FARMERS' USE OF INFORMATION SOURCES IN BRITISH COLUMBIA

by

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ABSTRACT

This study is an investigation of the sources of information used by farmers in British Columbia. The study had four specific objectives: to determine what sources of information farmers in British Columbia use and how much they value them, to determine the relationships that exist between demographic characteristics and the use of information sources, to determine if there were significant differences in demographic characteristics of those who do or do not use British Columbia government extension services, and to compare the level of contact district agriculturists and horticulturists have with farmers with that measured in 1969.

A survey was mailed to a stratified random sample of farmers. A total of 100 farmers responded, and this forms a representative sample of agricultural producers in British Columbia.

Out of the 10 groups of individuals who formally provide extension information to farmers, agri-business sales representatives have the highest level of contact, followed by the district agriculturist and horticulturist.The most frequent method of contact between providers of extension information and farmers is through mail, fax, or computer. The least frequent method of contact is through farm visits. The most frequently used source of written information was general farm papers, followed by British Columbia Ministry of Agriculture publications. The number of farmers reporting that they obtained information from a visit to a British Columbia Ministry of Agriculture demonstration site is the same as the number obtaining information from

visits to foreign countries. Visits to other farms was reported as being a significant source of information.

A strong consistent positive correlation was found against farm sales for both sales representatives and financial advisors for several forms of contact. Farmers of all demographic backgrounds are obtaining information at meetings and field days, as no correlations were found between this method and any demographic variable. Farmers place increasing value on commercial supplier publications as the value of their farm sales increases.

Farmers obtaining information from the British Columbia Ministry of Agriculture were, on average, younger, more educated, and had higher off-farm income and farm sales than those who did not. On a province wide basis, a comparison of the level of contact between farmers and district agriculturists and horticulturists found that these contacts were at a higher level as compared with those observed in 1969.

The research conducted was not a diffusion/adoption study and no information was collected about how innovative the farmers were who responded to the survey. In addition, no information on how farmers made their judgements about the "value" of various information sources was obtained. This study does not explain why farmers consult the various sources, or what information they obtain from each one. Caution must be exercised in drawing conclusions that the Ministry of Agriculture is providing a better level of service than in 1969. These results simply report the status of contact during those two time periods.

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CHAPTER 1

INTRODUCTION

Farmers use a variety of sources from which to obtain information to answer a wide range of technical and financial questions. These sources range from the next door neighbor to specialized consultants. Each of these is used with varying degrees of frequency depending on a number of factors such as availability and cost. The nature of the source of information, the frequency with which it is used, and the preference exhibited by the farmer for each type are important considerations in evaluating the effectiveness of existing extension methods and the design of new ones. For example, if farmers are obtaining most of their information on pesticides from a company sales representative, promoting the safe handling of pesticides by having brochures on display at a British Columbia Ministry of Agriculture[1] office may not be an effective way of reaching them. Providing training to sales representatives and giving them the brochures to leave with farmers could be a more efficient and effective way to promote the adoption of those practices.

The purpose of the research project reported in this thesis was to survey farmers in British Columbia about the sources from which they obtain technical information and to determine how the use of these information sources is related to their demographic characteristics. Specifically, there were four objectives of this study.

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[1] The Ministry of Agriculture has had several different names during the past two decades. It was previously known as the Department of Agriculture and has had the addition of "Food" and "Fisheries" over the past several years. For simplification, the term Ministry of Agriculture will be used throughout the text.

1. To determine what sources of information farmers are currently using in British Columbia and the relative preference they have for each type.

2. To determine if the preference and use of information sources can be correlated to demographic characteristics.

3. To determine if the demographic characteristics of farmers who use the British Columbia government extension services differ from those who do not.

4. To determine if the level of contact that farmers have with their district agriculturist or horticulturist has changed over time.

While a study of this nature is not new or unique, there are several reasons why current research would be of value. Work of this nature has not been published about British Columbia for over twenty years. All of the work previously published was conducted by graduate students between 1965 and 1969 under the direction of Professor Coolie Verner of the University of British Columbia.

The evolution of the global trading village places increased demands upon farmers to be more efficient in their business. The Ministry of Agriculture in a mission statement defines one of their six operating principles that "British Columbia agriculture, fish, and food industries will compete in a global economy" (Ministry of Agriculture, 1989, p.3). The way information is used has transformed the way in which business is conducted. Information is seen as the key to innovation and economic success. Driving this development is the technology of information acquisition and processing. Satellite communication, micro-computers, fax machines, databases, computer bulletin boards, and video equipment are readily available

technology that was not present or was limited in the nineteen sixties. Consequently, there is more information available and more choices in how to get it.

The study of the use of information sources is related to that of the adoption of innovations.

The adoption of innovations is a critical factor in the development and economic viability of British Columbia's agricultural industry. One of the Ministry of Agriculture's strategic priorities is to "enhance the competitiveness of the agriculture, fish, and food industries by assisting in effectively transferring technology to producers and processors" (Ministry of Agriculture, 1989, p.11). Different types of information sources are used at each stage of the adoption process. Previous research has found relationships between the type and frequency of use of information sources (Alleyne & Verner, 1969).

Information produced by studies such as this assist government in evaluating and understanding their role in the provision of information to farmers. For example, the 1979 British Columbia Legislative Assembly, Select Standing Committee on Agriculture (1979) used the research results from Akinbode & Dorling (1969) as material for evaluating and comparing agricultural extension systems in British Columbia, Alberta, and Oregon. Akinbode's work in 1969 involved a study of the nature and frequency of contact farmers had with the District Agriculturists in British Columbia. The report produced by the Select Standing Committee concluded with recommendations on the provision of extension services in British Columbia.

Government funding for all programs is harder to come by and there is an increased emphasis on justifying all expenditures. This has contributed to changes in

how extension programs are carried out. In general, greater emphasis is placed on programs that reach farmers in larger groups as opposed to the traditional personal farm visit. How this has affected the role the provincial extension service has in solving farmers' technical and financial problems is not known.

The agri-food industry is British Columbia's 3rd largest industry, ranking only behind forestry and mining. It is an $11 billion industry and employs 210,000 people. In 1990, British Columbia produced more than 60 percent of the province's total food requirement and exported $1.3 billion of agricultural products (BCMAF, no date).

