towards the problem of implementing remedial measures.

SURVEY FINDINGS

(i) Erosion and Sedimentation

- In Ontario between 75 - 81 percent of all farmers have at some time practiced at least one kind of soil conservation measure.

- New techniques such as minimum and zero tillage have only been ,used to a limited extent.

- Long time farmers and those classified as full time farmers were more likely to employ soil conservation measures.

- Forty-six percent of Ontario farmers actively cultivated less than 20 feet from stream or drainage ditch banks thus increasing the likelihood of eroded soil particles reaching the lakes.

- Thirty-seven percent of livestock farmers spread manure within fifty feet of streams thereby creating a potential problem of nutrient runoff to streams and lakes.

- Ninety percent of farmers were aware of soil testing services offered by OMAF although only 50 percent have had their soil tested in the last five years.

(ii) Livestock Manure

- Seventy-four percent of the respondents had livestock and/or poultry.

- Eighty-eight percent of livestock farmers used a solid manure management system and ninety-one percent of these were uncovered thus creating the potential for runoff and leaching of nutrients.

- Only 37 percent of farmers spread manure on the land during the winter period, resulting in a reduced hazard to water quality from this source. Forty-seven percent of the respondents did indicate however, that in modern farming manure was only a waste disposal problem thus raising the concern that a large number of farmers do not see the advantages of optimizing the use of manure.

  Thirty-three percent of livestock farmers allowed their livestock to have free access to streams.

- Only 32 percent of livestock farmers were familiar with the Ontario Agricultural Code of Practice which has served as one of the main vehicles for developing an environmental awareness amongst farmers.

(iii) Implementation of Remedial Measures

- Eighty percent of farmers indicated that they felt farming activities contributed to only a minor extent or not at all to water pollution and only 7 percent had ever personally experienced any adverse effects from water pollution.

- Despite this situation, 72 percent of the respondents indicated a willingness to learn more about the control of water pollution from farming activities.

- Forty-four percent of farmers indicated that the best policy for reducing water pollution associated with agriculture was not to rely on only the goodwill of farmers. In addition, 46 percent of farmers opted for strict enforcement of the regulations to reduce water pollution from farming activities.

- A majority of farmers felt that financial assistance must be forthcoming to assist in the implementation of remedial measures, although 77 percent felt that there should be no general increase in everyone's taxes to subsidize this.

- Newspapers and magazines were the most popular source of information on water pollution control in agriculture.

- Twenty-two percent of respondents had never received any information at all.

- Almost half the respondents had attended a meeting related to agriculture in the last year.

CONCLUSIONS

On the basis of this study a number of areas have been identified where new initiatives are required to improve the level of awareness of farmers concerning agriculture and water pollution. Information/education programs must provide farmers with sufficient technical information to enable them to take the initiative in implementing remedial action. Sufficient technical resources in the form of field personnel must also he available to demonstrate a variety of remedial measure options.

In those areas of the province designated as having a higher priority in terms of needed remedial action, steps must be taken to develop cost sharing programs to assist farmers during the implementation stages.

Intensive environmental Monitoring of agricultural activities will likely be prohibitively expensive due to the large land area involved and the considerable natural fluctuations in environmental conditions from year to year. Therefore, new and existing programs directed towards reducing the environmental impact of agricultural practices must undergo periodic evaluation to determine their effectiveness in bringing about the anticipated changes.

INTRODUCTION

SCOPE AND PURPOSE

This survey was carried out in partial fulfillment of the Pollution from Land Use Activities Reference Group's obligation to the International Joint Commission to prepare an environmental management plan for the Great Lakes System. This plan was to incorporate the most practical remedial measures available for decreasing nonpoint source water pollutant loads to an acceptable level.

The Reference Group's determination of the practicality of the various remedial measure options not only incorporated an evaluation of the technical and economic implications but also the social ramifications of their eventual adoption and implementation.

If PLUARG had been restricted to the study of a set of problems for which the proposed solutions would not produce any conflicts within the broad spectrum of society, the need to consider the interests of the public in addition to those directly involved in the study would probably not have developed. The PLUARG study, however, was directed towards assessing the water quality impacts of a wide variety of land use activities across the entire area of the Great Lakes Basin. Therefore, the findings and recommendations of this Reference, ultimately hold significance for many sectors of society and will likely be important in bringing about social change.

Social change has been characterized by Rogers[1] as consisting of three distinct parts:

(1) Invention - the process by which new ideas are related or developed.

(2) Diffusion - the process by which new ideas are communicated to the members of a given social system.

(3) Consequences - the process of either adoption or rejection and the changes that occur as a result of these actions.

(1.) E.M. Rogers, E.F. Shomaker, Communication of Innovations, The Free Press Div. of Macmillan Co., 1971, p. 38

The invention stage of this process can be compared to the various technical and scientific studies undertaken by PLUARG.The other two phases which are just as important to the eventual success of PLUARG are an integral part of the PLUARG public consultation program. This program was initiated early in 1977 and proceeded to its conclusion in July 1978. During this period a number of distinct activities were carried out to provide the Reference Group and the public alike with new opportunities to operate within the diffusion and consequences stages of the process.

In addition to the survey, the public consultation program consisted of two other activities:

(1) The distribution of a series of public information kits, audio/visual presentations and news releases designed to develop an awareness of nonpoint water pollution problems and their solutions.

(2) A series of public consultation panel meetings aimed at encouraging a public debate on the remedial measure options available to deal with the identified problems. The members of the panels represented a broad cross-section of the public, including municipal government officials, foresters, environmentalists, farmers, ratepayers, cottagers, educators, fishermen, industry and other interested persons.

While it was accepted that the public consultation panels would provide a useful mechanism for ensuring that the views of the more vocal and active groups were considered; it was also acknowledged that some means for involving those persons who would be unwilling) or unable to participate in this more active capacity must be included. This was especially important where the "consequence" stage of social change is largely determined by the voluntary action of individuals and not by government. Past experience has indicated that even when dealing with government institutions, assurances for the adoption and enforcement of remedial measures are often tenuous. This situation may result for a variety of reasons, including insufficient staff and other resources for operating an enforcement program, a decline in the commitment by senior administrators, a lack of political pressure due to public apathy or indifference and an insufficient

commitment by those persons affected by the proposed action. This difficult situation will be further complicated when the respective Federal, Provincial and local levels of government attempt to influence the voluntary adoption of remedial measures by individual members of society.

The use of a survey was considered to be the most appropriate means of ensuring that the present attitudes, perceptions and practices of those individuals not participating in the public consultation panel process would be considered.

In order for the survey results to have maximum utility, it was determined that a more narrowly defined population than that of the entire Great Lakes Basin would have to be specified. The sample population would have to be associated with a land use activity that was suspected of contributing heavily to the nonpoint pollution problem and it would have to be a sector where the voluntary implementation of remedial measures is fundamental to the success of the program.

Early in PLUARG, it was acknowledged that agriculture by virtue of its significant spatial dimensions, thirty-five percent of the Basin Land area, the intensity of the activities taking place there and the potential pollutant nature of many of the inputs - fertilizers and pesticides and some of the residuals --livestock and poultry manure, was likely to make an important contribution to the total nonpoint pollution load.

Farmers have also been characterized by a tradition of independent decision making and as a bastion of "laissez-faire" thinking. The existence of this situation will undoubtedly further complicate the process of social change when governments begin to :implement PLUARG's recommendations. All of these factors encouraged PLUARG to identify the rural farm population as the target for the survey.

Essentially the survey had two purposes. The first was to provide sufficient information on the attitudes and behaviour of farmers to enable the Reference Group to make practical recommendations related to the management of agricultural pollution. The second was to provide a basis from which agencies involved in the implementation of PLUARG's recommendations could successfully begin the process of affecting change.

In order to achieve these purposes, three objectives were set:

(1) To assess present farm management practices especially as these relate to water pollution control.

(2) To measure the level of awareness exhibited by the rural farm population vis a vis water pollution associated with agricultural activities.

(3) To assess the attitudes of the rural farm population towards the adoption of remedial measures and/or management techniques in order to reduce the impact of agricultural related pollution.

METHODOLOGY

The survey which was called the "Agricultural Practices Survey" was conducted with the full co-operation of Statistics Canada. The questionnaire was appended to the Ontario portion of the Canada-wide Agricultural Enumerative Survey (AES) which was carried out between June 27 and July 9, 1977. The A.E.S. is a multi-purpose agricultural survey undertaken on an annual basis to produce reliable estimates for a range of crop, livestock and income items. The survey includes all farms in the province of Ontario with the exception of those farms on Indian reserves.

To ensure coverage of all possible farms, an area sample was used, rather than a farm list. The area frame was readily available from the 1971 Census of Canada. The frame was formed by dividing each Federal Electoral District (ED) into Enumeration Areas (EA's). Each EA represents the area canvassed by one representative in collecting the census data. Since EA's never cross provincial boundaries, the use of this sample frame allowed Ontario to be treated independently of the others at the design stage. Furthermore, the most extensive up-to-date coverage of farms in Canada, the 1971 Census of Agriculture related each census farm to the EA in which the farm headquarters lay. Because of this, it was possible to separate the area frame of EA's into two mutually exclusive sub-populations, those denoted as agricultural and non-agricultural respectively.

A two-stage stratified sampling design was employed with the EA's used as first stage units and the segments (compact geographical areas within EA's) as final stage units.

First Stage

A stratified random sampling technique was used to identify sample EA's. After the exclusion of Indian reserves, the survey universe of all farms was split into three modules:

(1) Specified farms
(2) Agricultural EA's
(3) Non-agricultural EA's

(1) Specified Farms

These farms are those denoted as large livestock producers and were selected with a probability of 1. Eighty-six specified farms were included in this survey.

(2) Agricultural EA's

These are EA's that had the headquarters of at least one farm located within them at the time of the Census.In statistical terms, the sample design is a stratified one, where within each stratum independent equal-sized replicates are selected, each replicate consisting of a simple random sample of EA's from that stratum population.

In Ontario, the strata were based on the following criteria :

(a) EA's with the largest values of certain items, or combinations of items, were identified and grouped into strata, one stratum for each item or combination.

(b) The remaining EA's in general displayed no dominant agricultural characteristics. For this reason, a single conglomerate variable X was constructed using a combination of items found in the equation. Stratification was then carried out using this variable. The last four strata also included the use of a geographic variable in order to achieve a more specific control over the sampling from such a large EA population.

A detailed description of the strata is provided in the following :

Stratum Code	Description of EA's constituting stratum
1	All EA's with (total chickens + 7 times total pigs) $\geq$ 75,000
2	All other EA's with (total milk cows + total milk heifers) $\geq$ 1,300
3	All other EA's with (total cattle + total pigs) $\geq$ 5,500

Stratum Code	Description of EA's constituting stratum
4	All other EA's with (total wheat area in acres) $\geq$ 650
5	All other [A's with (total mixed grain area in acres+ total corn for grain area in acres) $\geq$200
6	All other EA's with X $\geq$ 20
7	All other [A's with X $\geq$ 10
8	All other EA's with X $\geq$ 3 in Region A
9	All other [A's with X $\geq$3 in Region B
10	All other EA's in Region A
11	All other EA's in Region B

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where 'all other' refers to all EA's other than those included in the preceding strata and

$$X = 10{,}000\,[R(C) + R(D) + R(E) + R(F)]$$

where C = area under total hay and potatoes (in acres)

D = one-tenth of cash wages paid for hired labour (in dollars)

E = total number of cattle, pigs and chickens

F = crop land area in acres

and R refers to the ratio of the value of the item for the EA to that of the value for all the agricultural EA's included in the frame.

Region A = Ontario - Region B.

Region B = Includes the Counties and Districts of Algoma, Cochran, Haliburton, Kenora, Manitoulin, Muskoka, Nipissing, Parry Sound, Rainy River, Sudbury, Thunder Bay and the Municipality of Metropolitan Toronto.

The allocation of the number of EA's to be sampled from the strata was a compromise allocation determined after studying the best allocation to the strata for each of some important agricultural items.

(3) Non-Agricultural EA's

Non-agricultural EA's were split into two groups; one, excluded from the survey, was composed of urbanized core EA's. While this introduced a potential bias, it was found that this was negligible. The other group was further subdivided into 3 strata: (a) those EA's located in municipalities which had no agricultural EA's in them, (b) those EA's located in municipalities which had at least one agricultural EA from strata 7-11 within their boundaries and (c) those EA's located in municipalities which had at least one agricultural EA from strata 1-6 within their boundaries. This design using three strata random sampling of EA's within each stratum. The proportions of EA's sampled in these strata were much smaller than those in the agricultural EA strata.

Second Stage

The second stage of the sample design required the delineation and selection of sample segments within the specified EA's. The number of segments within individual EA's varied depending on the size and complexity of the EA. Three criteria were followed, however, in the designation of segments. These included the following :

(a) Individual segments within a given EA were similar in area.

(b) Approximately equal portions of the total agricultural activity within an EA was located in each segment.

