

AGRI-ENVIRONMENTAL INDICATOR PROJECT



Agriculture and Agri-Food Canada

REPORT NO. 8

**FARM RESOURCE MANAGEMENT INDICATOR:
INPUTS MANAGEMENT COMPONENT**

Discussion paper on a Survey of Inputs Management Practices

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**FARM INPUTS MANAGEMENT SURVEY
DISCUSSION PAPER**

TABLE OF CONTENTS

Preface	ii
1.0 Introduction	1
1.1 The Agri-Environmental Indicator Project	1
1.2 The Farm Inputs Management Survey	1
2.0 Survey Content	3
2.1 Potential Survey Questions: Issues and Rationale	3
3.0 Survey Design	11
3.1 Data Collection Vehicle	11
3.2 Content Testing	11
3.3 Universe	11
3.4 Sample Design and Selection	12
3.5 Timing	12
3.6 Cost Considerations	13
3.7 Final Report	13
4.0 Bibliography	14

LIST OF APPENDICES

Appendix A: Draft Questionnaire	17
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PREFACE

This paper describes the approach proposed for collecting information on inputs management practices. It discusses the rationale for asking various questions related to best management practices (BMPs); the testing of those questions prior to the survey; issues related to the selection of universe (both coverage and type of farm to be surveyed); desired levels of geographic reporting, which will affect sample size and selection, as well as costs; the utility of using the proposed computer assisted telephone interviewing (CATI) approach for data collection; and roles and responsibilities for various aspects of the project.

To ensure that the data collected will respond to the needs of a wide range of potential users, it is crucial that the survey pose pertinent, understandable and answerable questions. Your comments and suggestions for finalizing the survey are therefore invited. Please FAX them to either of the following persons by August 4, 1995:

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Thank you.

FARM INPUTS MANAGEMENT SURVEY - DISCUSSION PAPER -

1.0 INTRODUCTION

1.1 The Agri-Environmental Indicator Project

The Agri-Environmental Indicator (AEI) Project of Agriculture and Agri-Food Canada (AAFC) was initiated in 1993 in response to recommendations made by various agencies, organizations and special studies. The overall objective of the project is to support the larger policy goal of integrating environmental considerations into decision-making processes at all levels of the agri-food sector.

The project aims to develop a core set of regionally-sensitive national AEs that build on and enhance the information base currently available on environmental conditions and trends related to primary agriculture in Canada. Through an interactive consultation process with stakeholders initiated in 1993, the following six indicators have been identified for development: Soil Degradation Risk, Risk of Water Contamination, Agroecosystem Biodiversity Change, Greenhouse Gas Balance, Farm Resource Management and Input Use Efficiency.

Each indicator is comprised of several components or attributes and is linked to an issue and a corresponding performance objective. The first four indicators correspond to the following agri-environmental issues, respectively: land and soil, water quality, biodiversity and climate change. The fifth indicator tracks farm-level management practices and the sixth is linked to efficiency and productivity concerns.

At both national consultations held to date on the AEI project in December 1993 and February 1995, the concept of tracking adoption of farm management practices as indicators was strongly supported (McRae and Lombardi, 1994; McRae, 1995). Management practices are fundamental to environmental sustainability and are directly influenced by policy initiatives, as well as by other factors. The Farm Resource Management indicator is comprised of two components: soil cover and management and inputs management. This document is concerned with the inputs management component.

1.2 The Farm Inputs Management Survey

How inputs are used and managed relates to environmentally sustainable agriculture in several ways. Improper use and application of inputs such as pesticides and

nutrients can adversely affect on-farm resources such as soil and also off-farm resources such as water quality and biodiversity. Chemical use is the major issue of public concern regarding agriculture and the environment (Miller, 1995). However, through sound management and use of best management practices, inputs can be used in a manner which poses little or no risk to the environment while contributing to productivity, a safe food supply and farm financial health. It is, therefore, appropriate to include inputs management factors within the larger suite of agri-environmental indicators being developed.

The farm inputs management survey is an initiative by AAFC and Statistics Canada to address a data gap at the national level regarding the management of three farm input types: commercial fertilizers, commercial pesticides and manure. In some ways, the present lack of national level data on inputs management is similar to the lack of land management data prior to the 1991 Census of Agriculture. To help address the data gap on land management, a land management module was added to the census in 1991. The module tracks on-farm adoption rates of land management practices for tillage, erosion and weed control as well as the use of conservation structures such as windbreaks and grassed waterways.