The agricultural sector is constrained by a limited land base that is comprised of fertile valleys located between several mountain ranges. The province can be divided into eight distinctive agricultural regions on the basis of climate, geography. These regions as shown in Figure 1 are: 1. Vancouver Island, 2. Fraser Valley, 3. Thompson/Okanagan, 4. Kootenays, 5. Cariboo, 6. North Coast, 7. Nechako, and the 8. Peace River. Vancouver Island has a moist climate suited for long-season specialty crops. Vegetables, berries, nursery stock, and specialty crops such as kiwifruit can be grown. Dairy is the predominate livestock, however swine and poultry are important. The second region is the Fraser Valley which has a similar climate to Vancouver Island. These two regions have the highest number of frost-free days in the province and the most rainfall. Dairy is again the most predominate livestock industry however a significant poultry and swine industry is also present. Vegetables, berries, forages, and legumes are common. While a small greenhouse industry is located on Vancouver Island, this industry is mainly concentrated in the Fraser Valley. Extensive operations produce lettuce, flowers, peppers, cucumbers, and tomatoes. The third region, the Thompson/Okanagan, is known primarily for tree fruit production, however wineries, dairy, and beef are also important industries. The climate is mild with low annual

precipitation. The fourth region, the Kootenays, has a moderate climate and is located in small valleys between various mountain ranges in the south-eastern part of the province. While a variety of products are produced, including vegetables, tree fruits, and honey, the cattle industry is most important. Area number five, the Cariboo, is

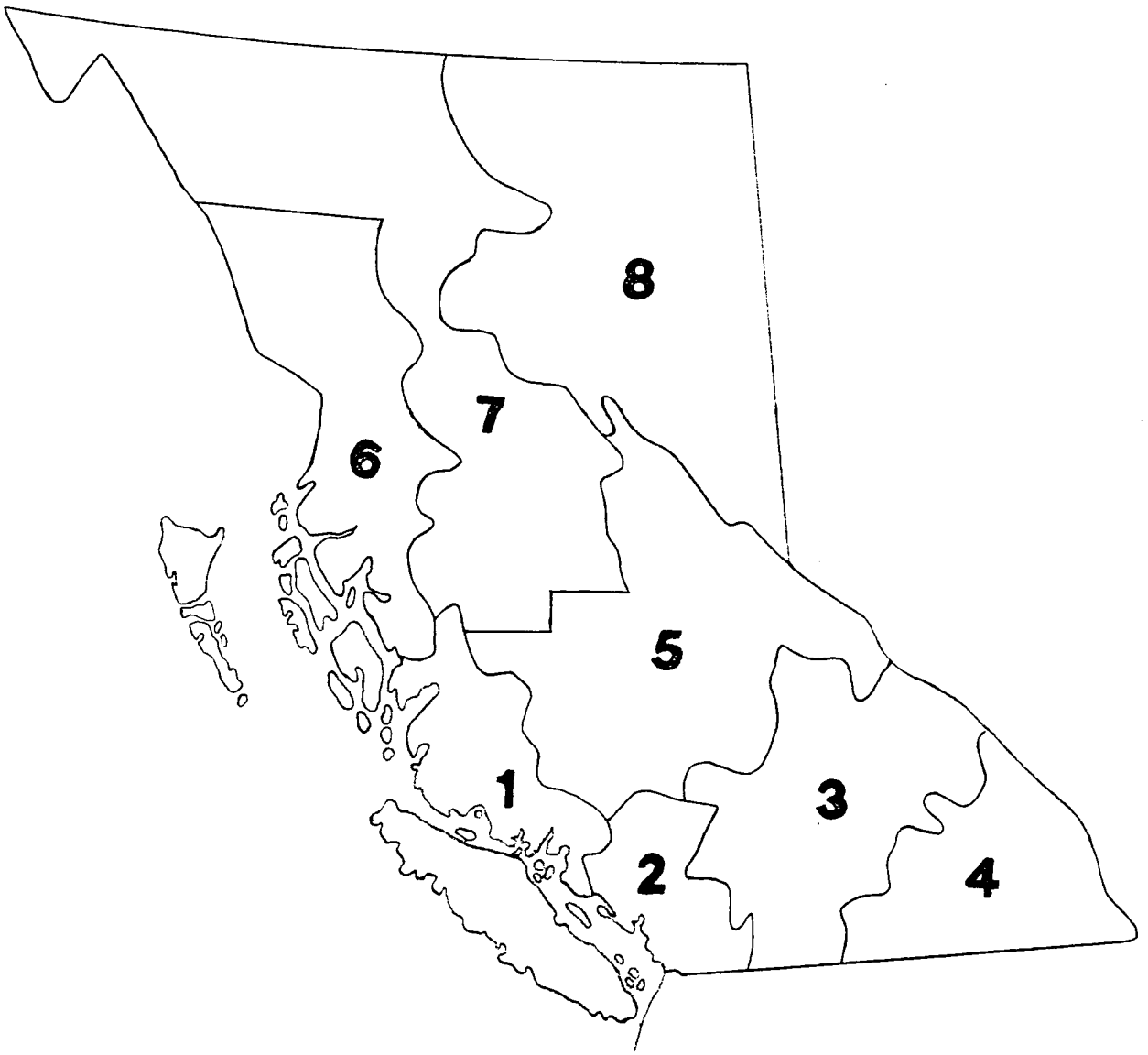


Figure 1: Agricultural Regions of British Columbia

known as the heart of the ranching industry. A significant amount of forages is produced to support the cattle industry. Irrigated alfalfa, some root vegetables and potatoes are produced along the Fraser River benches. The growing season is relatively short with moderate rainfall. The sixth region, the North Coast includes the Queen Charlotte Islands and moves inland as far as Terrace. The climate varies significantly with significant rainfall on the coast and the Queen Charlottes to semi-arid areas near Terrace. The range of commodities that can be grown is limited by a short frost-free period. Agriculture here is limited to ranching. Further east lies the seventh region, known as the Nechako, which is the area from Prince George to Smithers. The growing season is short, (53 days), and there is moderate rainfall. Forage production for the dairy and cattle industry is widespread. Some grain is grown in the Vanderhoof area. Region eight, known as the Central Peace River region, produces 86% of the province's grain. Some beef and vegetables are grown for local markets. Honey production is a million dollar industry.

Formal agricultural extension activities are primarily carried out by the provincial Ministry of Agriculture, although many other government agencies and non-governmental organizations play a role. The ministry has commodity specialists and district extension staff located in 22 different offices around the province. More than 200 regional extension staff provide the "front line" contact with producers. The staff engage in many types of extension activities, including field trials and variety evaluation, publication of technical bulletins and other informational materials, production of audio-visual materials, and seminars, short courses and workshops.

CHAPTER 2

REVIEW OF PREVIOUS WORK

This chapter provides an overview of the current literature on the relationships between demographic factors and use of information sources by farmers. It first describes how the literature search was conducted, and then describes the previous work in three sections: British Columbia studies, Canadian work, and United States research.

Three database programs were available through the University of British Columbia's libraries to survey the body of literature. The first database is known by the term "Agricola" which is an acronym for Agricultural OnLine Access. It is available on CD-ROM disk and extends from 1970 to the present. "Agricola" is a service provided by the National Agricultural Library of the United States Department of Agriculture. The database indexes citations from 2120 journals, monographs, theses, software, audiovisual material, and technical reports.

The second database used was the "Current Index to Journals in Education" (CIJE). This database encompasses 750 periodicals from 1969 to the present in the field of education. The material is primarily American with some British and Canadian references.