(c) Boundaries of segments followed, wherever possible, natural or man-made features (fence rows, roads, water courses, etc.)

Once segments were delineated on topographic maps at a scale of 1 : 50,000, segments were randomly selected so that 1 segment was chosen for each 10 segments designated in the EA. This was the general rule to which there were some exceptions.

Survey Procedures

The survey was carried out through the use of personal interviews. Interviewers were provided with topographic maps, scale 1:50,000, and air photos, scale 1:15,840, for the respective segments that they were assigned to cover. Interviewers called at every residence in the segment and completed an interview at those residences where the inhabitants reported the sale of agricultural produce greater than $50.00 in the past year. Since the completion of the AES did not require the cooperation of the farm operator, allowance was made for one more special call back to ensure that the operator was available to answer the Agricultural Practices Survey questionnaire. If the operator was still unavailable and no other person fitting the definition of the farm operator was available, no questionnaire was completed.

The use of a personal interview with no allowance for questionnaires to be left at a holding for completion and later pick up, improved the accuracy of questionnaire response and the level of confidence based on the accumulated responses. During the survey 1755 farms were visited, out of which, 1484 valid records were received. The difference was accounted for by non-responses which were comprised of refusal, non-availability of the operator, non-completed questionnaires and lost questionnaires.

Standard sampling errors were calculated for each entry on the questionnaire. However, in the case of cross tabulations a sampling error was not calculated for each cell. The "significance" of cross tabulations will be determined by the reliability of the questions from which they are built. A copy of the questionnaire including response levels at a confidence level of 95% are provided in Appendix 1.

Farm operator was classified as someone who was involved in the field operation of the farm holding (e.g. operating a cultivator or other farm equipment).

SURVEY FINDINGS

The questionnaire was comprised of thirty-four separate questions. The questions were designed to provide basic information on the socio-economic characteristics of the respondents, the nature of their agricultural practices which had the potential for affecting water quality and finally the attitudes held by farm operators in respect to the adoption and implementation of remedial measures to reduce agricultural related water pollution.

As a result of the PLUARG study, a number of specific problems associated with agricultural activities were identified along with questions about the most appropriate means for implemerting a management strategy. The extent to which these agricultural activities are subscribed to across the province and insights into the means available for successfully implementing remedial measures are presented in this report. Questionnaire responses have been separated into the following three main subject areas: (1) Erosion and sedimentation, (2) Livestock manure and (3) Implementation of remedial measures.

In a number of areas specific cross tabulations between individual question responses have been performed to provide further clarification. Many of these may be of particular interest to those involved in the design and implementation of an agricultural nonpoint water pollution control program.

(1) Erosion & Sedimentation - Soil Conservation:

During the 1960's and early 70's soil erosion in Ontario agriculture was not viewed as an important problem. Earlier efforts made in the 1950's by the Ontario Ministry of Agriculture and Food which were directed towards encouraging adoption of soil conservation measures were either discontinued or assigned a lower priority. Much of this change in outlook was attributed to the fact that the existing levels of erosion were generally not exerting an economic disbenefit to agricultural production.

The PLUARG study, however, has identified soil erosion and the resultant transport of the eroded soil particles to the Great Lakes, as an important factor contributing to the two principal Great Lakes water quality problems of eutrophication or over enrichment of the waters by nutrients

and the contamination of the lake water, sediment and biota by trace quantities of toxic substances. Soil particles detached by the forces of erosion act as an important delivery mechanism for transporting nutrients such as phosphorus and toxic substances including heavy metals, pesticides and other organic compounds (e.g. PCBs) to the Lakes.

Eroded soil particles also cause problems when they settle in harbours and other navigable waters. In the Great Lakes Basin alone, over 100 million dollars are spent annually to dredge these deposited sediments. In many cases these sediments are too contaminated to allow for open lake disposal and this has necessitated the construction of dredge spoil containment facilities at an additional cost of several hundred million dollars each year. While the eroded soil particles which contribute to this dredging problem are not all attributable to the erosion of agricultural land, this still represents an important controllable source. In many cases, actively farmed soils are enriched beyond background levels with nutrients and pesticides, thus increasing the importance of their input to the Lakes. This is especially important in an agricultural context when the enriched soil particles located close to a stream are disturbed so that delivery to the lakes is assured. Before developing new initiatives designed to encourage farmers to undertake improved soil conservation, it is important to assess the level of their present and past conservation measures. In this survey farmers were asked if they had ever practiced any of the following and if they had or would practice them during 1977.

(i) Contour ploughing - ploughing across the slope.

(ii) Crop rotation - includes alternating from year to year row crops such as corn or soybeans, with cereals, forage and pasture crops.

(iii) Grass waterways - are natural or man made depressions which carry water during periods of runoff and which have been seeded to grass to reduce erosion.

(iv) Minimum Tillage - includes practices such as fall or spring chisel ploughing with only light discing. Does not include the use of the moldboard plough.

(v) Zero Tillage - no seed bed preparation - planting takes place directly in the unworked, residue of the previous year's crop.

In Ontario, between 75% - 81% of farmers have at some time practiced at least one or more of the conservation practices listed on the questionnaire. This level of adoption has also not dropped appreciably when viewed only from the perspective of one year - 1977 (69.7% - 75.9%). Crop rotation remains the most popular soil conservation practice with between 75.7 - 68.1% of Ontario farmers having implemented this measure at some time - Table 1. As might be expected zero tillage was the least popular technique probably due to the need for new and expensive tillage equipment and reduced yields under some Ontario soil and climatic conditions.

In many areas in the U.S., minimum and zero tillage have been widely implemented and have been credited with success in reducing levels of soil erosion substantially. Considerable effort will be necessary in Ontario to convince farmers of the viability of these techniques when implemented in the Ontario context.

TABLE 1: Level Of Soil Conservation Practices Implemented (Q11, 12)*

	Contour ploughing % Error	Crop rotation % Error	Grass waterways % Error	Minimum Tillage % Error	Zero Tillage % Error	None of the above % Error
Ever**	10.4 ±3.2	71.9 ±3.8	10.3 ±2.6	16.7 ±3.4	3.2 ±1.0	22 ±3.0
In 1977	7.1 ±2.8	65.7 ±4.2	8.3 ±2.4	11.8 ±3.0	2.0 ±1.0	27.7 ±3.6

* Accuracy of responses shown at a confidence level of 95%.

** For the purposes of this survey, the term "ever" refers to the entire length of time that the respondent has been farming.

The level of implementation of soil conservation practices was compared with the length of time the respondents had been farming. Those farm operators who have been farming five years or less were the least likely to have ever adopted soil conservation practices - 65%, while those farming more than fifteen years reported the highest frequency of adoption - 82%. The adoption of minimum and zero tillage however, provides an exception, with farmers in the five years or less category reporting slightly higher levels than the normal. Similar trends in respect to the level of adoption of practices in 1977 were also apparent - Table 2 - 3.

The level of off farm work reported by farmers was also considered to be an important variable when assessing the level of implementation by farmers of soil conservation practices. Many farmers are not involved in food production on a full time basis and often receive considerable income from off-farm work. In the 12 months prior to July 1, 1977, an estimated 46.5 percent of Ontario farmers reported some days of off farm work. The majority of these reported more than 157 days at the off-farm job.

Full-time farmers or those reporting no off-farm work more often adopted soil conservation practices than those who did report off farm work. Eighty-one percent of those farmers who had not reported off farm work adopted one of the specified measures while only 74% of those reporting off farm work had ever adopted one of the listed soil conservation measures. The levels of adoption of these two groups varied most in the area of crop rotation. Seventy-six percent of full-time farmers had at some time adopted the practice while only 68% of the part-time farmers had ever adopted crop rotation - Table 4 - 5.

For a more complete analysis of off-farm work by Ontario farmers see R.D. Bollman, "Off-Farm Work by Ontario Farmers in 1977" Canadian Farm Economics.

TABLE 2*: Soil Conservation Practices Adopted Ever (Q11)
By Length Of Time Farming (Q4) (%)

Number Of Years Farming	Contour Ploughing	Crop Rotation	Grass Waterways	Minimum Tillage	Zero Tillage	None of The above
5 yrs or less	8	56	8	20	4	35
6-15 yrs	15	69	11	15	4	26
More than 15 years	10	76	11	16	3	18
ALL FARMERS	10	72	10	17	3	22

TABLE 3*: Soil Conservation Practices Adopted In 1977 (Q12)
By Length Of Time Farming (Q4) (%)

Number of Years Farming	Contour Ploughing	Crop Rotation	Grass Waterways	Minimum Tillage	Zero Tillage	None of The above
5 yrs or less	7	57	9	13	3	35
6-15 yrs	11	67	7	11	2	27
More than 15 years	6	67	8	12	2	26
ALL FARMERS	7	66	8	12	2	28

* Since individual respondents could have adopted more than one category of soil conservation practice, the rows will not sum to 100 %

TABLE 4*: Soil Conservation Practices Adopted Ever (Q11) By Extent Of Off Farm Work (Q3) (%)

No. of Days of Off-farm Paid work In the past 12 months	Contour Ploughing	Crop Rotation	Grass Waterways	Minimum Tillage	Zero Tillage	None of The above
None	10	76	11	17	2	19
1-365 days	10	68	9	17	4	26
ALL FARMERS	10	72	10	17	3	22

TABLE 5*: Soil Conservation Practices Adopted In 1977 (Q12) By Extent Of Off Farm Work Q3 (%)

No. of Days of Off-farm Paid work In the past 12 months	Contour Ploughing	Crop Rotation	Grass Waterways	Minimum Tillage	Zero Tillage	None of The above
None	6	69	9	13	1	25
1-365 days	8	62	8	11	2	31
ALL FARMERS	7	66	8	12	2	28

* Since individual respondents could have adopted more than one category of soil conservation practice, the rows will not sum to 100 %.

When the level of adoption of soil conservation measures is compared with the income levels of farmers a number of interesting relationships are apparent.* Farmers with sales of agricultural products less than $10,000 reported lower levels of adoption of soil conservation practices than those selling more than this amount (see Figure 1). Farmers with sales greater than $150,000 reported similar levels of adoption as those farmers with sales less than $10,000. The relatively small size of the high value group - only 3.4 percent of the farmers responding, does however, reduce the dependability of this result.

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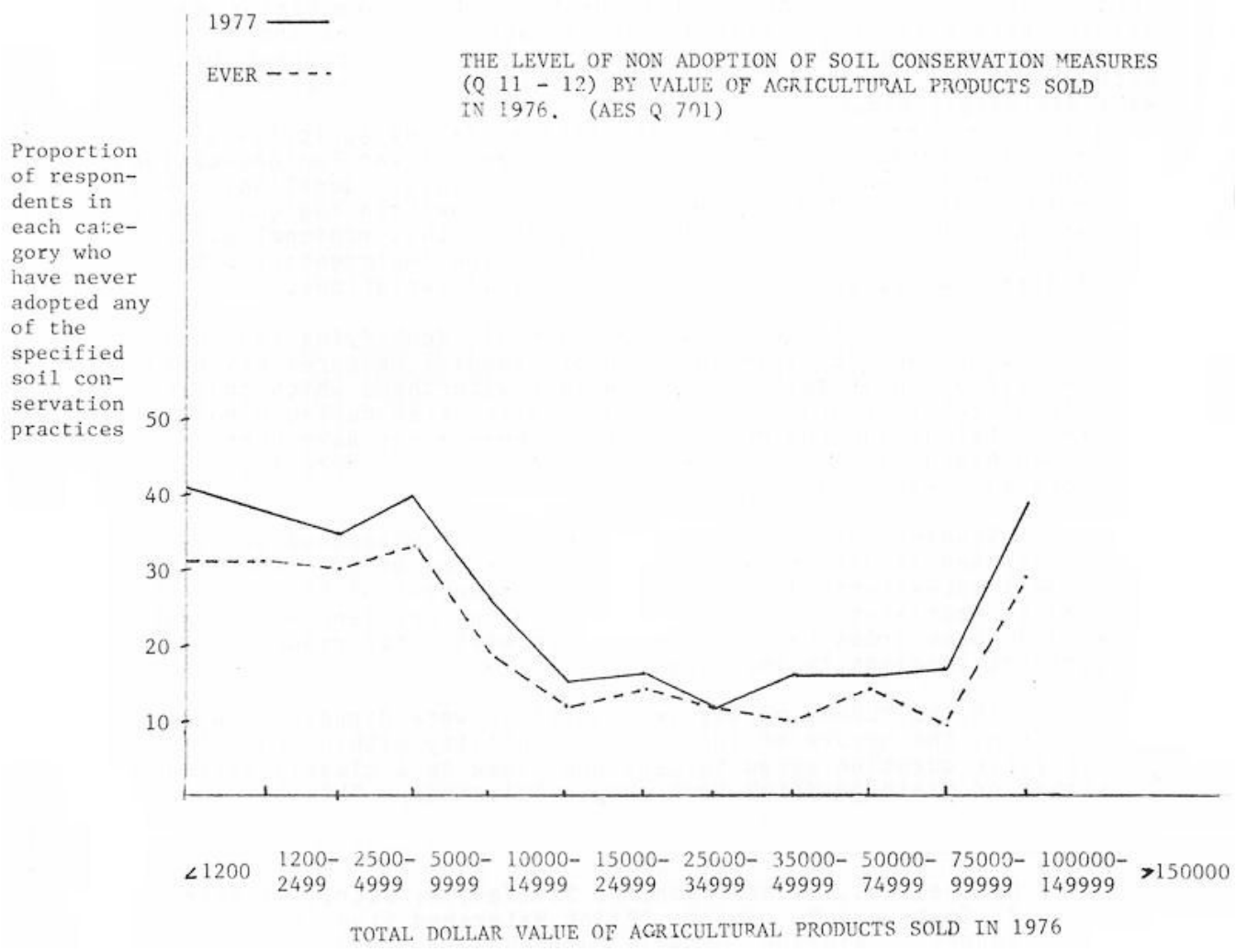
* For the purposes of interpreting the survey results - the value of agricultural products sold in 1976 or gross farm income has been used as a surrogate of net farm income although it is recognized that there is not always a direct relationship between both.