For the 1996 Census of Agriculture, some questions were proposed for inclusion that relate to farm inputs, such as quantities of inputs applied (by active ingredient, by crop); manure storage; frequency and timing of manure application; frequency and timing of fertilizer application; and methods used to help decide the type and amount of inputs to apply. Although producers may have been willing and able to answer, some questions took too long to complete and were deemed too burdensome for inclusion in the 1996 Census of Agriculture. However, a new question dealing with manure application methods has been added.

Although not as comprehensive as the census, the inputs management survey will collect data on adoption and use of selected management practices for inputs. To address the significant data gap concerning quantities of inputs applied is beyond the scope of the present survey effort. Data on how these inputs are managed are essential to developing the input management component of the Farm Resource Management indicator. In addition, in light of the many linkages between the various indicators and their components, the data collected through the survey will be useful to the development of other indicators, such as Risk of Water Contamination."

2.0 SURVEY CONTENT

2.1 Potential Survey Questions: Issues and Rationale

Issues: Proposed data gaps/issues to be targeted by this survey are:

- 1) Manure Management: storage and timing of application;
- 2) Fertilizer Management: how to decide the type and amount of fertilizer to apply, timing of application, frequency of soil testing, reduction of nitrogen by amount of legume plough down, reduction of nutrients by amount of manure application;
- 3) Pesticide Management: custom application, sprayer calibration, timing of pesticide applications;
- 4) Irrigation Management: methods, sources.

A linkage to results of the 1995 crops and livestock surveys conducted by Agriculture Division, Statistics Canada will provide additional data including some demographics (off-farm income, age, education, sales category, etc.).

Rationale:

1) **Questions on Manure Management:**

Issue A: Manure Storage (Capacity)

The storage of livestock manure is regarded as an important part of nutrient management and in reducing the potential environmental impacts associated with manure. Adequate sizing is a critical feature of manure storage design to contain nutrients and prevent runoff. Manure storage must be large enough to handle the volume of wastes generated until weather, soil and crop conditions allow spreading. The best management practice is that the manure storage should be large enough to store manure, bedding, waste feed and all liquids for at least 200 days. The proposed question will provide an indication of manure storage capacity, in order of best to worst:

How long can you store manure?

- a. longer than 200 days
- b. between 150 and 200 days
- c. between 100 and 150 days
- d. less than 100 days

Issue B: Manure Storage (Methods)

The adoption of manure storage methods that minimize runoff, thereby preventing surface and groundwater contamination is encouraged through various government programs in some provinces. To provide baseline data, the following question is proposed to those who store liquid manure:

Which of the following statements best describes how liquid manure is stored on your operation? (CHECK ALL THAT APPLY)

The manure is stored in a _____

- a. lagoon
- b. tank above ground
- c. tank above ground on concrete pad
- d. sealed covered tank

While each option has the potential to leak, a lagoon is much more likely to leak without notice. It is easier to see a leak and contain it on a tank on a concrete pad. The best practice, however, is to store the manure in a sealed covered tank.

To obtain information on the adoption of manure storage methods that minimize runoff, thereby preventing surface and groundwater contamination, the following question is proposed to those who store semi-solid or solid manure:

Which of the following statements best describes how semi-solid or solid manure is stored on your operation?

The manure is stored _____

- a. as an open pile on the ground
- b. in the barn until cleaned out and spread in one operation

- c. on an open pad without run-off containment
- d. on an open pad with run-off containment
- e. on a covered storage pad

Again a question of leakage, an open pile on the ground has great potential to leak. The covered storage pad is best.

Issue C: Timing of Manure Application

The issue here is winter application of manure where few, if any, nutrients are taken up by crops and the soil and the risk of runoff into local surface waterways is greatest. Spring can present a similar situation, so when interpreting the data, it will be important to consider the conditions of the particular spring in various regions when the data are collected. Ideally, manure should be applied when the soil is dry enough and crop conditions are suitable for manure use. It is difficult to rank which season is actually best. The following question is proposed:

During which season do you apply manure to your fields and what percentage of your total manure do you apply in each season?