The third database utilized was the "Resources in Education" (RIE) which is organized into two separate databases. RIE1 covers Educational Resources Information Center (ERIC) microfiche from 1980 to the present while RIE2 covers microfiche from 1966 to 1979.

An extensive literature search quickly found that information available on this subject was limited and obscure. Many articles published in the field of extension in Canada are not widely distributed and available in the University of British Columbia library system. It proved to be easier to find information about agricultural innovators in Ohio in 1961 because of the monthly journals produced by agricultural experimental stations in the United States, than it was to locate work done on farmer's use of information sources in Canada. Fortunately, most of the work pertaining to the British Columbia situation was done through the Department of Administrative, Adult, and Higher Education at the University of British Columbia and is available in the departmental library. Dr. Coolie Verner and his graduate students conducted a number of studies from 1965 to 1969 (Akinbode, 1969), (Alleyne, 1968), (Millerd, 1965), (Verner & Gubbels, 1967). There has been no work published on the use of information sources in British Columbia since that time.

The literature on farmer's use of information sources can be broken into three categories. The first group includes published studies done on British Columbia. The second set of studies includes all other Canadian studies, and the final group describes work conducted in the United States.

British Columbia Studies

Four studies have been published which include data on the use of information sources in British Columbia. These were all done prior to 1969, and were conducted by University of British Columbia graduate students under the direction of Professor Coolie Verner.

A study by Verner & Gubbels (1967) looked at the adoption of innovations through a random sample of 100 dairy farmers in the Lower Fraser Valley. They found that dairy farmers used different sources of information at different stages in the adoption process. Mass media sources were the most important at the awareness stage, with personal and individual instruction sources being important at the interest stage.

Alleyne (1968) interviewed 100 strawberry growers in the Lower Fraser Valley. He looked at the information sources that were used at each stage of the adoption of innovation process. The adoption of innovation process categorizes farmers by the length of time it takes for them to adopt a new method or technique of farming. The four stages are: laggard, late majority, early majority, innovator. Friends and neighbors was the most referred to source for all stages of the adoption process. This accounted for 23.5% to 28.7% of the farmers. Sales representatives, observations on other farms, the District Horticulturist, agricultural meetings along with personal experience and foreign travel were the other most important information sources consulted. The rank of importance of the preceding sources varied depending on the adoption stage. The District Horticulturist ranked second for all adoption stages except for the laggard group.

Millerd (1965) interviewed Okanagan Valley orchardists to determine the sources of information used in each of the five stages of the adoption process. The group studied had been served by the 1964 television Chautauqua program. This program was widely viewed and introduced a number of innovations to orchardists. It was one of the earliest uses of the electronic media for educational purposes in the Okanagan. Prior to this program, innovations were introduced to orchardists through meetings in district halls. Millerd found that the following five sources were the most used overall in the following order: District horticulturist, other orchardists,

Summerland Research Station (Agriculture Canada), the television Chautauqua program, and magazines.

Akinbode (1969) conducted personal interviews with 265 farmers throughout British Columbia about their contact with District Agriculturists. He looked at the different ways in which a District Agriculturist may make contact with a farmer and broadly categorized them into two groups, personal and impersonal methods. Personal contact methods ranged from a high of 35% for those who visited the District Agriculturist at their office, to a low of 16% for farm visits. Impersonal contact methods ranged from a high of 93% for articles written by the District Agriculturist in farm newspapers to a low of 81% for mail sent from the office. This was a British Columbia wide study and is used later in this report to compare with the current level of contact with District Agriculturists.

Canadian Studies

Dent (1968) conducted personal interviews of 147 farm operators in Two Hills, Alberta. Farmers reported that their top five most frequently used sources of information were their own experience, farm papers, magazines, family, and friends and neighbors.

Blackburn et al. (1983) surveyed 731 farmers selected at random and a second group of 452 farmers known as agri-leaders chosen by the Ontario Ministry of Agriculture. Farm papers and magazines, Ontario Ministry of Agriculture publications, and ministry office programs were the most highly rated. All of the

public and private agency programs investigated were considered important by more than one-half of the farmers.

Alberta Agriculture (1983) conducted a telephone survey of 2312 Alberta farmers who had annual sales of at least $2500 to determine their information needs. A total of 39 questions were asked, eight of which related to demographic information. The remaining questions asked about the types of information they required, the best source for certain types of information, and about the types of information Alberta Agriculture should be offering. The survey did not ask where they were currently getting their information. The sources that were rated most useful by Alberta farmers were:

1. Neighbors and friends
2. Radio
3. Alberta Department of Agriculture
4. Farm magazines and newspapers
5. District Agriculturist

United States Studies

Nolan & Lasley (1979) surveyed 691 farmers during the spring of 1978 in Missouri to determine who was using agricultural extension services. He investigated the use of government extension publications, visits to the extension office, attendance at extension meetings, and the frequency of visits by extension specialists to the farm. Younger pork farmers with large amounts of land were the heaviest users of extension publications, and visited the extension office the most. Overall 55% of the farmers had

been to the office at least once during the past year, and 44% had been to an extension meeting. The characteristic with the strongest positive correlation with attendance was farm size. Farm visits proved to be the least frequent source of contact, with only 23% reporting a visit during the past year.

Warner & Christenson (1981) surveyed the general Kentucky population to determine a profile of the users and non-users of extension services. They found no statistical difference in the age groups reached, and the educational level of users and non-users was the same. They found that extension served a slightly larger proportion of those with lower incomes.

Gross (1977) researched farmers' attitudes towards extension to see if there were differences based on demographic characteristics. Farmers were asked to select from a list of 20 statements, five that he agreed with. These statements ranged from the favorable to the unfavorable and had been previously ranked on a scale of 1 to 11. The median score became the attitude score. Gross (1977) found that the younger farmers (26-35) and older farmers (56+) had the highest attitude scores, with middle aged farmers scoring less. The higher the attitude score, the more favorably the farmer viewed the extension service. Attitude scores increased with level of education, frequency of contact with the extension service, and with participation in farm organizations. Attitude scores for meetings, mailed information, and mass media were higher than for office visits and phone calls. Gross (1977) interpreted this to mean that there was a greater certainty that farmers would get the information they were looking for from meetings, mailed information, and mass media methods, whereas if they visited the office or tried to phone the extension agent, there was a good opportunity that staff members were out of the office and delays were was incurred in getting the information.

Warner & Christenson (1984) conducted a national survey of the United States population to discover the demographic characteristics of those who do and do not use extension services, along with a measurement of the awareness, support, and satisfaction people have of the United States Cooperative Extension Service. A 101 item questionnaire was administered through a telephone survey of 1048 people. They found that extension clientele were predominately middle class. They had middle to upper incomes, a high school or college education, were white, married, employed, and homeowners.

Coughenour (1959) studied the use 285 farmers made of five agricultural agencies in Kentucky from 1950 to 1955. The single most important characteristic in the use of agencies was socio-economic status. Socio-economic status was measured through their participation in farm organizations, value of farm sales, and the favorability of the social climate of the farmer's neighborhood. Therefore as farm sales, participation in farm organizations, and the favorability of the social climate increased, so did the farmers' use of the agricultural agencies. The extent of the farmer's formal education was the second most important factor. The farmers' age, years in farming, and attitude towards scientific farming were the least associated with whether or not they would obtain information from various agricultural agencies.