FIGURE 1


1977
EVER
THE LEVEL OF NON ADOPTION OF SOIL CONSERVATION MEASURES (Q 11 - 12) BY VALUE OF AGRICULTURAL PRODUCTS SOLD IN 1976. (AES Q 701)
Proportion of respondents in each category who have never adopted any of the specified soil conservation practices
50
40
30
20
10
<1200
1200-2499
2500-4999
5000-9999
10000-14999
15000-24999
25000-34999
35000-49999
50000-74999
75000-99999
100000-149999
>150000
TOTAL DOLLAR VALUE OF AGRICULTURAL PRODUCTS SOLD IN 1976

Regional Priorities

Although problems associated with erosion and sedimentation occur throughout the Great Lakes' Basin, the severity of these problems varies both amongst the individual Lake Basins and within these Basins. Variations in climate, soil type and the intensity and kinds of land use activities are all important in determining the level of erosion and resultant sedimentation that will ultimately occur.

Unfortunately, the results of this survey are not amenable to a further breakdown by region and thus a clearer assessment of regional variations in the attitudes and practices of farmers cannot be reported at this time. It should be noted however, that since this survey was undertaken, at least one other similar survey has been completed. The "Thames Valley Agricultural Practices Survey" carried out by the Thames River Implementation Committee in July 1978 uses many of the original questions asked in the PLUARG survey but addresses a more defined regional population. Hopefully, additional surveys of this regional nature will be carried out to provide planners and implementors with a clearer understanding of existing regional variations.

Implicit in the PLUARG approach of identifying regional priorities for the implementation of remedial measures has been the resolution of smaller areas within watersheds which contribute directly to ground and surface water, even during minor precipitation and snowmelt events. These areas have been termed hydrologically active areas (HAA) and are normally located close to rivers, lakes and streams.

Studies completed in the PLUARG pilot watershed series illustrated situations where 15 to 20 percent of the land within a small sub-watershed produced up to 90 percent of the sediment load to receiving streams[2]. Obviously, proper land management within these areas has the greatest potential for reducing sediment loadings to the lakes.

In the PLUARG survey two questions were directed towards assessing the nature of agricultural activity within the HAA. The first question asked farmers how close to a clearly defined stream or drainage ditch bank they cultivated. This is especially important given that the closer

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(2.) G. Chesters, J. Robinson, R. Stiefel, R. Ostry, T. Bahr, R. Coote and D.Whitt". Pilot Watershed Studies; Summary Report",Windsor, Ontario June 1978, p.4-3.

cultivation is carried out to a watercourse the greater is the likelihood that detached soil particles will be carried to receiving waters. In many areas of the Basin, natural vegetative buffers have been maintained along streambanks due to the lower capability of this land to support agricultural production. In other areas however, the value of land as a factor in agricultural production has been too high for this land to be left in its natural state.

PLUARG identified the reestablishment of these vegetative buffer strips along stream and drainage ditch banks as an important remedial measure for reducing the movement of eroded soil to the receiving waters.

TABLE 6: Distance Of Cultivation From A Stream Or Drainage Ditch* (Q13)

DISTANCE	PROPORTION (%)	ERROR
Less than 10 feet	30.1	+2.1
11 to 20 feet	16.4	+7.7
More than 20 feet	17.5	+1.9
No clearly defined streams or ditches in or beside those fields cultivated	34.6	+2.1

* Includes those streams or ditches which only carry water for a part of the year.

Although only 30 percent of those farmers responding indicated that they cultivated less than 10 feet from the banks, it is important to note that 35 percent of the farmers did not have streams or ditches near the field they cultivated. When the cultivation practices of only those farmers who have streams and who cultivate less than 10 feet are compared, this figure rises

dramatically. In this situation, 47 percent of the farmers cultivated less than 10 feet - 26 percent, 11-20 feet and 27 percent more than 20 feet. Certainly an intensive program of farmer education concerning the HAA will be necessary, coupled with a program of economic incentives to encourage farmers to return this cultivated land close to streams and ditches to uses where soil disturbance is minimized.

Other agricultural activities which must be carried out with caution in the region of the HAA are land spreading of manure and fertilizing with inorganic fertilizer. In the questionnaire farmers who spread manure on the land were asked, "How close to a clearly defined stream or drainage ditch bank do you usually apply manure". Once again the results indicated that farmers generally do not restrict their activities just because a stream or ditch is in the area.

TABLE 7: Distance Of Manure Application From A Stream Or Drainage Ditch* (Q20)

DISTANCE	PROPORTION (%)	ERROR
Less than 20 feet	16.4	± 1.6
21 to 50 feet	21.1	± 2.1
51 to 100 feet	7.0	± 0.9
More than 100 feet	18.4	± 1.6
No clearly defined streams or ditches in or beside those fields cultivated	36.7	± 2.4

* Includes those streams or ditches which only carry water for a part of the year.

If the practices of farmers who had no clearly defined streams or ditches are removed from consideration, then the proportion of farmers spreading less than 20 feet become 26 percent - spreading 21-50 feet, 34 percent - 51-100 feet, 11 percent and those spreading more than 100 feet - 29 percent.

Finally a cross tabulation was conducted between this question which determines distance of manure spreading and the companion question which identified the distance of cultivation. The results of this comparison may be found in Table 8.

TABLE 8: Distance Of Cultivation From A Stream Or Drainage Ditch Bank (Q13) By Proximity Of Manure Application (Q20) (%)

Proximity of manure Application	Distance of Cultivation			
	Under 10 Feet	11-20 Feet	Over 20 Feet	No stream or Ditch Beside the Fields Cultivated
Less than 20 feet	80	16	2	2
21-50 Feet	35	43	20	2
51-100 Feet	26	20	52	2
More than 100 Feet	23	15	52	9
ALL FARMERS	30	17	18	35

While 30 percent of all farmers cultivated less than 10 feet from a stream bank, 80% of those farmers who spread manure less than 20 feet also cultivated less than 10 feet. Similarly while only 17 percent of all farmers cultivated between 11-20 feet from stream banks, 43 percent of those farmers who spread manure between 21-50 feet from the banks also cultivated between 11-20 feet. Taken together the risks to water quality are much greater if both cultivation and manure spreading are carried out in this zone.

Another activity of concern is the use by the farmers of inorganic fertilizers especially in the area of the HAA. During the PLUARG pilot watershed studies, it was determined that the application of fertilizer phosphorus in excess of that required for crop production will increase the amount of phosphorus in runoff water. Other data collected during the study indicated that on average, fertilizer phosphorus additions exceeded the estimated county requirements for all crops except hay -pasture[3]. Although this overuse did not generally result in major increases in water quality problems, it was acknowledged that if this practice was followed in the HAA, the hazard of causing water quality problems would increase.

In order to encourage the efficient use of inorganic fertilizers by farmers, the Ontario Ministry of Agriculture and Food operates a free soil testing service in Guelph. Farmers are provided with advice on how to prepare soil samples and where to take them for analysis. A report is subsequently provided to the farmer, detailing his fertilizer needs by considering not only the soil sample but also the farmers cropping plans and adjusted for manure application and for sod plowed down.

When farmers were asked on the questionnaire if they were aware of the soil testing services offered by the Ontario Ministry oF Agriculture and Food, 90 percent responded in the affirmative - Table 9. Subsequent to this question, when farmers were asked if they had ever had

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(3.) M.H. Miller, A.C. Spires, "Contribution of Phosphorus to the Great Lakes from Agricultural Land in the Canadian Great Lakes Basin", Windsor, Ontario, Mar. 1978, p. 16-18.

their soil tested for fertilizer needs, only 60 percent indicated that they had - Table 10. In an effort to determine why farmers who were aware of the service had not tested their soil, a number of cross tabulations were performed (Tables 11 - 14). As a result of this statistical analysis a number of observations were made. Generally farmers who reported no off farm work were more inclined to have had their soil tested than those farmers who did work off the farm - Table 11. The length of time farming also seemed important when considering the level of soil testing. Those in farming less than 5 years were far less likely to have had their soil tested than the average for all farmers. Conversely those respondents who had farmed more than 15 years exceeded the level of soil testing reported for all farmers - Table 12.

TABLE 9: Awareness Of Soil Testing Service (Q6)

	Proportion (%)	Error
Yes	89.5	+1.3
No	10.4	+1.3

TABLE 10: Extent Of Soil Testing (Q7)

	Proportion (%)	Error
Yes	59.8	+ 2.1
No	40.1	+ 2.0

TABLE 11: Soil Testing (Q7) By Extent Of Off Farm Work (Q3)

Number of Days of off-farm paid work in the past 12 months	Operators who have had their soil tested for fertilizer needs (%)	
	Yes, Tested	No, Not Tested
None	65	35
1 - 365	54	46
ALL FARMERS	60	40

TABLE 12: Soil Testing (Q7) By Length Of Time Farming (Q4)

Number of Years Farming	Operators Who Have Had Their Soil Tested For Fertilizer Needs (%)	
	Yes, Tested	No, Not Tested
5 years or Less	39	61
6-15 years	56	44
More than 15 years	66	34
ALL FARMERS	60	40

TABLE 13: Soil Testing (Q7) By Value Of Agricultural Sales (AES Q 701)

Total Value of Agricultural Sales in 1976	Operators who have had their soil tested for fertilizer needs (%)	
	Yes, Tested	No, Not Tested
Less than $10,000	44	56
$10,000 - $74,999	69	31
More than $74,999	89	11
ALL FARMERS	60	40

TABLE 14: Soil Testing (Q7) By Commercial Fertilizer Expenditures (AES Q 808) (%)

Commercial Fertilizer Expenditures in 1976	Operators who have had their soil tested for fertilizer needs (%)	
	Yes, Tested	No, Not Tested
0 - $449	45	55
$450 - $1,799	68	32
More than $1,799	79	21
ALL FARMERS	60	40

Farmers who reported the highest value of agricultural products sold in 1976, also reported the highest level of soil testing. Almost 90 percent of farmers with sales greater than $74,999 reported having had their soil tested while only 44 percent of farmers with sales less than $10,000 reported soil testing - Table 13. Similarly farmers who reported the highest expenditures for commercial fertilizers in 1976 also reported the highest level of soil testing - Table 14.

Further questions were directed at those farmers who had had their soil tested. This group reported that the Ontario Agricultural College at Guelph was the dominant source of soil testing information - 59 percent. This proportion can be further increased by adding the 13 percent of the respondents who indicated that the Ontario Ministry of Agriculture and Food was their source of soil testing information. In fact both of these agencies represent the same soil testing facility. Interestingly enough, 29 percent of respondents had their soil tested by a fertilizer company and the remainder did it through some other mechanism - Table 15.

TABLE 15: Source Of Soil Testing (Q8)

	PROPORTION (%)	ERROR
Ontario Ministry of Agriculture and Food	12.5	± 1.5
Ontario College at Guelph	59.0	± 2.2
Fertilizer Company	29.3	± 2.2
Other	7.5	± 1.6

TABLE 16: Frequency Of Soil Testing During The Past Five Years (Q9)

	PROPORTION(%)	ERROR
Several times a year	0.7	± 0.3
Every year	14.2	± 1.7
Every 2 years	23.1	± 2.0
Once or Twice	27.0	± 2.7
Other	17.6	± 2.7
None	17.1	± 1.8

Although 60 percent of the respondents indicated that they had had their soil tested at some time, when respondents in this 60 percent category were asked whether or not they had tested over the past five years there was a further decline in their number. Out of the original 60 percent, 17 percent indicated that they had not tested in the last five years and only 14 percent had tested every year - Table 16.Thus less than half of Ontario's farmers have had their soil tested over the past 5 years resulting in the possibility that farmers are not matching application rates to crop requirements. In a situation where under use occurs, reduced yields may result with concommitant reduction in farm incomes; in the example of over use, the farmer gains an alternate form of crop yield insurance but at the extended cost of enriching surface and groundwater with nutrients.