- | | (%) |
|-----------|-------|
| a. spring | _____ |
| b. summer | _____ |
| c. fall | _____ |
| d. winter | _____ |

2) Questions on Fertilizer Management:

Issue A: How to decide the amount and type of fertilizer to apply

Informed decision-making by producers is at the heart of adopting best management practices. While it is difficult to attach a BMP to any of the options, the respondent who indicates that he/she uses several strategies to decide the amount and type of inputs to apply shows a keen interest in soil conservation and, by extension, stewardship of the land. Options such as "experience" (or, "it's the way I've always done it", etc.) provide a necessary comfort level for those respondents unable to come up with any other ways of deciding. The following question is proposed:

In your own words, could you tell me how you usually decide on the amount and type of fertilizer to apply to your fields? (DO NOT READ LIST)

- a. soil testing
- b. foliage testing (nutrient analysis)
- c. experience
- d. consultations
- e. reference materials
- f. cost
- g. provincial government recommendations
- h. other (specify) _____

Issue B: Timing of Fertilizer Application

For economic as well as environmental reasons, nutrients should be applied in amounts and at the stage of the growing season which corresponds to the nutrient requirements of the crop. For mobile nutrients such as nitrogen, application prior to crop establishment may increase the nutrient concentration in soils and the risk of leaching; application following establishment will provide nutrients for uptake by plants and plant growth, thus reducing risks associated with leaching and runoff. The following question is proposed:

In 1995, when did you apply fertilizer to your crops and what percentage of your total fertilizer did you apply at each time:

- | | (%) |
|------------------------------|-------|
| a. in fall before planting | _____ |
| b. in spring before planting | _____ |
| c. at planting | _____ |
| d. after planting | _____ |

Issue C: Frequency of Soil Testing

Generally, soil test values will indicate the amount of nutrients to apply for maximum yield and testing at 2-3 year intervals is considered best. The following question is proposed:

(If the operator soil tests, ask) On average, how often do you soil test each of your fields? (DO NOT READ LIST!)

- a. at 2-3 year intervals
- b. at 4-5 year intervals
- c. over 5-year intervals

Issue D: Reduction of nitrogen by amount of legume plough down

Leguminous crops such as alfalfa and clover in a rotation add nitrogen to the soil. It is important to include the nutrient contributions from such crops when deciding how much commercial fertilizer is required. Failure to do so may lead to excessive fertilization and thus increase the risks associated with leaching and runoff. The following two questions are proposed:

(If operator soil tests and grows alfalfa or other legumes, ask) Do you usually apply (nitrogen) fertilizers to fields where a legume has just been ploughed down?

- a. yes
- b. no

(If YES above, ask) Do you reduce the amount of nitrogen by the value of your legume ploughdown?

- a. yes
- b. no

Limited response is likely, however, because it is anticipated that only a small percentage of operators plough down prior to seeding the next crop. In that instance, there is the potential for poor data quality at lower geographic levels.

Issue E: Reduction of nutrients by amount of manure application

It is important to include the contributions from manure when deciding how much commercial fertilizer is required. The following question is proposed:

(If operator applies fertilizers to land which has had manure applied on it since the last harvest, ask) Do you reduce the amount of fertilizer applied by the value of your manure application?

- a. yes
- b. no

3) Questions on Pesticide Application Practices:

Issue A: Custom application as indicator for better application

The assumption here is that custom application is done by a trained or certified person. There is a trend towards increasing use by producers of custom application services when dealing with pesticides (including herbicides, insecticides and fungicides). This is due to more sophisticated equipment, time constraints, more regulatory requirements, etc. For baseline data acquisition, the following two questions are proposed:

(if herbicides were applied in 1995, ask) What percentage of your acreage treated with herbicides in 1995 was treated by a custom applicator? (note to interviewer: assume custom applicator is certified)

percentage _____ %

(if insecticides or fungicides were applied in 1995, ask) What percentage of your acreage treated with insecticides or fungicides in 1995 was treated by a custom applicator? (note to interviewer: assume custom applicator is certified)

percentage _____ %

Issue B: Sprayer Calibration

Careful sprayer calibration ensures the proper rate of application and is a recommended BMP. Using more pesticide than is needed is expensive, wasteful and unnecessarily increases the load on the soil. Some herbicides persist in the soil and may harm next year's crop. The following question is proposed:

(if LESS THAN 100% at either of the above, ask) I would like to read a series of three statements about the calibration of your sprayer. Please tell me which one best represents your situation:

My sprayer is calibrated _____ (DO NOT ROTATE OR RANDOMIZE)

- a. only when it breaks or when major components are replaced
- b. before the beginning of each season
- c. between applications of different types of pesticides

The best practice is to calibrate the sprayer between applications of different types of pesticides.