Iddings and Apps (1990) looked at the factors that influenced farmers' use of computers. They referred to a 1987 *Successful Farming* article, which reported on a Michigan State University study of Michigan farmers in which 21% of farmers either owned, leased, or shared a computer, while an additional 24% planned to obtain one in the next three years. In their study, they worked closely with 18 farmers in Wisconsin and Kansas to determine how much the farmers used their computers. They found that

good sources of information such as user groups, newsletters, and software reviews, along with a wide network of other users, were important factors in increasing the frequency of use.

Many of the previous studies such as Dent, (1968), Verner & Gubbels, (1967), Alleyne, (1968), etc. have relied upon less sophisticated techniques of statistical analysis because of the limitations or accessibility of computer software. The mathematics involved in computing statistical results from a survey with a number of questions can only be reasonably dealt with through computer analysis. The types of statistical analyses used by those researchers were much more limited than that available today.

Extension in the United States is delivered quite differently than in Canada. Extension was created by the Smith-Lever Act in 1914 as part of the land-grant system for transmitting agricultural information from the colleges to the local people. In Canada extension is mainly under the jurisdiction of the provincial ministries of agriculture. United States extension programs tend to be broader in nature. They interact with a significantly larger urban clientele, and can involve community development programs. The purpose in reviewing the Canadian and United States studies was to show some of the similiarities that exist amongst farmers' use of extension programs in other areas. The review also illustrates that studies such as Iddings & Apps (1990) and Gross (1977) are very dependent on the type of extension programs that are offered and how they are conducted along with the cultural milieu at hand. Therefore it is difficult relate some the findings from studies such as these to the British Columbia situation without fully understanding the context within which those extension programs are carried out.

Several of the studies reviewed looked at information sources in view of the process of adoption of new innovations (Alleyne, 1968),(Millerd, 1965), (Verner & Gubbels, 1967). The adoption of innovation process describes how new ideas and practices are communicated to farmers and how they decide to adopt or reject those innovations. Farmers can be classified into "adoptor" categories based on the "degree to which an individual is relatively earlier in adopting new ideas than other members of the system" (Lamble, 1984). These categories are know as: innovators, early adoptors, early majority, late majority, and laggards. Innovators are noted as being very adventuresome and are eager to try out new ideas. This group represents 2-3% of the population. Early adoptors represent the next 10 to 15%,. and unlike innovators whose interests lead them out of their local circle of peers, tend to be regarded with a great deal of esteem. "Potential adoptors look to early adoptors for advice and information about the innovation" (Rogers, 1983). The early majority is describe as being "deliberate" as a result of their long innovation-decision period. This group represents about a third of the population. "Although they rarely hold leadership positions, they interact frequenctly with with peers and provide an important link in the diffusion process between the early adoptors and the late majority" (Lamble, 1984). The late majority presents another third of the population who adopt new ideas just after the average person. "Pressure of peers is necessary to motivate adoption" (Rogers, 1983). The laggards are the last 15% to adopt. Laggards tend to be the most "traditional" and make decisions in terms of what was done in the past. "Laggards tend to be frankly suspicious of innovations and change agents" (Rogers, 1983).

As can be seen from the above discussion, the type of information source a farmer may use is related to some degree to the adoptor category they are in. While this study did not attempt to relate sources of information to the farmer's adoptor category, it is important to remember that different groups of farmers prefer different

sources for obtaining information. Categorization of farmers into these groups is best done through examining specific examples of the adoption of an innovation for a specific commodity group and by determining how the farmer learned about the innovation.

CHAPTER 3
RESEARCH DESIGN

Development of the Instrument

The information required to satisfy the objectives of the research could be collected through personal interviews, telephone interviews, or through a mailed survey. A number of the previous studies on use of information sources by farmers collected the information through personal interviews. For example, studies for the Canada Land Inventory (Verner, 1967) were conducted over a period of two summers during 1966 and 1967 by hired staff. Each staff member was able to interview between 3.0 and 5.1 people per day, which included time spent in the evenings (Verner, 1967). Dent (1968) took between August and December of 1965 to personally interview 158 farmers in the county of Two Hills, Alberta. It took Verner & Gubbels (1967) 194 farm visits to complete 100 personal interviews in the Lower Fraser Valley. It is apparent that this method of collecting information is costly.

A second method of collecting the required information would be by telephone interview. It is a policy of University of British Columbia to discourages initial contact by telephone for research involving human subjects. To conduct telephone interviews, each farmer would have to be mailed a letter informing them about the study and advising that they would be contacted by telephone for an interview. In addition to this expense would be that of long distance phone calls, as the survey group was scattered throughout the province. This method would also remove the anonymity of the responses, and would make it difficult to collect information on sensitive demographic information, such as income from outside the farm and total farm sales. In addition,

the questions require the respondent to think and reflect over who they may have talked to in the past year, and some of the information such as farm sales may have to be looked up.

Mailed questionnaires are widely used for many types of surveys, and permit wide coverage at minimal expense (Charach, 1975, p. 1). Mailed questionnaires allow the survey to be applied uniformly without any influence from an interviewer. They also provide a greater sense of privacy and anonymity, which is beneficial when asking personal questions such as income.

The greatest concern with mailed questionnaires is the response rate. Is there a difference between those who completed the questionnaire and the non-respondents? Mailed surveys also limit the number of questions that can be asked, and their complexity.

As a result of these considerations, and the very limited amount of funds available to carry out the information gathering, a mailed survey proved to be the best method. Significant consideration went into the design of the survey in order to deal with the negative aspects of mailed questionnaires.

Survey Design

This section describes how the survey was developed and carried out. A number of key circumstances dictated the number of surveys sent out and the time frame available.

In spring of 1991, the author's advisor, Thomas J. Sork, was asked by the British Columbia Ministry of Agriculture to prepare a comprehensive description of British Columbia's extension programs and services since 1983. In addition, he was asked to propose recommendations on the future development of these programs and services. Several of the questions asked in the mandate of the review were: Who is currently being served by extension; Which aspects of extension work are best carried out by the Ministry?; Which are best carried out by non-Ministry agencies? In order to answer questions like this, basic information about the current extension services and the information sources farmers use had to be gathered. The extension review was given a small budget and a mandate to report back by August 30, 1991. The final report was based on information gathered from the survey used in this thesis, a second survey on different aspects of extension, and interviews of many ministry staff. The report only utilized the raw survey results from this thesis and did not contain any of the statistical analysis.