The use of the soil test is one means of ensuring that this situation does not occur. This is probably a good first step which will result in benefits both for the farmer and for the environment. The problem remains, however, as to how individual farmers use their soil test results. In a survey

of Haldimand County farmers use of the soil test report, it was found that 90 percent of the respondents did make a change in the amount of fertilizer applied from that suggested on their soil test report. In addition, 56 percent of the respondents made one-half or more changes that were considered as ill advised.

In this survey, although 60 percent of the respondents had reported having their soil tested at some time, only 23 percent indicated that the soil test reports were the most helpful information source for determining fertilizer application rates. Fertilizer sales representatives and neighbours were the second and third most important specified sources; although, the largest portion of the respondents, 32 percent, indicated that "other" sources were the most important - Table 17.

Thus the Ontario Ministry of Agriculture and Food has two important challenges ahead of it in the area of improving fertilizer use. The first, will be to increase the level of soil testing amongst Ontario farmers and the second will be to improve the understanding and interpretation of the soil test results, so that farmers maximize the utility of the inputs to production while minimizing the externalities of production which may result in degraded water quality.

TABLE 17: Information Sources For Determining Fertilizer Application Rates (Q10)

	PROPORTION (%)	ERROR
Fertilizer Sales Representative	22.3	± 1.7
Soil Test Reports	23.4	± 1.8
Neighbours	13.5	± 1.5
Agricultural Extension Representative	7.4	± 0.8
Other	31.7	± 1.6

(4.) K.E. Best and D.J. Blackburn "Farmer's Use of the Soil Test Report", School of Agricultural Economics and Extension Education, University of Guelph Publication, EE/72/2, December, 1972.

LIVESTOCK AND POULTRY MANURE

In the Great Lakes Basin, livestock and poultry manure represents an important uncontrolled source of nutrients. It has been calculated that in 1971 there were 66,792 MT of P_2O_5 and 150,634 MT of nitrogen derived from this source in the Ontario portion of the Great Lakes Basin.[5] Despite these large quantities of available nutrients, PLUARG monitoring studies estimated that livestock only contributed phosphorus at rates which averaged 20 percent of the agricultural loads studied.[6] Thus much of the nutrient value of livestock manures is retained by the soil and does not run overland into streams and drainage ditches.

The major exceptions to this occur when manure is spread on frozen and snow covered ground during the winter months of the year. Nutrients in this manure may be either volatilized or carried in runoff during periods of snowmelt. This situation not only results in degraded water quality but also in a loss of nutrients to the farm operation. Other practices such as the inappropriate design and location of concentrated feeding operations and manure storage facilities close to streams or drainage ditches also holds the potential for the rapid runoff of livestock derived nutrients into surface water supplies.

Although the land spreading of manure is the most common and potentially the most beneficial method of manure management; the timing, method and site of application are also important in determining the relative benefits and losses to agriculture of this source of nutrients.

In terms of the popularity of land spreading of manure, 79 percent of all farmers responding to the questionnaire indicated that they applied some manure to the land, although, only 74 percent indicated that their operations had livestock or poultry - Table 18, 19.Thus a small percentage of cash crop farmers also appear to utilize manure to supplement the depleted supplies of nutrients and organic material in their soil.

(5.) G.E. Bangay "Livestock and Poultry Wastes in the Great Lakes Basin: Environmental Concerns and Management Issues".Inland Waters Directorate, Social Science Series No. 15. 1976 p.28.

(6.) Pollution from Land Use Activities Reference Group, Task Group C, "Agricultural Watershed Studies Great Lakes Drainage Basin Canada".Windsor, Ontario. May, 1978. p.48.

TABLE 18: Proportion Of Respondents Having Livestock And/or Poultry (Q 14)

	PROPORTION (%)	ERROR
Yes	73.9	± 1.8
No	15.6	± 1.9

TABLE 19: Proportion Involved In Land Spreading Of Manure (Q 18)

	PROPORTION (%)	ERROR
Yes	79.1	± 1.6
No	20.3	± 1.7

On Ontario farms a number of different manure management systems are employed. The different systems involve varying levels of capital investment and operating costs. The most common system is the solid system of manure management. Eighty-eight percent of the respondents who had livestock or poultry indicated that they had solid systems while only 2 percent reported having liquid systems. The remainder were divided between semi-solid, combinations of the forgoing and an inability to classify their systems - Table 20.

TABLE 20: Type Of Manure Management System Used (Q 16)

	PROPORTION (%)	ERROR
Solid	88.4	± 1.5
Semi-Solid	3.5	± 0.6
Liquid	2.3	± 0.6
Combination	2.5	± 0.6
Cannot Classify	2.8	± 0.7

TABLE 21: Extent Of Coverage Of Manure Storage Areas (Q 17)

	PROPORTION (%)	ERROR
Yes, Covered	11.1	± 1.1
No, Not Covered	87.1	± 1.3
Combination	0.8	± 0.4

TABLE 22: Degree Of Cover Over The Manure Storage Area (Q 17) By Type Of Manure Management System (Q 16) (%)

	Yes, Covered	No, Not Covered
Solid	9	91
Semi-Solid	12	88
Liquid	65	35
ALL SYSTEMS	11	87

These same livestock or poultry farmers were also asked if their manure storage areas were covered. This is especially important if the leachate or decant from these areas can either move quickly across the surface to a stream or drainage ditch or to groundwater. In addition, the lack of an adequate cover will also result in the loss of valuable nutrients needed for optimum agricultural

production through the leaching action of precipitation. Eighty-seven percent of the livestock and poultry farmers reported that their manure storage areas were not covered - Table 21. The existence of this situation creates the potential for continued problems of nutrients moving from manure storage areas to surface and groundwater. The construction of adequate protection for these areas will also require capital investments by the farmers which may not be easily accommodated. In Table 22 the degree of coverage was compared by the kind of storage system used. Solid systems were found to be more likely to be uncovered than liquid systems.

Those farmers who indicated that they applied manure to the land were asked a further question related to the timing of this application. Of particular concern was the extent of land spreading during the period December 1st through to March 31st; the period in Ontario when the soil surface is generally frozen and there is very often snow cover. As was stated earlier, manure spreading during this period of the year will likely result in disbenefits for both the farmer and for water quality.

Fortunately, in Ontario, a majority - 63 percent of farmers, do not apply manure during this critical winter period. Despite this optimistic situation however, there still remains an important segment - 36 percent who do apply some portion of their total manure at this time - Table 23. When the respondents practices regarding manure spreading were compared to the total value of their agricultural products sold in 1976, a definite trend can be observed. Those farmers reporting the lowest value of sales also reported the lowest proportion spreading manure during this critical winter period. On the contrary, those farmers with the highest reported value of agricultural products sold, reported the highest proportion involved in winter spreading - Table 24. It may be, that in the case of those operations within the lowest value of agricultural products sold, manure is considered to be a more valuable input to the production process than it is on the higher value operations and thus its use is optimized during that period of the year when plants can use the nutrients. When all farmers were asked if they thought manure was anything more than a waste disposal problem in modern farming, only 51 percent replied in the affirmative - Table 25.Thus for many farmers, manure is perceived primarily as a waste disposal problem. This response was further analyzed by comparing it to the value of agricultural products sold in 1976 -- Table 26. Farmers with sales over $10,000 reported the lowest proportion of respondents, who felt that

TABLE 23: Proportion Of Total Manure Applied During The Winter Months Dec. 1st - Mar. 31st (Q 19)

	PROPORTION (%)	ERROR
None	63.2	± 2.6
¼ of manure	15.1	± 1.7
½	10.4	± 1.5
¾	3.2	± 0.6
All	7.6	± 1.4

TABLE 24: Extent Of Winter Spreading Of Manure (Q 19) By Value Of Agricultural Sales (Aes Q 701) (%)

Value of Agric. Products Sold in 1976	Portion of Manure Applied During the Winter Months Dec.1st - Mar.31	
	None	Some
Less than $10,000	72	28
$10,000 - 74,999	58	42
More than $75,000	53	48
ALL FARMERS	63	36

TABLE 25: Assessment Of The Value Of Manure

	PROPORTION (%)	ERROR
Yes, Valuable	50.6	± 2.7
No, Not Valuable	46.9	± 2.7
Don't Know	1.5	± 0.4

TABLE 26: Assessment Of The Value Of Manure (Q 23) Manure (Q 19) By The Total Value Of Agricultural Sales (AES Q 701) (%)

	Yes, Valuable	No, Not Valuable	Don't Know
Less Than $10,000	56	42	2
$10,000 - 74,999	46	52	1
More than $75,000	49	47	3
ALL FARMERS	51	47	2

manure was something more than a waste disposal problem, while a large percentage of farmers with sales less than $10,000 indicated that manure was more than just a waste disposal problem. During the survey, farmers were also asked if they felt that their present farm management practices were adequate for controlling water pollution. When the results from this question were compared to the responses relating to the proportion of manure spread during the winter, it is apparent that those farmers spreading manure during the winter period did not perceive this as causing a water pollution problem - Table 27.

The existence of this situation coupled with the additional costs that farmers will face in constructing adequate manure storage facilities should act as a stimulus to agricultural agencies to improve their existing information/- education and cost sharing programs. These programs should stress not only the nutrient value of manure but also the advantages to the farm operation of increasing the soil organic content and timing the application of manure to best suit crop needs.

TABLE 27: Assessment Of The Adequacy Of Their Own Operations For Controlling Water Pollution (Q 33) By Extent Of Winter Manure Spreading (Q 19) (%)

	Yes, Valuable	No, inadequate	Do not Know
No Winter Spreading	95	3	1
Some Winter Spreading	94	3	2
ALL FARMERS	94	3	2

Providing livestock with free access to streams has also been identified as another potentially harmful practice followed by some livestock farmers. Problems which may result include accelerated stream bank erosion through increased bank instability and slumping and the discharge of livestock manure directly in the streams with resultant nutrient and bacterial problems. Neither of these activities were accurately quantified during the PLUARG study, although, there is sufficient concern about these problems that at least two Ontario Conservation Authorities have established programs to assist farmers in restricting the access of livestock to streams.[7]

Fortunately only 33 percent of the livestock or poultry farmers responding to the questionnaire indicated that they provided free access to water courses such as streams, open drains or lakes - Table 28.When the response to this question was compared to the different kinds of cattle operations a number of interesting observations were made.

TABLE 28: Means Of Watering Livestock (Q 15)

	PROPORTION* (%)	ERROR
Provide Free Access to Water Courses	32.9	± 2.7
Pump Water to Livestock	88.0	± 1.6
Other	7.4	± 1.4

* Total of proportions may exceed 100% since more than one category could be identified by the respondent.

(7.) Saugeen Conservation Authority - Private Streambank Improvement Program, 1978. Ganaraska Conservation Authority - Fish and Wildlife Habitat Improvement Program, 1978.

TABLE 29: Means Of Watering Livestock (Q 15) By Number Of Cows Milked Yesterday (AES Q 420) (%)*

	Free Access	Pump Water	Other
Less Than 10	48	74	10
10 - 59	32	95	5
More Than 59	40	100	0
All Farmers In This Category	36	90	6

TABLE 30: Means Of Watering Livestock (Q 15) By Number Of Animals Fattened Or Finished For Slaughter (Sum Of AES Q 426 - Q 433) (%)*

	Free Access	Pump Water	Other
Less Than 10	34	86	13
10 - 99	48	88	8
More Than 99	32	95	0
All Farmers In This Category	41	88	10

* Total of proportions may exceed 100% since more than one category could be identified by the respondent.

TABLE 31: Means Of Watering Livestock (Q 15) By Total Cattle And Calves Minus Cows Milked Yesterday (AES Q 410 Minus AES Q 420) (%)*

	Free Access	Pump Water	Other
Less Than 10	41	69	11
10 - 99	36	86	8
More Than 99	51	94	6
All Farmers In This Category	39	83	9

In the case of finishing operations, those with between 10 - 99 animals reported the highest incidence of providing free access to streams, while in the dairy category the smallest and the largest sized operations reported the highest incidence. In each case, the largest operations reported the highest proportion pumping water to livestock. In the case of dairy herds with more than 59 animals being milked, this reached 100 percent - Tables 29 - 31.

Given the potentially harmful effects of giving large numbers of cattle free access to streams, some consideration should be given to the development of defined access points which could be properly constructed to minimize erosion problems and reduce the time cattle remain in

* Total of proportions may exceed 100% since more than one category could be identified by the respondent.

the stream. This would certainly help to reduce siltation and nutrient and bacteria problems especially in those areas of the province where this problem is most apparent.

Since 1970, in an effort to reduce the environmental impact of livestock operations, a series of revised Ontario Agricultural Codes of Practice have been issued jointly, by the Ontario Ministries of Agriculture and Food, Environment and recently Housing. Initially, the Code and its accompanying Certificate of Compliance were directed towards minimizing odour problems between livestock operations and surrounding residences. Subsequently, this objective has been modified to include some guidance with respect to the protection of water quality. The adoption of the Code and the Certificate has been on a voluntary basis and has served as the principal mechanism for ensuring that the environmental impact of livestock operations is minimized.