Issue C: Timing of Pesticide Applications

The adoption of Integrated Pest Management (IPM) techniques is key here. The best management practice is to spray according to pest lifecycles and thresholds on site. Each field should be monitored separately because conditions vary. Identifying problems early may translate to a reduced need for pesticides. Sometimes the problem is very localized and only spot treatment is required. Regional weather monitoring programs are next and can be used to time fungicide spraying, and provincial government programs and information lines provide pest updates. Spraying at the first sign of pests is often not recommended since the presence of pests does not always cause economic damage. It is tempting to do so, however, because immature pests are easier to control than adult insects or larger, mature weeds. Spraying based on calendar dates is discouraged (some apply pesticide when the benefit from controlling the pest exceeds the cost of the pesticide). The following question is proposed:

Which of the following statements best describes your approach to the timing of pesticide applications? (READ LIST)

- a. spraying is based on calendar dates
- b. spraying is done at first sign of pests
- c. regional monitoring of pests, including weeds, is used to determine spray application dates
- d. First and weed life cycles and thresholds are monitored on site to determine spray application dates
- e. do not apply pesticides

4) Questions on Irrigation Methods and Sources:

The following question, based on the detailed question asked in the 1986 Census of Agriculture, is required for the irrigation efficiency component of the Input Use Efficiency Indicator being developed by PFRA. It fills a data gap as opposed to indicating adoption of any particular BMP. As such, caution is advised in interpreting the resulting data since many of the systems are similar in their impact on the environment. Issues of efficiency to consider include leakage, evaporation, etc. However, in the right circumstances, even flood irrigation can be an appropriate method of water application.

(if irrigated land in 1995, ask) How many acres (hectares) of land were irrigated using each of the following systems: (SPECIFY UNITS)

	# acres or hectares
a. flood	_____
b. hand move	_____
c. wheelroll	_____
d. pivot	_____
e. volume gun or giant gun	_____
f. trickle	_____
g. other means (specify) _____	_____

What is the source of your irrigation water?

- a. irrigation district or works
- b. river, stream or creek
- c. lake or reservoir
- d. groundwater (well or springs)
- e. other (specify) _____

The full list of potential questions related to these topics has been compiled into a draft questionnaire for CATI development (see Appendix A).

3.0 SURVEY DESIGN

3.1 Data Collection Vehicle

Where a self-enumerative vehicle, such as the Census of Agriculture, is inappropriate, other collection options may be considered. The annual crops and livestock surveys conducted by Agriculture Division, Statistics Canada provide an excellent list frame from which to draw a representative sample to conduct a survey and collect data using other techniques, such as personal interviews or a computer assisted telephone interview (CATI) approach. These collection methods perhaps are better suited for collecting this type of environmental data.

It is proposed that this survey be conducted using a CATI application to be developed by Agriculture Division, Statistics Canada. Questions developed with input from Agriculture and Agri-Food Canada and other stakeholders will be submitted to Statistics Canada for CATI development, testing, data collection, processing and final report generation.

3.2 Content Testing

A content testing process is planned to determine which of the proposed questions are viable in the proposed CATI environment. The objectives of the process will be to:

- i. determine the respondents' ability and willingness (sensitivity, etc.) to correctly answer the questions proposed to be asked;
- ii. measure (qualitatively) respondent reaction to the issues and types of questions asked;
- iii. recommend an appropriate number of questions (length of questionnaire); and
- iv. provide information on the distribution of response variation across the country, helping to ensure that questions are interpreted similarly in different regions or cropping systems. In this way, the possibility of yielding misleading results should be minimized.

The content testing strategy will be carried out by Statistics Canada.

3.3 Universe

Coverage: Due to the limited resources allocated to the project, it is proposed that the coverage for the survey be limited to provision of results at the provincial level. Lower levels of geographic reporting (e.g., Census Agricultural Region, Census

Division, Census Consolidated Subdivision, Enumeration Area, watershed, Soil Landscapes of Canada (SLC), other user-defined boundary area) are possible if partnerships are established.

Farm Types: The farm types to be included in this survey are:

- livestock (beef, dairy, hogs, poultry, sheep, other);
- crops (grains and oilseeds, specialty crops, fruit and vegetable, forage, other).