The intent and design of the survey was to collect information in three major areas.

a) Frequency of use of different information sources
b) Opinions on the value of different information sources
c) Demographic data on the respondent

The survey, which can be found in Appendix One, was divided into three main sections. In order to obtain a clear picture of the various sources a farmer may consult, section one of the survey contained an exhaustive list of possible sources a farmer might consult. Questions one through five asked about contact with a list of 10 individuals who are generally considered to be in the business of providing information to farmers. The objective of these questions was to explore the different ways in which

farmers interact with these individuals. In addition, this question format parallels that of questions asked by Verner (1967) in 1966 and 1967 while conducting the Canada Land Inventory Demographic Surveys. This allows direct comparison of those results with the information gathered in this survey. Question six asked farmers about a variety of publications that may contain information useful in making farm management decisions. Questions 7 through 16 contain all the remaining questions about sources the farmer may have consulted that did not fit into any of the previous categories.

Section two consisted of question 17 and asked farmers how valuable they found each source even if they have not had an opportunity to use them in the last 12 months. Section three consisted of questions 18 through 30 which pertain to demographic information.

The survey only asked whether or not a farmer used or valued a particuliar source of information. The questions do not attempt to determine why a farmer chose that particuliar source or how reliable or trustworthy the source may be. To determine the answers to these questions would make the questionnaire much longer and would make it difficult to report on all of the information sources farmers are using. Questions of this nature would be more appropriate when investigating particuliar sources of information in more detail.

Due to the large number of questions asked on the survey, they were organized into similar categories that could be answered by simply checking one of the boxes provided. The length, appearance, and complexity of the survey was of major consideration. Charach (1975, p. 6) cites a number of studies on the effect of the length of a survey. He states that the evidence suggests that a reduction in the amount of time required to complete a survey may increase the response rate, however this has

not been proven. In fact, increasing the length can be beneficial if it improves the format.

Discussions with various individuals suggested that 20 minutes was an ideal time length to complete a survey. A forced choice questionnaire made it easier to fill out. The structure of the questions was such that forced choices would not obscure the true situation.

Pilot testing of the survey was done on two farmers prior to mailing out the survey. One was a beekeeper and the second was a nursery grower. Verbal feedback resulted in several minor changes to the instructions in order to better explain how to complete the questionnaire.

The final questionnaire format along with the cover letter was submitted to, and approved by, The University of British Columbia Behavioral Sciences Screening Committee For Research and Other Studies Involving Human Subjects. The review by the committee ensures that research conducted under the university's name meets the standards approved by the University.

The survey was also submitted to the 1991 Extension Program Review Steering Committee of the Ministry of Agriculture. They approved the use of the survey and provided funds for it to be conducted as part of the 1991 Extension Review. Since the review was not public, approval was also given for the publication of the survey results for this thesis.

As described earlier, Dr. Thomas J. Sork of the University of British Columbia was appointed Director of the 1991 Extension Review. As the author works with a

well known agricultural supply company, cover letters for the survey were sent on University of British Columbia letterhead under Dr. Thomas J. Sork's signature. It was felt that this would lend additional credibility to the survey and increase the response rate, as the results were going directly to the Ministry of Agriculture. Farmers could have been disinclined to respond if they felt the survey was related to a particular agricultural business rather than an impartial institution, such as the University of British Columbia.

Return envelopes included with the questionnaire were addressed and stamped. Regular postage stamps were used for the return envelopes. Charach (1975, p. 7) suggests that a stamp increases the sense of obligation of subjects to respond because the sender will be out the price of postage if they do not. In addition, the use of stamps avoids the survey being associated with junk mail.

Time was a factor affecting how the survey could be carried out. Funding from the 1991 Extension Program Review project only became available in late April. The survey had to be constructed, pilot tested, carried out, and a final report to the Ministry of Agriculture completed by August 31, 1991. For this reason, there was insufficient time to carry out follow-ups or reminder letters to people in order to increase the response rate. Follow ups to mailed surveys can significantly increase response rates. Two and three follow-up letters followed by a telephone call, can in some instances, increase the response rate to over 90% (Orlich, 1978, p. 97). According to the literature, one could expect at least a 10% increase in the response rate. However, since the survey was anonymous, it would not have been possible to determine who replied. A follow-up could be conducted by sending every individual a reminder, while thanking them if they had responded already. A copy of the survey would have to be included with the reminder in case they had lost or misplaced the first one.

Conducting a follow-up of this nature therefore would have doubled the costs however funds were not available to do this.

Sampling Procedures

This section describes how the sample was drawn and the statistical significance of the sample size. The 1991 Extension Program Review included another survey that was sent to a different group of farmers. The samples for the two surveys were drawn from the same set of producer addresses, so the following discussion includes references to the second survey.

Drawing the Sample

The main objective in developing a sampling procedure is to draw a sample that is representative of the total population. Consequently, if a different sample was drawn from the same population, the results would be similar. To distinguish between the two surveys, the survey used in this thesis on farmer information sources is referred to as the "long questionnaire", and the other is referred to as the "short questionnaire".

Sufficient funds were available to mail 1200 questionnaires in total. As the long questionnaire was an addition to the questions being posed by the Ministry of Agriculture in the 1991 Extension Program Review, only 400 of the long questionnaires were sent out, with the remaining 800 receiving the short questionnaire.

Mailing lists for farmers in British Columbia are difficult to obtain, as many of them are confidential. Lists are maintained by various farm organizations, private companies who supply products and services, and the Ministry of Agriculture. As the Ministry had requested the study, and their mailing lists are the most complete, Ministry-supplied mailing lists formed the basis for defining the survey population. Two types of lists were available. The commodity specialists maintained lists that were specific to their specialty. District agriculturists and horticulturists maintained more general lists. Each name on the list was categorized by the commodity the individual was involved with. Individuals on the mailing lists could get on them in a variety of ways. Ministry staff attempt to keep accurate lists of individuals in their area, but one could get on the list by simply requesting it. While Ministry mailing lists could be considered biased in favor of farmers using Ministry services, it is expected that due to the fact they have been maintained for a number of years, that they are most likely to be the most complete.

On the basis of these mailing lists, 1200 names were drawn using a weighted average which combined the contribution each commodity group made in farm cash receipts with the estimated number of producers in each group (Wiersma, 1986). This was calculated by taking the mean value of the percentage of producers in each commodity group and farm cash receipts. The results are presented in Table 1 below:

Table 1
Selected Sample by Commodity Group

Commodity Group	Producers				Farm Cash Receipts[a] (millions)		Weighted Sample	
	(#)[b]	(#)[c]	(%)[d]	(%)[e]	($)	(%)	(#)	(%)
Beef	2524	2524	27.6	28	190.5	18	276	23.0
Grains & Oilseeds	800	800	8.8	9	31.8	3	72	6.0
Dairy	950	950	10.4	10	242.9	22	192	16.0
Poultry	443	443	4.9	5	200.1	18	138	11.5
Swine	240	240	2.6	3	45.3	4	42	3.5
Tree Fruits	1600	1600	17.5	17	50.5	5	132	11.0
Berries	1200	103	1.1	1	54.0	5	10	1.0
Vegetables	600	600	6.6	7	100.7	9	96	8.0
Floriculture & Nursery	380	380	4.2	4	111.8	10	84	7.0
Other	400	1497	16.4	16	60.3	6	160	13.0
Totals	9137	9137	100.1[f]	100	1087.9	100	1200	100.0

[a] 1989-90 British Columbia Ministry of Agriculture and Fisheries Annual Report
[b] Estimated number of farmers in each commodity group
[c] Number of farmers used to draw the sample
[d] Actual percentage of each category
[e] Percentage of farmers used to draw the sample
f Difference due to round-off error

Column 1 and 2 describes the number of farmers in each commodity group as supplied by Terry Dever (1991) of the Ministry of Agriculture. Column 3 lists the number of farmers in each commodity group that were used to draw the sample. Column 4 presents the percentage of farmers in each commodity group. In calculating the weighted average, these percentages had been rounded off and these values are presented in column 5. A small round-off error was made for the tree fruit category, however this has little effect on the actual sample.