Since the Code relies on voluntary acceptance and adoption by farmers, it is important to know just how widespread the knowledge is concerning the general guidelines of the Code and/or Certificate of Compliance. In the survey, all farmers were asked to indicate whether or not they were familiar with these general guidelines. Interviewers were instructed to indicate a yes response even if the respondent did not relate directly to the name of the Code or Certificate but indicated that these had something to do with the siting of farm buildings to avoid odour problems and/or for the management of animal wastes. The response to this question by all farmers was disappointingly low, with only 31% responding in the affirmative - Table 31. It may however, be argued that this low level of response was to be expected, given that the program has been directed mainly at livestock or poultry farmers and not the entire farm population. A further analysis defining the level of awareness of the livestock or poultry farmers responding to the questionnaire was conducted and this produced results which were very similar to the level measured for the entire survey population - Table 33.

TABLE 32: Familiarity With The Ontario Agricultural Code Of Practice And/or The Certificate Of Compliance (Q 32)

	PROPORTION (%)	ERROR
Yes	31.4	±1.8
No	67.0	±1.8
No Answer	1.4	± 0.4

TABLE 33: Presence Of Livestock Or Poultry (Q 14) By Familiarity With Code (Q32) (%)

	Yes, Present	No, Not Present	All Farmers
Yes, Familiar	32	31	31
No, Not Familiar	67	68	67
No Answer	1	1	1

Since the early editions of the Code, a number of references have been made respecting the need for at least 6 months storage capacity for manure. Presumably these have been included to encourage farmers to avoid the environmental problems associated with winter spreading and also to maximize the utility of manure in crop production. The most recent revision of the Code has also included a section on the spreading of manure during winter and spring and advice aimed at discouraging free access of livestock to streams.

In order to determine if farmers were following these suggestions three additional cross tabulations were performed - Tables 34-36.These included a comparison of the practices of chose farmers aware and those unaware of the general guidelines of the Code with respect to winter spreading of manure, distance of manure spreading from a clearly defined stream or drainage ditch and the provision of free access to streams for livestock. In each case, there was very little difference between the practices of farmers who were aware of the Code and those who were unaware.

Given this situation, it would appear appropriate to provide greater emphasis on the delivery of the Code to the Ontario farm population especially if this is to remain the principal vehicle for ensuring good environmental management of Ontario's livestock operations.

Based on the low level of familiarity measured in this survey, some reconsideration should be directed to the "voluntary" aspects of future programs encouraging compliance. It may be that the educative affect of regulatory programs could encourage a higher level of compliance. Certainly, if a purely voluntary approach is chosen, an annual or at least biannual evaluation of the level of awareness, adoption and implementation of the program must be undertaken.

TABLE 34: Familiarity With The Code (Q 32) By Extent Of Winter Spreading Of Manure (Q 19) (%)

	Yes, Familiar	No, Not Familiar	No Answer
No Winter Spreading	32	67	1
Some Winter Spreading	31	69	-
All Livestock or Poultry Farmers	32	67	1

(- Data not available)

TABLE 35: Familiarity With The Code (Q 32) By Proximity Of Manure Application To A Stream Or Drainage Ditch Bank (Q 20) (%)

Distance of Spreading	Yes, Familiar	No, Not Familiar	No Answer
Less Than 20 Feet	32	67	1
21 - 50 Feet	31	68	1
More Than 50 Feet	34	66	0
No Stream or Ditch	30	69	1
All Livestock or Poultry Farmers	32	67	1

TABLE 36: Familiarity With The Code (Q 32) By Method Of Watering Livestock (Q 15) (%)

	Yes, Familiar	No, Not Familiar	No Answer
Free Access to Water Courses	27	72	1
Pump Water to Livestock	34	65	1
Other	25	71	2
ALL FARMERS	31	67	1

(3.) IMPLEMENTATION OF REMEDIAL MEASURES

In the final section of the questionnaire, questions were directed to farmers concerning a number of topics which relate directly to the design and implementation of a remedial measure program. These topics included an assessment of: (i) the level of awareness of farmers concerning agriculture and water pollution (ii) the commitment by farmers to reduce water pollution and (iii) the nature of the delivery system for providing farmers with information on pollution related topics. Hopefully, through an analysis of the responses to each of these question areas, some further resolution will be provided to those ultimately charged with the responsibility of implementing a remedial measure program.

(i) Level of Awareness of Farmers Concerning Agricultural and Water Pollution

Perhaps the first step to consider in designing and implementing a remedial measure program is whether or not the population who will be required to take action are even aware of the problem. Too often programs are designed by those who are fully aware of the problem, only to be delivered somewhat precipitously to a group who are yet unaware or unconvinced of its existence. The results of the PLUARG survey clearly demonstrates the wide gap between the identification of the problem and the general awareness of the problem which existed in the summer of 1977 and which is only now beginning to close. To attempt to implement a program of remedial measures in agriculture before more farmers are more fully aware would engender more resistance than cooperation. Eighty percent of the farmers responding to this survey indicated that they felt that farming activities contributed to only a minor extent or not at all to water pollution - Table 37. When the farmer's assessment of agricultural related water pollution was compared to their own agricultural practices such as winter spreading of manure, little variation was detected- Table 38. This would seem to demonstrate that farmers have not yet been made aware of the connection between the winter spreading of manure and agricultural related water pollution.

As a general observation, it should also be noted that when farmers wera asked the question ranking the importance of agriculture's contribution to water pollution, many respondents became very concerned that there should even be a suggestion that agriculture was causing any problems.

In most cases, farmers pointed to the most obvious sources of industrial pollution and asked what governments were doing about those sources. It is likely that any successful remedial program in agriculture must also develop some awareness on the part of farmers concerning activities related to the reduction of these industrial and municipal sources of water pollution.

TABLE 37: Assessment Of The Contribution Of Farming Activities To Water Pollution (Q 21)

	PROPORTION (%)	ERROR
Very Great	1.8	± 0.4
Considerable	6.7	± 0.8
A Minor Extent	54.4	± 2.0
Not At All	25.1	± 1.8
Don't Know	11.3	± 1.1

TABLE 38: Assessment Of Agricultural Related Water Pollution (Q 21) By Portion Of Manure Applied In The Winter (Q 19) (%)

	A Very Great Or Considerable Contribution	A Minor Or No Contribution	Do Not Know
None Applied	9	78	12
Some Applied	7	82	11
ALL FARMERS	9	80	11

Another question directed to the respondents asked them to rank four agriculture related activities according to their contribution to water quality. The response level to this question was very low, only 60 percent of those responding to the questionnaire, and thus the results should be considered accordingly-Table 39. Most farmers not responding indicated that if farming was not causing a problem then what was the use of ranking problem sources. This response serves again to emphasize the lack of awareness of farmers concerning agriculture related water quality problems.

TABLE 39: Ranking Of Agricultural Activities According To Their Contribution To Water Pollution (Q 22)

	RANK	Number of Respondents
Pesticide Use	1	467
Soil Erosion	2	217
Livestock & Poultry Manure	3	119
Commercial Fertilizer Use	4	103

Early in the PLUARG program there was agreement that a large proportion of the Basin residents who did not use the Lakes as a source of drinking water or as a place for water based recreation would not respond favourably to a pollution control program which had as its major rationale, the improvement of Great Lakes water quality. It was felt, however, that most individuals would respond to a program aimed at improving the quality of local water supplies. When farmers were asked if they themselves or their operations had ever experienced any adverse effects from water pollution only 6.7 percent indicated that they had - Table 40.This very low level of experience concerning even local water quality problems would underline the need to appeal to other factors besides Great Lakes or local water quality improvement to encourage adoption.

TABLE 40: Experience Of Adverse Effects From Water Pollution (Q 30)

	PROPORTION (%)	ERROR
Yes	6.7	± 1.1
No	92.1	± 1.0
Don't Know	0.2	± 0.1

When the same 6.7 percent of the respondents were asked further if the water pollution they experienced was as a result of farming activities, only 32.9 percent replied in the affirmative-Table 41.Therefore, only a very small fraction of Ontario farmers have ever experienced adverse effects from degraded water quality as a result of agricultural activities.

TABLE 41: Source Of Pollution Due To Farming Activities (Q 31)

	PROPORTION (%)	ERROR
Yes	32.9	± 6.6
No	59.1	± 5.3
Don't Know	6.6	± 3.9

Farmers were also asked if they felt that their present farm management practices were adequate for controlling water pollution. Not surprising, given the nature of responses to other questions in this section, the vast majority of farmers responded in the affirmative - Table 42. Given the existence of this situation, there is a clearly demonstrated reed for a program of information/education developed specifically for farmers to identify agricultural practices which are of concern and to suggest alternatives which will minimize water quality impacts.

When responses to this question were compared to those given to a number of other questions concerning practices which are potentially hazardous from a water quality perspective, there was little demonstrated variation in the response. The practices considered in these cross tabulations included, winter spreading of manure, cultivation and application of manure close to stream banks - Tables 43, 44, 45.

In conclusion, farmers, were generally unaware of agricultural water related pollution problems and had seldom in terms of their own experience suffered any adverse effects. Most farmers felt that their own operations were not causing problems despite the fact that many of the respondents had adopted practices which had a clear potential for causing water quality problems.

TABLE 42: Adequacy Of Present Farm Management Practices For Controlling Water Pollution (Q 33)

	PROPORTION (%)	ERROR
Yes	94.3	± 0.6
No	3.0	± 0.4
Don't Know	1.6	± 0.4

TABLE 43: Adequacy Of Present Farm Management Practices (Q 33) By Extent Of Winter Application Of Manure (Q 19) (%)

	Yes, Adequate	No, Inadequate	Do Not Know
None Spread	96	3	1
Some Spread	94	4	2
ALL FARMERS	94	3	2

TABLE 44: Adequacy Of Present Farm Management Practices (Q 33) By Distance Of Cultivation From Streambanks (Q13) (%)

	Yes Adequate	No, Inadequate	Do Not Know
Less Than 10 Feet	94	5	1
11 - 20 Feet	95	4	2
More Than 20 Feet	95	3	1
ALL FARMERS	94	3	2

TABLE 45: Adequacy Of Present Farm Management Practices (Q 33) By Distance Of Application Of Manure (Q 20) (%)

	Yes, Adequate	No, Inadequate	Do Not Know
Less Than 20 Feet	93	6	1
21 - 50 Feet	94	3	2
More than 50 Feet	95	4	1
ALL FARMERS	94	3	2

(ii) The Commitment by Farmers to Reduce Water Pollution

In this section, a number of questions were directed to farmers to assess their willingness to implement remedial measures. This included a determination of the farm population's interest in receiving more information, the need for voluntary versus regulatory approaches and the desirability of cost sharing programs.

Despite the low level of awareness by farmers of the relationships between their operations and water quality; their responses to the questionnaire have provided a positive indication that they are prepared to consider changes. When farmers were asked if the government should provide them with more information on the control of water pollution from farming activities 72 percent responded yes - Table 46. It is possible that many of these respondents answered yes since it is a more positive response and therefore less likely to be criticized. There was however, a marked difference in the response to this question depending on the age of the respondent, whether or not they worked off the farm and the length of time farming. Younger farmers and those who have spent less time farming and those who supplement their farm income with off farm work were the most receptive to receiving more information - Table 47 - 49.

TABLE 46: Should Farmers Be Provided With More Information On Water Pollution (Q 26)

	PROPORTION (%)	ERROR
Yes	71.9	± 2.0
No	21.3	± 1.8
Don't Know	5.2	± 0.8

TABLE 47: Preference For More Information (Q 26) By Age Of Farm Operator (Q 34) (%)

	Yes	No	Don't Know
Less Than 35 Years	83	15	3
35 - 49 Years	75	20	4
More than 49 Years	68	25	7
ALL FARMERS	72	21	5

TABLE 48: Preference For More Information (Q 26) By Length Of Time Farming (Q 4) (%)

	Yes	No	Don't Know
5 Years or Less	84	13	3
6 to 15 Years	81	15	4
More than 15 Years	68	26	6
ALL FARMERS	72	21	5

TABLE 49: Preference For More Information (Q 26) By Off Farm Paid Work (Q 3) (%)

	Yes	No	Don't Know
No Off-Farm Paid Work	69	26	6
1 - 365 Days Of Off-Farm Paid Work	78	17	5
ALL FARMERS	72	21	5

In the Introduction to this report, it was noted that this survey was just one part of an overall program of public consultation. Another segment of this program involved a more narrowly defined public in a more interactive mode through the formation of 17 public consultation panels. During the course of several panel meetings, the members reached a consensus on a number of common recommendations. Probably the most fundamental one identified, was the need for an improved public information and education program. Thus, through an analysis of both the findings of the panel process and the survey, it is apparent that farmers not only want more information but they also require more information if they are to successfully make the necessary changes in their operations to reduce water pollution.