3.4 Sample Design and Selection

The level of detail required indicates an appropriate sample size (i.e., a larger sample size will yield higher quality results and enable reporting at lower geographic levels). However, survey costs are directly related to the number and complexity of questions, the number of observations (sample size), and the collection vehicle to be used (usually budgeted on a cost per observation basis). Tradeoffs/compromises are required.

The survey will utilize the list frame from the existing 1995 crops and livestock surveys conducted by Agriculture Division, Statistics Canada, taking necessary precautions to minimize response burden. The list will be stratified by farm type, farm size, and a variable sampling rate will be considered to enhance the reliability of the estimates. Also to be considered is provision of a letter to all proposed respondents to inform them of the upcoming request to answer the survey.

Sample design and selection, as well as estimates of expected precision and accuracy, will be determined with input from Business Survey Methods Division, Statistics Canada.

3.5 Timing

In light of Statistics Canada's commitment to minimizing response burden wherever possible, it is proposed that the survey be conducted in late fall 1995 (November). Harvest will be completed, i.e., less hectic for producers than at other times of the year, yet it will be soon enough after the crop season that they should still remember facts about various practices used during the season. Other benefits include comparability with the results of the 1996 Census of Agriculture (same reference period) and, of course, avoiding collection in census year.

3.6 Cost Considerations

Budget: The current budget allocation for the project is \$75,000. This will cover all expenses incurred by Statistics Canada.

Sample size directly related to cost: An estimate of the cost/sample will be furnished when the questions have been finalized and the sample design and selection have been completed (end of August 1995).

Level of geographic detail required: This is related to the sample size; the cost/sample will impact on the level of geographic detail possible for the monies available.

Time available: Person resources, in addition to funding, are limiting factors. A collaborative effort is required for successful completion of the project.

3.7 Final Report

The final report to be prepared by Agriculture Division, Statistics Canada, will encompass the following sections:

- executive summary
- introduction (objectives, roles of various collaborators, coverage, etc.)
- survey design
- survey methodology (survey frame, stratification, distribution, sample selection, etc.)
- data collection
- edit and imputation
- processing
- estimation
- validation
- data quality
- survey results
- appendices: geographic description (map), CATI screens (questions), etc.

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Appendix A
- Draft Questionnaire -

**FARM INPUTS MANAGEMENT SURVEY:
DRAFT QUESTIONNAIRE**

Hello, this is _____ calling on behalf of Statistics Canada. We are talking to farm operators in your area as part of an important research study on the subject of inputs management on Canadian farms. This information is being collected for Agriculture and Agri-Food Canada for the purpose of developing indicators of environmental sustainability on Canadian farms. Provision of the information requested in this survey is voluntary and you may, without prejudice, decline to respond. Information may be accessible or protected as required under the provisions of the Access to Information Act. The collection registration number is _____

SECTION I - Respondent Identification:

1. May I please speak to the person on your [INSERT FROM BELOW] who makes most of the day-to-day decisions?

[INSERT APPROPRIATE PHRASE DEPENDING ON SOURCE LIST]

- | | | |
|----|---------------------------|---|
| a. | beef operation | 1 |
| b. | dairy operation | 2 |
| c. | hog operation | 3 |
| d. | poultry operation | 4 |
| e. | cash crop operation | 5 |
| f. | fruit/vegetable operation | 6 |
| g. | grains/oilseed operation | 7 |

If speaking, skip to Q2

If available, re-introduce yourself and continue at Q2

If not available, skip to Q4

2. Do you have 20 minutes (TBD) now to answer some questions?

Yes, continue at Q5

No, go to Q3

3. We would like to call you back at a more convenient time. When can I call you back?

Date & Time _____

4. (If answer to Q1 was "not available", say) We would like to call back. Could you tell me the name of the person I should ask for and the best time to reach them?

Name _____

Date & Time _____

SECTION II - Manure Management:

1. Is manure stored on this holding?

- a. yes
- b. no

2. (If YES at Q1, ask) Do you store your manure as: (CHECK ALL THAT APPLY)

- a. liquid
- b. semi-solid, or solid

3. How long can you store manure?

- a. longer than 200 days
- b. between 150 and 200 days
- c. between 100 and 150 days
- d. less than 100 days

4. During which season do you apply manure to your fields and what percentage of your total manure do you apply in each season?