A mailing list for berry growers was not available at the time of the survey. A time deadline for the final report to the Ministry of Agriculture meant that the survey

had to be conducted without this information. As the mailing lists from the district offices contained all the farmers in a district, it was possible to put together a list of 103 berry growers. As names for the remaining 1097 were not available, this total was added to the 'other' category. This means that berry growers are under-represented in the survey, while 'other' producers may be slightly over-represented. From this information a weighted sample of 1200 names was drawn.

Sample Size

Financial considerations dictated the number of surveys that could be sent out. However, for the results from the survey to be interpreted as being significant, it is important to know how many surveys must be completed and returned in order to provide a statistically representative sample. A basic assumption to this is that the survey is not self-selecting, so that certain demographic groups are not less likely to respond than others, and that the return of surveys is random, i.e. the reasons for not responding are random.

To determine if the 400 names drawn for the long questionnaire was large enough to be statistically representative of the population, the following equation (Scheaffer, Mendenhall, & Ott, 1986) can be used. For a stratified random sample, the approximate sample size (n), required to estimate the mean (m), with a bound B, on the error of the estimated size of n is given by Equation 1.

$$n = \frac{\sum_{i=1}^{10} N_i^2 \sigma_i^2 / w_i}{N^2 D + \sum_{i=1}^{10} N_i \sigma_i^2} \qquad \text{Eqn (1)}$$

where

n = sample size

N = total population size

N_i = population of each stratum

w_i = fraction of N used for each stratification

σ_i^2 = population variance of each stratum

D = $B^2/4$

B = size of allowable error in estimating sample size n

The mean (m) referred to above can refer to a variety of information such as the average value of age, income, or number of farm visits. The population of each stratum refers to the number of dairy farmers, beef farmers, et cetera. There are a total of 10 stratums0. The population variance refers to how much individual scores of the item being measured differ from the average value of that item. For example, if the average age of farmers is 50 years, and the total population varied between 40 and 60 years of age then the variance would be much lower than if the total population varied between 18 and 82 years of age. Since the variance of the total population is unknown, it can be estimated by the use of Tchebysheff's Theorem and the mathematical principle of the normal distribution (Scheaffer, Mendenhall, & Ott,1986). This theorem states that the range will be between four to six standard deviations of the mean. Therefore:

$$\sigma^2 = [\text{range}/(4 \text{ to } 6)]^2 \qquad \text{Eqn (2)}$$

The range refers to how accurate the values for the total population and population stratums are thought to be. Since the population variance and the allowable error must be estimated, the most suitable technique for using this equation is to calculate a range of values of the sample size (n) to see if reasonable sample sizes result. The results of these calculations are listed in Table 2 below.

Table 2
Estimated Sample Sizes Required

Range	B[a]	D[b]	Number of Standard Deviations	Sample Size (n)
5%	10	25.00	4	18
10%	10	25.00	4	69
10%	5	6.25	4	270
20%	10	25.00	4	270
20%	20	100.00	4	69
5%	10	25.00	6	8
10%	10	25.00	6	31
10%	5	6.25	6	122
20%	10	25.00	6	122
20%	20	100.00	6	31

[a] size of allowable error in estimating sample size n
[b] $D = B^2/4$

Values for the range and "B" were picked to see the resulting sample size "n" that would result. The assumption is made that since the Ministry of Agriculture has been maintaining the mailing lists for many years, that any degree of error that exists must be less than 20%. Using these values in equation (1) gives a range of sample sizes from 8 to 270. This range indicates the size the sample should be based on the degree of error estimated. As the degree of error is not known, and the sample size range of 8 to 270 represents a broad range of possible errors. A total of 400 questionnaires were mailed with 100 responses. Given the range of values presented in Table 2, a survey response of 100 appears to be large enough to minimize the possibility of making an

error when generalizing the results of this survey to the total population of farmers in British Columbia.

CHAPTER 4

RESEARCH RESULTS

Questionnaire Response

This section describes and compares the response rate to the surveys that were sent as part of the 1991 Extension Program Review. As mentioned previously, the questionnaire that forms the basis of this thesis is referred to as the 'long questionnaire', and the other questionnaire the 'short questionnaire'.

A total of 100 completed questionnaires were returned out of the 400 long questionnaires that were sent out. In addition to the 100 responses, three were returned by the post office indicating that the individuals had moved, and one was returned with a letter explaining that the individual had retired and was no longer farming. Therefore, the overall response was 25% of the surveys sent out, but as the actual total sample was 396, the true response rate was 25.25%. The questionnaires were mailed on July 5 and a reply was requested by July 15. The response rate could have been higher if more time had been available for people to respond to the survey, or if it had been conducted at a time of year when farmers were not busy. Some of the surveys were held up by the post office and were not mailed until July 9. Given that mail can take up to 10 days to reach more remote areas of the province, it is clear that insufficient time was allowed for a response. The results to be presented will show that the goals of the thesis were not compromised. Respondents made several written comments on the returned questionnaires about the lack of time they were given to respond. One respondent, postmarked Victoria, noted that they had received the survey on July 13 and another, from an unknown location, indicated that they had received it on July 19. At the time the report was written, only 86 surveys had been

received. Surveys continued to trickle in until early October. This demonstrates that the survey itself was viewed positively by farmers, as they took the trouble to respond long after the given deadline. On the basis of the values presented in Table 2, it appears that the response rate of 100 is large enough to represent the total population of farmers, on the assumption that the estimates of the number of farmers in each commodity groups is accurate to within about 20%.

A total of 120 completed questionnaires were returned out of the 800 short questionnaires sent out. The response rate for this questionnaire was 15.0%. The response rates for each questionnaire are presented by commodity group in Table 3 below. Comparison of the response rate by commodity group show variances on the magnitude of 5% to 70%.