Two options or combinations thereof have most often been considered for the implementation of remedial measures. Either the soft approach stressing voluntary compliance or the hard approach which relies on regulatory action to achieve program objectives. Up to the present, governments have attempted to change agricultural activities with a potential for environmental problems almost entirely through a reliance on voluntary compliance. This approach may be considered to be something less than a resounding success when one views the results found in Table 32. Certainly PLUARG's public consultation panels went to great length to stress the importance of adopting voluntary approaches at least in the first instance. These could then be followed by stiffer regulatory approaches where success had not been met.

When respondents to the survey were asked if they thought the best policy for reducing water pollution associated with agriculture was to rely on only the good will of farmers, 56 percent responded yes - Table 50. Certainly this is not as high a proportion as one might have expected given the present popular level of anti government sentiment. When farmers were asked later in the questionnaire, if they thought that government should strictly enforce regulations in order to reduce water pollution from farming activities 46 percent were for strict enforcement and 44 percent were against - Table 51.

TABLE 50: Rely On Only The Good Will Of Farmers For Reducing Water Pollution (Q 24)

	PROPORTION (%)	ERROR
Yes	55.9	± 2.6
No	35.0	± 2.2
Don't Know	8.0	± 1.3

TABLE 51: Strictly Enforce Regulations To Reduce Water Pollution (Q 28)

	PROPORTION (%)	ERROR
Yes	46.2	± 2.0
No	43.9	± 2.1
Don't Know	8.2	± 0.9

Responses to both of these questions were further compared with variables such as the age of respondents, amount of off farm work reported and the length of time that they had been farming. In both cases, younger farmers were generally more in favour of more regulation and stricter enforcement than older farmers. Farmers who reported off farm work were also more likely to support stricter enforcement and less reliance on goodwill. Those farmers who had been farming less than 5 years were also more likely to support a stronger role for government regulation of their operations - Tables 52 - 57.

Another critical area of concern in the development of an implementable remedial measure program will be the determination of financial liability. The question remains unresolved as to what extent the public purse should be used to support agricultural pollution abatement.

There are numerous examples of where both the Federal and Provincial levels of government have supported, through the use of financial incentives, pollution abatement at municipal sewage treatment plants and industrial point sources. In Ontario agriculture there are already a number of cost sharing programs available to assist farmers in maintaining production. A review of those fiscal tools however, indicated that most of these were either inadequate or inappropriate in their present form to assist in water pollution control on farm operations.[8]

TABLE 52: Preference For Voluntary Regulation (Q 24) By Age Of Farm Operator (Q 34) (%)

	Yes, Voluntary Regulation Preferred	No, Voluntary Regulation Not Preferred	Don't Know
Less Than 35 yrs.	46	49	5
35 - 49 years	53	40	8
More than 49 years	62	29	9
ALL FARMERS	56	35	8

(8.) J.F. Castrilli, "Control of Water Pollution from Land Use Activities in the Canadian Great Lakes Basin: An evaluation of legislative, regulatory and administrative programs". IJC PLUARG Technical Report Windsor, Ontario, 1977.

TABLE 53: Preference For Voluntary Regulation (Q 24) By Off Farm Paid Work (Q 3) (%)

	Yes, Voluntary Regulation Preferred	No, Voluntary Regulation Not Preferred	Don't Know
No off-farm paid work	60	32	7
1 - 365 days of off-farm paid work	51	38	9
ALL FARMERS	56	35	8

TABLE 54: Preference For Voluntary Regulation (Q 24) By Length Of Time Farming (Q 4) (%)

	Yes, Voluntary Regulation Preferred	No, Voluntary Regulation Not Preferred	Don't Know
5 Years or Less	46	49	5
6 - 15 Years	54	38	8
More than 15 Years	60	32	9
ALL FARMERS	56	35	8

TABLE 55: Preference For Strict Government Enforcement (Q 28) By Age Of Farm Operator (Q 34) (%)

	Yes, Prefer Enforcement	No, Do Not Prefer Enforcement	Don't Know
Less Than 35 Years	55	39	6
35 - 49 Years	51	42	7
More than 49 Years	41	49	10
ALL FARMERS	46	44	8

TABLE 56: Preference For Strict Government Enforcement (Q 28) By Off Farm Paid Work (Q 3) (%)

	Yes, Prefer Enforcement	No, Do Not Prefer Enforcement	Don't Know
No Off-Farm Paid Work	45	47	8
1 - 365 Days Of Off-Farm Paid Work	49	42	9
ALL FARMERS	46	44	8

TABLE 57: Preference For Strict Government Enforcement (Q 28) By Length Of Time Farming (Q 4) (%)

	Yes, Prefer Enforcement	No, Do Not Prefer Enforcement	Don't Know
5 Years or Less	61	32	7
6 - 15 Years	51	42	7
More than 15 Years	43	48	9
ALL FARMERS	46	44	8

In the United States, there has been a long tradition of government assisted cost sharing programs to encourage farmers to implement soil conservation measures on their own operations. The United States Department of Agriculture, through the Soil Conservation Service and the Agricultural Stabilization and Conservation Service makes technical and funding assistance available to farmers throughout the U.S. These programs which have been in place since the 1930's have been promoted through a network of state and local policy and administrative units providing grass roots control on the delivery mechanism.

When Ontario farmers were asked if they thought farmers should pay the cost of water pollution control on their own properties, 60 percent responded no. Although this represents a majority of farmers, it is interesting to note that 30 percent felt that farmers do have some responsibility for the problems created by their own operations and should therefore pay these costs - Table 58. In an effort to determine how farmers felt about raising the necessary revenues to pay for these programs, respondents were further asked if everyone's taxes should be raised in order to subsidize the control of water pollution from farming activities. Seventy-seven percent of farmers responded that no general increase in taxes for this purpose should be considered - Table 59. The nature of these two responses appears to present government with a dilemma in which a small majority of farmers wish financial assistance and an even larger majority do not want general tax levies raised to support this assistance.

TABLE 58: Should Farmers Pay The Cost Of Water Pollution Control (Q 25)

	PROPORTION (%)	ERROR
Yes	30.4	± 1.6
No	59.9	± 1.7
Don't Know	8.5	± 0.9

TABLE 59: Should Everyone's Taxes Be Raised To Pay For Water Pollution Control (Q 27)

	PROPORTION (%)	ERROR
Yes	16.2	± 1.6
No	77.4	± 1.7
Don't Know	5.0	± 0.8

Additional questions are necessary to determine if the desired financial assistance should be arranged on a cost share basis (ratios to be determined) or if a program of tax incentives should be developed.

In the case of those farmers who indicated that they were willing to pay the costs of cleaning up their own operations, young farmers and those who had been farming less than five years demonstrated the greatest interest - Tables 60 - 61. It should be stressed however, that in neither case did they represent a majority of their respective groups.

In terms of a preference for increased taxation, resistance did not vary despite the difference in age, amount of off farm paid work and length of time farming.

It would therefore, appear sensible for those agencies involved in program implementation to consider a reordering of present program priorities in order to make the necessary funds available. A program of tax write-offs allowing farmers to spread the cost of pollution control efforts over a number of years may also be worthwhile considering.

TABLE 60: Preference For Funding Water Pollution Control On Their Own Operations (Q 25) By Age Of Farm Operator (Q 34) (%)

	Yes, Preferred	No, Not Preferred	Don't Know
Less Than 35 Years	38	58	5
35 - 49 Years	34	59	7
More than 49 Years	27	63	11
ALL FARMERS	30	60	9

TABLE 61: Preference For Funding Water Pollution Control On Their Own Operations (Q 25) By Length Of Time Farming (Q 4) (%)

	Yes, Preferred	No, Not Preferred	Don't Know
5 Years or Less	39	57	6
6 - 15 Years	31	63	7
More than 15 Years	30	61	10
ALL FARMERS	30	60	9

(iii) Program Delivery

Without a properly conceived and delivered program of information and education, subsequent efforts to enjoin farmers in an effort to improve water quality will meet with only partial success. How this message is delivered is of major importance. In an effort to provide at least a partial answer to this question, farmers were asked to identify the information sources which had in the past provided them with the most information on the control of water pollution from farming activities.

Without a doubt, newspapers and magazines provided farmers with the most information on this subject. There were, however, a variety of other sources used but perhaps what was most important was the 22 percent of respondents who had not received any information - Table 62. Although government agencies were identified as one of the least informative sources, it is probable that a portion of the information on the subject of controlling water pollution found in newspapers, magazines etc. came from this source.

TABLE 62: Most Important Source Of Information On Water Pollution

	PROPORTION (%)	ERROR
Government Agencies	7.2	± 0.9
Newspapers and Magazines	36.7	± 1.8
Radio and Television	16.6	± 1.6
Farm Organizations	12.2	± 1.2
Other	3.6	± 0.6
No Information	22.4	± 1.5

TABLE 63: Attendance At Agricultural Meetings

	PROPORTION (%)	ERROR
Yes	43.1	± 1.9
No	56.6	± 1.9

Farmers were also asked about their attendance over the past year at any organized meetings related directly to agriculture. Forty-three percent of respondents had attended a meeting during this period - Table 63. Certainly this, is a clear indication that a great many farmers are actively seeking more information compared to those satisfied with more passive sources such as, television, radio and newspapers. Despite only a minority of farmers attending meetings their value in delivering a specified message should not be overlooked. When awareness of the soil testing services and the Code of Practice are compared between those attending and not attending meetings there is a marked increase in awareness in both cases amongst those who attended - Tables 64 - 65.

In many cases farmers who attend these meetings are responsible for spreading information

further through the agricultural community. For example, when farmers were asked their most helpful source of information in determining fertilizer application rates, 14 percent of respondents indicated that their neighbours were. The soil test reports and the fertilizer company sales representative received 23 and 22 percent respectively- Table 66.

Thus farmers can and do receive information from a wide variety of sources. They tend not to perceive the government as an important part of this information delivery. New initiatives will be required to establish government as agents of assistance before they are seen only as regulators when water pollution controls for agriculture are implemented.

TABLE 64: Attendance At Organized Agricultural Meetings (Q 5) By Awareness Of The Soil Testing Services Offered By OMAF (Q 6) (%)

	Yes, Attended	No, Did Not Attend
Yes, Aware	46	54
No, Not Aware	19	81
ALL FARMERS	43	57

TABLE 65: Attendance At Organized Agricultural Meetings (Q 5) By Familiarity With The Code Of Practice (Q 32) (%)

	Yes, Attended	No, Did Not Attend
Yes, Familiar	64	36
No, Not Familiar	34	66
ALL FARMERS	43	57

TABLE 66: Information Sources Most Helpful For Determining Fertilizer Application Rates (Q 10)

	PROPORTION (%)	ERROR
Fertilizer Sales Representative	22.3	± 1.7
Soil Test Reports	23.4	± 1.8
Neighbours	13.5	± 1.5
Agricultural Extension Representative	7.4	± 0.8
Other	31.7	± 1.6

CONCLUSIONS

Agricultural activities in many areas of the Great Lakes Basin are contributing to the degradation of water quality. In the southwestern region of the province, the cultivation of row crops on fine textured clay soils is resulting in a measurable impact on the water quality of the Great Lakes. In other areas, the impacts are often limited to changes in local water quality. Despite these differences in magnitude, remedial action will be necessary on a priority basis throughout the province if overall improvements in water quality are to be realized.

Through the use of this survey, a number of observations have been made concerning the requirements of a successful remedial measure program. First, it is evident that there are still many farmers who follow practices which can lead to water quality problems. These include practices such as -- a high incidence of cultivating and spreading manure within the more hydrologically active areas surrounding streams and drainage ditches; an insufficient use of the soil test as a means of determining fertilizer needs; a significant proportion of farmers still spreading manure during the winter period; a large percentage of manure storage areas remaining uncovered and a negligible use of some of the more effective soil conservation measures for reducing soil loss on cultivated land.

Although there are not yet any government programs aimed directly at changing agricultural activities for the purpose of protecting and improving water quality; there are a number of programs which may indirectly afford benefits in this area. Soil testing for fertilizer needs is one such program. Over the years the provincial government has developed a high level of awareness amongst farmers concerning the availability of this service. Unfortunately, this level of awareness has not been translated into a similarly high level of adoption and implementation of the program by farmers. In another example, the promotion of the Ontario Agricultural Code of Practice has even failed in achieving a high level of awareness amongst farmers. Only when this occurs will there be widespread adoption and implementation of this Code.

Also of importance to the design of a successful remedial measure program is an awareness

of the attitudes and concerns of farmers. In the survey, it was determined that farmers were generally unaware of the relationship between their activities and changing water quality. A majority of respondents indicated that farming activities contributed to only a minor extent or not at all to water pollution and only a very small number of respondents had ever experienced any adverse effects from water pollution. In many cases respondents indicated that the government would be better off controlling industrial sources of water pollution before bothering with agriculture.