- | | (%) |
|-----------|-------|
| a. spring | _____ |
| b. summer | _____ |
| c. fall | _____ |
| d. winter | _____ |

5. (If answer to Q2 was 1-liquid, ask) Which of the following statements best describes how liquid manure is stored on your operation? (CHECK ALL THAT APPLY)

The manure is stored in a _____

- a. lagoon
- b. tank above ground
- c. tank above ground on concrete pad
- d. sealed covered tank

6. (If answer to Q2 was 2-semi-solid or solid, ask) Which of the following statements best describes how semi-solid or solid manure is stored on your operation?

The manure is stored _____

- a. as an open pile on the ground
- b. in the barn until cleaned out and spread in one operation
- c. on an open pad without run-off containment
- d. on an open pad with run-off containment
- e. on a covered storage pad

SECTION III - Fertilizer Management:

1. In your own words, could you tell me how you usually decide on the amount and type of fertilizer to apply to your fields? (DO NOT READ LIST!)

- a. soil testing
- b. foliage testing (nutrient analysis)
- c. experience
- d. consultations
- e. reference materials
- f. cost
- g. provincial government recommendations
- h. other (specify) _____

2. In 1995, when did you apply fertilizer to your crops and what percentage of your total fertilizer did you apply:
- (%)
- a. in fall before planting _____
 - b. in spring before planting _____
 - c. at planting _____
 - d. after planting _____
3. Do you soil test?
- a. yes
 - b. no
4. (If YES at Q3, ask) On average, how often do you soil test each of your fields? (DO NOT READ LIST!)
- a. at 2-3 year intervals
 - b. at 4-5 year intervals
 - c. over 5-year intervals
- 5a. (If YES at Q3, and grows alfalfa or other legumes, ask) Do you usually apply fertilizers to fields where a legume has just been ploughed down?
- a. yes
 - b. no
- 5b. (If YES at Q5a.) Do you reduce the amount of nitrogen by the value of your legume ploughdown?
- a. yes
 - b. no
- 6a. (If YES at Q3, ask) Do you apply fertilizers to land which has had manure applied on it since the last harvest?
- a. yes
 - b. no

- 6b. (If YES at Q6a) Do you reduce the amount of nutrients by the value of your manure application?
- a. yes
 - b. no

SECTION IV - Pesticide Application Practices:

1. In 1995, were any herbicides applied to crops on your farm?
- a. yes
 - b. no
2. (If YES at Q1) What percentage of your acreage treated with herbicides in 1995 was treated by a custom applicator (assume custom applicator is certified)?
- percentage _____%
3. In 1995, were any insecticides or fungicides applied to crops on your farm.
- a. yes
 - b. no
4. (If YES at Q3) What percentage of your acreage treated with insecticides or fungicides in 1995 was treated by a custom applicator (assume custom applicator is certified)?
- percentage _____%
5. (If LESS THAN 100% at either Q2 or Q4) I would like to read a series of three statements about the calibration of your sprayer. Please tell me which one best represents your situation:
- My sprayer is calibrated _____ (DO NOT ROTATE OR RANDOMIZE)
- a. only when it breaks or when major components are replaced
 - b. before the beginning of each season
 - c. between applications of different types of pesticides

6. Which of the following statements best describes your approach to the timing of pesticide applications? (READ LIST)
- a. spraying is based on calendar dates
 - b. spraying is done at first sign of pests
 - c. regional monitoring of pests, including weeds, is used to determine spray application dates
 - d. pest and weed lifecycles and thresholds are monitored on site to determine spray application dates
 - e. do not apply pesticides

SECTION V - Irrigation Methods and Sources:

1. Was any of the land you operate irrigated in 1995?
- a. yes
 - b. no
2. (If YES at Q1, ask) How many acres (hectares) of land were irrigated using each of the following systems: (SPECIFY UNITS)
- | | # acres or hectares |
|--------------------------------|---------------------|
| a. flood | _____ |
| b. hand move | _____ |
| c. wheelroll | _____ |
| d. pivot | _____ |
| e. volume gun or giant gun | _____ |
| f. trickle | _____ |
| g. other means (specify) _____ | _____ |
3. What is the source of your irrigation water?
- a. irrigation district or works
 - b. river, stream or creek
 - c. lake or reservoir
 - d. groundwater (well or springs)
 - e. other (specify) _____

Thank you very much for your time