Table 3
Survey Respondents by Commodity Group

Commodity Group	Long Questionnaire (%)	Short Questionnaire (%)
Sample Size	(n=100)	(n=120)
Beef	23.0	14.2
Dairy	17.0	17.5
Swine	5.0	1.7
Poultry	5.0	6.7
Grains & Oilseeds	4.0	4.2
Bee Products	0.0	0.8
Vegetables	4.0	9.2
Berries	1.0	2.5
Tree Fruits	5.0	13.3
Sheep	5.0	5.0
Grapes	4.0	2.5
Forage	2.0	1.7
Floriculture	2.0	2.5
Nursery	8.0	5.8
Other	4.0	6.7
Multiple Products	11.0	5.8
Totals	100.0	100.1[a]

[a] Difference due to round-off error

Of the four respondents in the long questionnaire classified as 'Other', two raised horses, one raised fallow deer, and the last one was a turf farmer. More choices of commodity groups were given on the questionnaire than the categories used to draw the sample. This allowed the respondents to find their commodity reflected in the survey. In addition, it provides a better picture of the characteristics of those who replied and allows flexibility when conducting the data analysis. It is always easier to collapse categories later than to try and expand them to fit the analysis being performed. An additional category of 'Multiple Products' was created as a result of the significant number of respondents who checked more than one commodity and indicated that neither commodity took precedence over the other. This occurred even though this question clearly asked for only one commodity to be checked.

Comparison of the response rate by commodity group to the sample drawn is done by collapsing the responses by commodity group down into the same categories The 'multiple' products' category has been added to the 'other' category. These results are presented in Table 4 below.

Table 4
Comparison of Survey Responses to the Sample Selected

Commodity Group	Long Questionnaire (%)	Short Questionnaire (%)	Sample[b] (%)
Beef	23.0	14.2	23.0
Grains & Oilseeds	4.0	4.2	6.0
Dairy	17.0	17.5	16.0
Poultry	5.0	6.7	11.5
Swine	5.0	1.7	3.5
Tree Fruits	5.0	13.3	11.0
Berries	1.0	2.5	1.0
Vegetables	4.0	9.2	8.0
Floriculture & Nursery	10.0	8.3	7.0
Other	26.0	22.5	13.0
Totals	100.0	100.0	100.1 [a]

[a] Difference due to round-off error
[b] From Table 1

A review of these results indicates that the 'other' category consists of a large percentage of the sample due to the multiple category being added. The original sample was drawn by selecting names from commodity lists maintained by government specialists. Since a category for farmers producing multiple products was not used to select the sample, it is necessary to eliminate it in order to make a better comparison. The only possible way to do this is to provide a frequency count in every category that a producer indicated a response and then dividing by the total. The 11 producers in the multiple category on the long questionnaire indicated a total of 29 frequency counts. Recalculating the percentages provides the following results in Table 5. The multiple product category for the short questionnaire was not broken down as the original questionnaires were unavailable.

Table 5
Adjusted Comparison of Survey Responses to the Sample Selected

Commodity Group	Long Questionnaire (%)	Short Questionnaire (%)	Sample[b] (%)
Beef	21.2	14.2	23.0
Grains & Oilseeds	4.2	4.2	6.0
Dairy	16.1	17.5	16.0
Poultry	8.5	6.7	11.5
Swine	5.9	1.7	3.5
Tree Fruits	6.8	13.3	11.0
Berries	4.2	2.5	1.0
Vegetables	5.9	9.2	8.0
Floriculture & Nursery	10.2	2.5	7.0
Other	17.0	7.2	13.0
Multiple Products	0.0	5.8	0.0
Totals	100.0	100.1 [a]	100.0

[a] Difference due to round-off error
[b] From Table 1

Comparing the distribution of responses for the long questionnaire to the distribution for the sample shows a fairly similar distribution. The chi-squared technique is used to make this comparison mathematically. The method compares the survey responses (observed frequencies), to the sample (expected frequencies) that was selected. The null hypothesis is that there is no difference between the observed frequencies and the expected frequencies. The chi-squared statistic, as shown in Equation 3, is calculated by finding the difference between the observed and expected frequencies and dividing the square of that difference by the value of the expected frequency. The sum of each of the commodity groups gives the chi-squared value.

$$\chi^2 = \sum_{i=1}^{10} \frac{(O - E)^2}{E} \qquad \text{Eqn (3)}$$

Calculation of the chi-squared statistic (χ^2) gives a value of 18.2. Evaluation of the chi-squared statistic is done by referring to a chi-squared table. At the 5% level, the chi-squared value is 16.92, and at the 1% level, the chi-squared value is 21.67. Since the calculated value falls between these two tabulated values, one can conclude that the probability of getting a chi-squared value as large as 18.2 is greater than 1%, but less than 5 %. The conclusion is that the response to the questionnaire by commodity group is not quite the same as was expected. The commodity group contributing the largest amount of variance between the observed and expected frequencies is the berry growers. Slightly more berry growers returned surveys than were expected. Since the survey was underestimating berry growers in the first place due to lack of a mailing list, this helps to mitigate the low representation this commodity group has in the survey.

In conclusion, the results of statistical analysis give a strong degree of certainty that the surveys are representative of the British Columbia population of farmers. Therefore, it can be concluded that the farmers responding to the survey are representative of all farmers in British Columbia and that the information derived from the survey accurately reflects their opinions and actions.

Factoring out the livestock producers from the 'other' category and adding up all other livestock categories indicates that 55.1% of the farms produce animal or animal products of some nature. This figure becomes important later on when analyzing contact rates by individuals who may be crop or livestock oriented such as veterinarians.

Questionnaire Results

The questionnaire results are divided down into three sections. Section one reports the demographic characteristics of the survey group. Section two summarizes the information obtained on the frequency of use of different information sources, and the third section deals with the opinions expressed by the farmers surveyed on the value of each information source. As not all of the farmers returning questionnaires completed every section of it, each results section indicates how many answered that part of the questionnaires out of the 100 returned

Demographic Characteristics

Based on the statistical analysis presented previously, the following demographic characteristics can be considered representative of British Columbia farmers with the exception of berry growers. The information is presented in tabular form by each demographic characteristic with comments on important aspects of each one.

The age distribution of the farmers surveyed is heavily weighted towards older individuals as indicated in Table 6. The mean age is 49.5 years and 54% of the farmers are aged 50 years or greater.

Table 6
Age Distribution of Sample

Age Category (years)	Percentage of Farmers[a] (%)
1 to 9	0
10 to 19	1
20 to 29	2
30 to 39	16
40 to 49	27
50 to 59	36
60 to 69	12
70 to 79	6

[a] Based on 100 cases

As can be seen in Table 7 below, the majority of the respondents were male. The questionnaire and cover letter did not contain instructions as to who should fill out the questionnaire should both a husband and wife consider themselves to be farmers. It is assumed that the individual who is involved in the day to day making of farm management decisions would be the respondent.

Table 7
Sex Distribution of Sample

Sex Category	Percentage of Farmers[a] (%)
Male	91
Female	9

[a] Based on 100 cases

Table 8 shows that over 90% of the respondents are married.