Despite the existence of this situation, farmers have indicated a desire for more information on controlling water pollution. Past efforts to inform farmers apparently have not been sufficient, since a considerable number of respondents had received no information at the time of the survey. Almost half the respondents had attended an organized meeting related to agriculture in the past year, indicating that farmers are certainly not passive in seeking out new information.

Surprisingly farmers indicated that governments should get tougher in the enforcement of regulations to reduce water pollution resulting from their activities. This observation certainly runs counter to the popular notion that farmers do not want any more government intervention in their affairs. A majority of farmers felt that there should be some financial assistance in the implementation of remedial measures. Certainly there has been sufficient precedent established in other sectors, including the control of water pollution from industrial and municipal sources to support this notion. Many of the remedial measures proposed by PLUARG could result in real costs for farmers not only in terms of equipment costs but also in the possible reduction of the land base used for production.

If governments are to meet the challenge of reducing agriculture related water pollution a number of steps will have to be taken. Immediate efforts are required to improve the means by which farmers receive information. Concurrent with this, will be the need to develop information materials related specifically to identifying measures that farmers can implement to reduce water pollution. As part of this information/education program, governments should not underestimate the educative value of regulatory approaches to solving problems. This should not be interpreted

as an invitation for governments to embark on a program of enforcing arbitrary measures for reducing agricultural related water pollution. Rather, present programs which rely solely on voluntary compliance should be reexamined to determine if they can be more effective through adoption of an approach which encourages more uniform compliance.

Although the concept of cost-sharing programs may be greeted with a good deal of reluctance in these times of fiscal belt-tightening, their value in encouraging adoption of measures is apparent. These programs can be modest however, since the problems requiring treatment are not uniform in nature across the Province. Through the adoption of program priorities, those areas exhibiting the worst conditions can be treated first. In many situations the adoption of remedial measures can result in real economic benefits to the farm operation both in the short and long term. More efficient use of manure and commercial fertilizers and the preservation of irreplaceable topsoil are only a few of the benefits which may be realized.

Finally any program aimed at changing the practices of farmers must receive periodic and detailed evaluation especially concerning the level of adoption. Only in this way can programs be modified to reduce resistance and encourage more uniform rapid acceptance. Too often programs may be perceived as being successful because the more prominent and thus more conspicuous members of the agriculture community have adopted them, leaving the great majority of farmers relatively uninvolved.

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APPENDIX I

QUESTIONNAIRE RESPONSES

Response levels to the Agricultural Practices Survey are listed below. The accuracy of these responses at a 95 percent confidence level is also noted.

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(1)	Is the respondent the operator ?		
	- Yes	96.7	0.8
	- No	3.3	0.8
(2)	Are you involved in the field operations of the farm ?		
	- Yes	100.0	0.0
	- No	0.0	0.0
(3)	How many days did you work off this holding at paid agricultural and nonagricultural work during the past 12 months ?		
	- None	53.5	2.6
	- 1-24	3.1	0.6
	- 25-96	5.6	0.9
	- 97-156	7.0	1.2
	- 157-365	30.8	2.6
(4)	How many years have you been actually farming ?		
	- 5 years or less	15.5	1.4
	- 6 to 15 years	19.2	1.2
	- More than 15 years	65.2	1.7
	- Non-Response	0.1	0.1
(5)	In the past year have you attended any organized meetings related directly to agriculture ?		
	- Yes	43.1	1.9
	- No	56.6	1.9
	- Non-Response	0.3	0.2

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(6)	Are you aware of the soil testing services offered by the Ontario Ministry of Agriculture and Food ?		
	- Yes	89.5	1.3
	- No	10.4	1.3
	- Non-Response	0.1	0.1
(7)	Have you ever had your soil tested for fertilizer needs ?		
	- Yes	59.8	2.1
	- No	40.1	2.0
	- Non-Response	0.1	0.1
(8)	By whom have you had your soil tested for fertilizer needs ?		
	Ontario Ministry of Agriculture and Food	12.5	1.5
	Ontario Agricultural College at Guelph	59.0	2.2
	A Fertilizer Company	29.3	2.2
	Other	7.5	1.6
	Non-Response	0.2	0.2
(9)	During the past five years how often have you had your soil tested ?		
	Every year	14.2	1.7
	Every two years	23.1	2.0
	Other	17.6	2.7
	Once or twice	27.0	2.7
	None	17.1	1.8
	Several Times a Year	0.7	0.3
	Non-Response	0.3	0.2
(10)	In determining application rates for fertilizer, which one of the following information sources has been the most helpful ?		
	Fertilizer sales representative	22.3	1.7
	Soil Test reports	23.4	1.8
	Neighbours	13.5	1.5
	Agricultural Extension representative	7.4	0.8
	Other	31.7	1.6
	Not Applicable	0.6	0.2
	Non-Respondent	1.1	0.3

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(11)	Have you ever practiced any of the following ?		
	Contour ploughing	10.4	1.6
	Crop rotation	71.9	1.9
	Grass waterways	10.3	1.3
	Minimum Tillage	16.7	1.7
	Zero Tillage	3.2	0.5
	None of the above	22.0	1.5
	Non-response	0.4	0.2
(12)	During 1977 did you or will you practice any of the following ?		
	Contour ploughing	7.1	1.4
	Crop rotation	65.7	2.1
	Grass waterways	8.3	1.2
	Minimum tillage	11.8	1.5
	Zero Tillage	2.0	0.5
	None of the above	27.7	1.8
	Non-Response	0.5	0.2
(13)	How close to a clearly defined stream or a drainage ditch bank do you usually cultivate ?		
	Less than 10 feet	30.1	2.1
	11 to 20 feet	16.4	1.7
	More than 20 feet	17.5	1.9
	No clearly defined stream or ditches in or beside those fields cultivated	34.6	2.1
	Non-Response	1.3	0.3
(14)	Does this farming operation have livestock or poultry ?		
	Yes	73.9	1.8
	No	25.6	1.9
	Non-Response	0.5	0.2
(15)	For the purpose of watering your livestock which of the following things do you do ?		
	Provide free access to water courses such as streams, open drains or lakes	32.9	2.7
	Pump Water to livestock	88.0	1.6
	Other	7.4	1.4
	Non-Response	0.5	0.4

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(16)	What kind of manure management system do you have ?		
	Solid	88.4	1.5
	Semi-solid	3.5	0.6
	Liquid	2.3	0.6
	Cannot classify	2.8	0.7
	Combination	2.5	0.6
	Non-Response	0.5	0.3
(17)	Is the manure storage area covered ?		
	Yes	11.1	1.1
	No	87.1	1.3
	Combination	0.8	0.4
	Non-Response	1.0	0.4
(18)	Do You apply manure to the land ?		
	Yes	79.1	1.6
	No	20.3	1.7
	Non-Response	0.5	0.2
(19)	Of the total manure you apply to the land, what portion do you usually apply during the winter months (December 1st - Mar.31)?		
	None	63.2	2.6
	¼	15.1	1.7
	½	10.4	1.5
	¾	3.2	0.6
	All	7.6	1.4
	Non-Response	0.5	0.3
(20)	How close to a clearly defined stream or drainage ditch bank do you usually apply manure ?		
	Less than 20 feet	16.4	1.6
	21 to 50 feet	21.1	2.1
	51 to 100 feet	7.0	0.9
	More than 100 feet	18.4	1.6
	No clearly defined stream or ditches in or beside those fields cultivated	36.7	2.4
	Non-Response	0.4	0.2

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(21)	To what extent do you think farming activities contribute to water pollution ?		
	Very great	1.8	0.4
	Considerable	6.7	0.8
	A minor extent	54.4	2.0
	Not at all	25.1	1.8
	Don't know	11.3	1.1
	Non-Response	0.7	0.2
(22)	Rank the following according to their contribution to water pollution ?		
	Pesticide use	31.4	1.9
	Commercial fertilizer use	6.9	0.9
	Livestock and poultry wastes	7.1	0.9
	Soil erosion	11.7	1.4
	Not ranked	44.6	2.1
(23)	Do you think manure is anything more than a waste disposal problem in modern farming ?		
	Yes	50.6	2.7
	No	46.9	2.7
	Don't know	1.5	0.4
	Non-Response	1.0	0.3
(24)	Do you think the best policy for reducing water pollution associated with agriculture is to rely on only the good will of farmers ?		
	Yes	55.9	2.6
	No	35.0	2.2
	Don't know	8.0	1.3
	Non-Response	1.0	0.3
(25)	Do you think farmers should pay the cost of water pollution control on their own properties ?		
	Yes	30.4	1.6
	No	59.9	1.7
	Don't know	8.5	0.9
	Non-Response	1.2	0.3

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(26)	Do you think the government should provide farmers with more information on the control of water pollution from farming activities ?		
	Yes	71.9	2.0
	No	21.3	1.8
	Don't know	5.2	0.8
	Non-Response	1.5	0.4
(27)	Do you think the government should raise everyone's taxes to subsidize control of water pollution from farming activities ?		
	Yes	16.2	1.6
	No	77.4	1.7
	Don't know	5.0	0.8
	Non-Response	1.4	0.4
(28)	Do you think that in order to reduce water pollution from farming activities, governments should strictly enforce regulations ?		
	Yes	46.2	2.0
	No	43.9	2.1
	Don't know	8.2	0.9
	Non-Response	1.6	0.4
(29)	Which one of the following information sources has provided you with the most information on control of water pollution from farming activities ?		
	Government agencies	7.2	0.9
	Newspapers and magazines	36.7	1.8
	Radio & television	16.6	1.6
	Farm organizations	12.2	1.2
	Other	3.6	0.6
	Did not receive information	22.4	1.5
	Non-Response	1.2	0.4

	QUESTION	LEVEL OF PROPORTION	RESPONSE ERROR
(30)	Have you or your farming operation experienced any adverse effects from water pollution ?		
	Yes	6.7	1.1
	No	92.1	1.0
	Don't know	0.2	0.1
	Non-Response	0.9	0.3
(31)	Was the source due to farming activities ?		
	Yes	32.9	6.6
	No	59.1	5.3
	Don't know	6.6	3.9
	Non-Response	1.4	1.1
(32)	Are you familiar with the general guidelines of the Ontario Agricultural Code of Practice and/or the Certificate of Compliance ?		
	Yes	31.4	1.8
	No	67.0	1.8
	Non-Response	1.4	0.4
(33)	Do you feel that your present farm management practices are adequate for controlling water pollution ?		
	Yes	94.3	0.6
	No	3.0	0.4
	Don't know	1.6	0.4
	Non-Response	1.0	0.3
(34)	How old are you ?		
	Less than 20	0.9	0.3
	20 -24	2.4	0.4
	25-29	5.8	0.7
	30 -34	7.1	1.0
	35 - 39	9.4	0.9
	40 - 44	11.2	1.2
	45-49	13.8	1.2
	50 -54	13.5	1.0
	55 -59	13.3	1.5
	60- 64	11.0	1.1
	65 -69	5.9	0.9
	70-74	3.5	0.5
	75 & more	2.3	0.5

APPENDIX 2

Statistics Canada Statistique Canada

CONFIDENTIAL

I.D.	1-3			
I.A.	4-6			
Segment No.	7-9			
V.C.R. Number	10-12			
Total R	13		1	

ONTARIO AGRICULTURAL PRACTICES SURVEY

1. *INTERVIEWER CHECK ITEM:*

Is the respondent the operator? ..... *Yes* 14 | 1 → *Go to 3*

No 14 | 2

2. Are you involved in the field operations of the farm? *(e.g. Operating a cultivator or other farm equipment)* ..... Yes 15 | 1

No 15 | 2 → *Terminate interview*

3. How many days did you work off this holding at paid agricultural and non agricultural work during the past 12 months? *(Do not include exchange work)*

Days	*Check (√) code*
None	1 ☐
1-24	2 ☐
25-96	3 ☐
97-156	4 ☐
157-365	5 ☐

Enter code 16 ☐

4. How many years have you been actually farming?

5 years or less	17		1
6 to 15 years	17		2
More than 15 years	17		3

5. In the past year have you attended any organized meetings related directly to agriculture? ..... Yes 18 | 1

No 18 | 2

6. Are you aware of the soil testing services offered by the Ontario Ministry of Agriculture and Food? ..... Yes 19 | 1

No 19 | 2

7. Have you ever had your soil tested for fertilizer needs? ..... Yes 20 | 1

No 20 | 2 → *Go to 10*

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8. By whom have you had your soil tested for fertilizer needs?
(If necessary check more than one)

Ontario Ministry of Agriculture and Food	21		1
Ontario Agricultural College at Guelph	22		1
A fertilizer company	23		1
Other *(specify)* _____	24		1

9. During the past five years how often have you had your soil tested?

Every year	25		1
Every two years	25		2
Other *(specify)* _____	25		3

10. In determining application rates for fertilizer, which one of the following information sources has been the most helpful?
(Check one only)

Fertilizer sales representative	1 ☐	
Soil test reports	2 ☐	
Neighbors	3 ☐	*Enter code* 26
Agricultural extension representative	4 ☐	
Other *(specify)* _____	5 ☐	

11. Have you ever practiced any of the following? *(If necessary check more than one)*

Contour ploughing	27		1
Crop rotation	28		1
Grass waterways	29		1
Minimum tillage	30		1
Zero tillage	31		1
None of the above	32		1

12. During 1977 did you or will you practice any of the following?
(If necessary check more than one)

Contour ploughing	33		1
Crop rotation	34		1
Grass waterways	35		1
Minimum tillage	36		1
Zero tillage	37		1
None of the above	38		1

13. How close to a clearly defined stream or a drainage ditch bank do you usually cultivate?

Check (√) code

Less than 10 feet	1 ☐	
11 to 20 feet	2 ☐	
More than 20 feet	3 ☐	*Enter code* 39
No clearly defined stream or ditches in or beside those fields cultivated	4 ☐	

14. *INTERVIEWER CHECK ITEM:*

Does this farming operation have livestock or poultry? ..... *Yes* 40 | | 1

No 40 | | 2 → *Go to 18*

15. For the purpose of watering your livestock, which of the following things do you do? *(If necessary check more than one)*

Provide free access to water courses, such as streams, open drains or lakes	41		1
Pump water to livestock	42		1
Other *(access to off stream ponds etc.)*	43		1

16. What kind of manure management system do you have?

Check (√) code

Solid	1 ☐	*Enter code* 44
Semi-solid	2 ☐	
Liquid	3 ☐	
Cannot classify	4 ☐	

17. Is the manure storage area covered? ..... Yes 45 | | 1

No 45 | | 2

18. Do you apply manure to the land? ..... Yes 46 | | 1

No 46 | | 2 → *Go to 21*

19. Of the total manure you apply to the land, what portion do you usually apply during the winter months (December 1st-March 31st)?

Check (√) code

None	1 ☐	*Enter code* 47
¼	2 ☐	
½	3 ☐	
¾	4 ☐	
All	5 ☐	

20. How close to a clearly defined stream or drainage ditch bank do you usually apply manure?

Check (√) code

Less than 20 feet	1 ☐	*Enter code* 48
21 to 50 feet	2 ☐	
51 to 100 feet	3 ☐	
More than 100 feet	4 ☐	
No clearly defined stream or ditches in or beside those fields cultivated	5 ☐	

21. To what extent do you think farming activities contribute to water pollution?

Check (√) code

Very great	1 ☐	
Considerable	2 ☐	
A minor extent	3 ☐	*Enter code* 49
Not at all	4 ☐	
Don't know	5 ☐	

22. Rank the following according to their contribution to water pollution: (1, 2, 3 and 4).

Pesticide use	50
Commercial fertilizer use	51
Livestock and poultry wastes	52
Soil erosion	53

FOR EACH OF THE FOLLOWING STATEMENTS PLEASE ANSWER YES OR NO

23. Do you think manure is anything more than a waste disposal problem in modern farming?

Yes	54		1
No	54		2
	54		3

24. Do you think the best policy for reducing water pollution associated with agriculture is to rely on only the good will of farmers?

Yes	55		1
No	55		2
	55		3

25. Do you think farmers should pay the cost of water pollution control on their own properties?

Yes	56		1
No	56		2
	56		3

26. Do you think the government should provide farmers with more information on the control of water pollution from farming activities?

Yes	57		1
No	57		2
	57		3

27. Do you think the government should raise everyone's taxes to subsidize control of water pollution from farming activities?

Yes	58		1
No	58		2
	58		3

28. Do you think that in order to reduce water pollution from farming activities, governments should strictly enforce regulations?

Yes	59		1
No	59		2
	59		3

29. Which one of the following information sources has provided you with the most information on control of water pollution from farming activities?

Check (√) code

Government agencies	1 ☐	*Enter code* 60
Newspapers and magazines	2 ☐	
Radio and television	3 ☐	
Farm organizations	4 ☐	
Other *(specify)* _____	5 ☐	
Did not receive information	6 ☐	

30. Have you or your farming operation experienced any adverse effects from water pollution? ..... Yes 61 1

No 61 2 → *Go to 32*

61 3

31. Was the source due to farming activities? ..... Yes 62 1

No 62 2

62 3

32. Are you familiar with the general guidelines of the Ontario Agricultural Code of Practice and/or the Certificate of Compliance? ..... Yes 63 1

No 63 2

33. Do you feel that your present farm management practices are adequate for controlling water pollution? ..... Yes 64 1

No 64 2

64 3

34. How old are you? 65

COMMENTS

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Statistics Canada Statistique Canada

CONFIDENTIEL

C.É.	1-3			
S.D.	4-6			
N° du segment	7-9			
N° du R.C.V.	10-12			
Questionnaire entier R	13		1	

ENQUÊTE SUR LES PRATIQUES AGRICOLES EN ONTARIO

1. *A L'INTERVIEWER:*

Le répondant est-il exploitant? ..... *Oui* 14 | | 1 → *Passez à 3*

Non 14 | | 2

2. Prenez-vous part au travail des champs? *(Par ex., manoeuvre de cultivateurs ou autre matériel agricole)* ..... Oui 15 | | 1

Non 15 | | 2 → *Mettre fin à l'interview*

3. Au cours des douze derniers mois, pendant combien de jours avez-vous travaillé à l'extérieur de l'exploitation à titre de travailleur agricole rémunéré? *(Ne pas tenir compte du travail d'entraide)*

Jours	*Cocher (√) code*	
Aucun	1 ☐	
1-24	2 ☐	
25-96	3 ☐	*Inscrire code* 16	
97-156	4 ☐	
157-365	5 ☐	

4. Depuis combien d'années exploitez-vous une terre?

5 ans ou moins	17		1
6 à 15 ans	17		2
Plus de 15 ans	17		3

5. L'année dernière, avez-vous assisté à des réunions liées directement au domaine de l'agriculture? ..... Oui 18 | | 1

Non 18 | | 2

6. Connaissez-vous les services d'analyse du sol offerts par le ministère de l'Agriculture et de L'Alimentation de l'Ontario? ..... Oui 19 | | 1

Non 19 | | 2

7. Avez-vous déjà fait analyser le sol de votre exploitation pour déterminer s'il avait besoin d'engrais? ..... Oui 20 | | 1

Non 20 | | 2 → *Passez à 10*

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"Déclaration exigée en vertu de la Loi sur la statistique, chapitre 15, Statuts du Canada de 1970-71-72"

8. Qui s'est chargé de cette analyse? *(Au besoin, cochez plus d'une case)*

Le ministère de l'Agriculture et de l'Alimentation de l'Ontario	21		1
L'Ontario Agricultural College de Guelph	22		1
Une entreprise spécialisée dans les engrais	23		1
Autre *(précisez)* _____	24		1

9. Au cours des cinq dernières années, combien de fois avez-vous fait analyser le sol de votre exploitation?

Chaque année	25		1
Tous les deux ans	25		2
Autre *(précisez)* _____	25		3

10. Parmi les sources d'information qui suivent, laquelle vous a le plus aidé à établir la quantité d'engrais à épandre?
(Cochez une seul case)

Un représentant d'une entreprise de vente d'engrais	1 ☐	*Inscrire code*	26
Des rapports d'analyse de sol	2 ☐		
Des voisins	3 ☐		
Un représentant du ministère de l'Agriculture de l'Ontario	4 ☐		
Autre *(précisez)* _____	5 ☐		

11. Avez-vous déjà utilisé les techniques suivantes?
(Au besoin, cochez plus d'une case)

Labour à contre-pente	27		1
Assolement	28		1
Irrigation des cultures	29		1
Culture minimum	30		1
Culture sans labour	31		1
Aucune des techniques susmentionées	32		1

12. En 1977, avez-vous utilisé ou utiliserez-vous l'une ou l'autre des techniques suivantes? *(Au besoin, cochez plus d'une case)*

Labour à contre-pente	33		1
Assolement	34		1
Irrigation des cultures	35		1
Culture minimum	36		1
Culture sans labour	37		1
Aucune des techniques susmentionées	38		1

13. A quelle distance d'un cours d'eau ou d'un canal d'assèchement cultivez-vous habituellement?

	Cocher (√) code		
Moins de dix pieds	1 ☐	*Inscrire code*	39
11 à 20 pieds	2 ☐		
Plus de 20 pieds	3 ☐		
Aucun cours d'eau ou canal d'assèchement près des terres cultivées	4 ☐		

14. *A L'INTERVIEWER:*

Cet exploitant élève-t-il du bétail ou de la volaille? ..... *Oui* 40 | | 1

Non 40 | | 1 → *Passez à 18*

15. Quelle méthode utilisez-vous pour faire boire le bétail?
(Au besoin, cochez plus d'une case)

Le conduits à des cours d'eau, comme des drains à ciel ouvert ou des lacs ..... 41 | | 1

Pompe l'eau jusqu'au bétail ..... 42 | | 1

Autre *(le conduit à un étang, etc.)* ..... 43 | | 1

16. Sous quelle forme conservez-vous ou traitez-vous le fumier?

Cocher (√) code

Solide ..... 1 ☐
Semi-solide ..... 2 ☐
Liquide ..... 3 ☐
Ne peut préciser ..... 4 ☐

} *Inscrire code* 44 | |

17. Gardez-vous le fumier dans un endroit couvert? ..... Oui 45 | | 1

Non 45 | | 2

18. Epandez-vous du fumier sur vos terres? ..... Oui 46 | | 1

Non 46 | | 2 → *Passez à 21*

19. De la quantité totale de fumier utilisée pendant l'année, combien en épandez-vous l'hiver (du 1er décembre au 31 mars)?

Cocher (√) code

Néant ..... 1 ☐
¼ ..... 2 ☐
½ ..... 3 ☐
¾ ..... 4 ☐
Tout ..... 5 ☐

} *Inscrire code* 47 | |

20. A quelle distance d'un cours d'eau ou d'un canal d'assèchement épandez-vous le fumier?

Cocher (√) code

Moins de 20 pieds ..... 1 ☐
21 à 50 pieds ..... 2 ☐
51 à 100 pieds ..... 3 ☐
Plus de 100 pieds ..... 4 ☐
Aucun cours d'eau ou canal d'assèchement près des terres cultivées ..... 5 ☐

} *Inscrire code* 48 | |

21. A votre avis, dans quelle mesure l'agriculture contribue-t-elle à la pollution de l'eau?

Cocher (√) code

Enormément	1 ☐	*Inscrire code*	49
Beaucoup	2 ☐		
Peu	3 ☐		
Pas du tout	4 ☐		
Ne sait pas	5 ☐		

22. Classez les facteurs suivants en fonction de la pollution qu'ils pourraient entraîner à l'eau (1, 2, 3, 4).

Utilisation de pesticides	50
Utilisation d'engrais commerciaux	51
Excréments du bétail et de la volaille	52
Erosion	53

REPONDEZ OUI OU NON AUX ENONCES SUIVANTS

23. De nos jours, le fumier ne constitue qu'un problème de traitement des déchets dans l'exploitation agricole	Oui	54	1
	Non	54	2
		54	3
24. La bonne volonté des exploitants constituerait la meilleure façon de réduire la pollution de l'eau attribuable aux activités agricoles	Oui	55	1
	Non	55	2
		55	3
25. Les cultivateurs devraient supporter les frais relatifs au contrôle de la pollution de l'eau sur leur exploitation agricole	Oui	56	1
	Non	56	2
		56	3
26. L'administration publique devrait mieux renseigner les cultivateurs sur le contrôle de la pollution de l'eau attribuable aux activités agricoles	Oui	57	1
	Non	57	2
		57	3
27. L'administration publique devrait majorer les impôts de tout le monde afin de subventionner le contrôle de la pollution de l'eau attribuable aux activités agricoles	Oui	58	1
	Non	58	2
		58	3
28. Afin de réduire la pollution de l'eau attribuable aux activités agricoles, l'administration publique devrait appliquer des règlements sévères	Oui	59	1
	Non	59	2
		59	3

29. Parmi les sources d'information suivantes, laquelle vous a le plus renseigné sur le contrôle de la pollution de l'eau attribuable aux activités agricoles?

Cocher (√) code

Organismes de l'administration publique	1 ☐	*Inscrire code* 60
Journaux et revues	2 ☐	
Radio et télévision	3 ☐	
Organismes professionnels agricoles	4 ☐	
Autre *(précisez)* _____	5 ☐	
N'a pas reçu d'information	6 ☐	

30. La pollution de l'eau vous a-t-elle déjà nui à vous ou à votre exploitation agricole? ..... Oui 61 1

Non 61 2 → *Passez à 32*

61 3

31. La pollution était-elle attribuable aux activités agricoles? ..... Oui 62 1

Non 62 2

62 3

32. Connaissez-vous les grandes lignes du "Ontario Agricultural Code of Practice" et(ou) du "Certificate of Compliance"? ..... Oui 63 1

Non 63 2

33. A votre avis, vos méthodes sont-elles suffisamment efficaces pour contrôler la pollution de l'eau? ..... Oui 64 1

Non 64 2

64 3

34. Quel âge avez-vous? 65

REMARQUES