Table 8
Marital Status Distribution of Sample

Marital Status	Percentage of Farmers[a] (%)
Married	93
Widowed, Divorced, Single	4
Never Married	3

[a] Based on 99 cases

Seventy percent of the farmers surveyed spoke English as their first language, while the remaining 30% are divided between 9 other categories as shown in Table 9. The predominant language/ethnic backgrounds, other than English, were German at 12% and Dutch at 9%. It is not clear from the survey results if any ethnic group is under-represented because of language difficulties in reading and completing the questionnaire. In particular, those of East Indian ancestry who speak Punjabi are not represented at all. It is possible that those farmers who have difficulty with English as a second language had older sons or daughters who spoke English as a first language complete the questionnaire for them, particularly if they are involved in the day to day farm activities. If this was the case they may have indicated English as their first language. More probable is the fact that many Punjabi speaking farmers are berry growers and berry farmers were the one commodity group under-represented in the survey.

Table 9
Mother Tongue of Sample

Mother Tongue	Percentage of Farmers[a] (%)
English	70
French	1
Chinese	1
Italian	1
Portuguese	1
Dutch	9
German	12
Native Indian	1
Scandinavian	2
Other	2

[a] Based on 100 cases

Table 10 indicates that over 90% of the farmers surveyed have children.

Table 10
Distribution of the Number of Children of Respondents

Number of Children	Percentage of Farmers[a] (%)
None	9.1
One	8.1
Two	29.3
Three	28.3
Four	12.1
Five or more	13.1

[a] Based on 99 cases

Table 11 shows the distribution of farmers by the level of their formal education. A total of 38% of the respondents have some form of post-secondary education. Most of the post secondary education (60.5% of the 38%) is at the college or technical diploma level.

Table 11
Highest Level of Formal Education of Sample

Level of Education	Percentage of Farmers[a] (%)
Less than Five Years	2
Five to Eight Years	10
Nine to Eleven Years	20
High School Diploma	30
College or Technical School	23
Bachelors Degree	9
Masters Degree	4
Doctorate	1
Other	1

[a] Based on 100 cases

Membership in farm organizations is presented in Table 12. It was clear from the way respondents answered this question that they did not fully understand it. For example, several people wrote out the name of the B.C. Cattleman's Association under

the 'other' category rather than checking the box for 'Breed Organization'. Membership in many farm organizations automatically gives a farmer membership in the B.C. Federation of Agriculture (B.C.F.A.). Some people recognized that they belonged to the B.C.F.A. either directly as members or through another group and checked that box. Others did not. A person indicating membership in the B.C. Cattleman's Association was not given a score for the B.C.F.A. if they did not indicate it, although membership in the cattleman's group gives automatic membership in the B.C.F.A. The results of this question are presented in Table 12.

Table 12
Farm Organization Membership

Farm Organization	Members[a] (%)
B.C. Federation of Agriculture	69.0
A Farmer's or Women's Institute	11.5
Alliance of B.C. Organic Producers' Association	1.2
B.C. Fair Association	6.9
Horse Council of B.C.	3.5
Commodity marketing board	26.4
Breed organization	41.4
Packing house or crop marketing co-op	17.2
A farm or rural women's group	5.8
Other, please specify	18.4

[a] Based on 87 cases

Table 6 showed that the 54% of the farmers are aged 50 years or more. Considering this in relationship to the information presented in Tables 13 and 14, it can be seen that many farmers have spent most of their life farming. Over 50% have been farming for at least 20 years. In addition, over 40% of them have been on their present farm for more than 20 years.

Table 13
Number of Years on Present Farm

Category (years)	Percentage of Farmers[a] (%)
1 to 9	30.3
10 to 19	28.3
20 to 29	18.2
30 to 39	14.1
40 to 49	3.0
50 to 59	4.0
60 to 69	1.0
70 to 79	1.0

[a] Based on 99 cases

Table 14
Number of Years as a Farmer

Category (years)	Percentage of Farmers[a] (%)
1 to 9	14.3
10 to 19	32.7
20 to 29	23.5
30 to 39	16.3
40 to 49	6.1
50 to 59	6.1
60 to 69	1.0
70 to 79	0.0

[a] Based on 98 cases

Farmers were asked to report how much income they and their spouse earned outside the farm during the past year. Most respondents (71.9%) reported earning some income. The distribution is shown in Table 15 below. The less than $5000 category and the $30,001 to $40,000 were the two largest groups reporting income at 12.5% each.

Table 15
Total Family Income Earned Off-Farm

Income Category (dollars)	Percentage of Farmers[a] (%)
None	28.1
Less than 5,000	12.5
5,000 to 10,000	9.4
10,001 to 20,000	6.3
20,001 to 30,000	8.3
30,001 to 40,000	12.5
40,001 to 50,000	7.3
50,001 to 60,000	4.2
60,001 to 70,000	5.2
70,001 and over	6.3

[a] Based on 96 cases

Farmers were also asked to report their total farm sales dollars. As seen in Table 16 below, 28% of respondents reported earning less than $19,999 from their operation. The rest of the farmers are divided amongst all the other categories with the next largest group (14%) falling in the $200,000 to $299,999 range.

Table 16
Total Farm Sales

Sales Category (dollars)	Percentage of Farmers[a] (%)
0-19,999	28
20,000 to 39,999	8
40,000 to 59,999	9
60,000 to 79,999	8
80,000 to 99,999	6
100,000 to 149,999	3
150,000 to 199,999	7
200,000 to 299,999	14
300,000 to 499,999	4
500,000 to 749,999	7
750,000 to 999,999	2
1 Million to 1,999,999	2
2 Million to 3,999,999	1
4 Million and over	1

[a] Based on 90 cases

Frequency of Information Use

As a large amount of information was collected on the survey, the following results are listed in summary form in order to facilitate the presentation and interpretation of the results. For example, the use of different sources of information is presented in a yes/no format as opposed to reporting the various levels of use. A more detailed and complete summary of the survey results in the form that the questions were asked is available in Appendix 1. The results presented in each table have been sorted so that the frequencies are presented in descending order of use. The question that was asked on the survey appears before each table so that the results can be interpreted in view of the wording that was used.

Questions 1 through 5 list ten categories of individuals who are either in the business of providing information to farmers, or the results of their work produces

information that could be of use to a farmer. Each question asks about different ways in which contact between the farmer and these individuals can occur.

QUESTION 1

Please put a check in the box to the right of each information source that best indicates how often during the past 12 months each person visited your farm and provided you with information pertaining to a farm matter.

Table 17 indicates that over half of all farmers were visited by a sales representative and a veterinarian. Considering that 55.1% (Table 5) of the farmers raise some form of livestock, the fact that 52% of all farmers had a veterinarian visit them on their farm and provide information pertaining to a farm matter, is worthy of attention. In addition, reference to Appendix 1, will indicate that the average frequency of those visits is 3 or 4 times.

Table 17
Frequency of Farm Visits

Information Source	Farm Visits[a] (%)
Sales Representative	58
Veterinarian	52
Other Provincial Specialist	25
Bank Manager/Financial Advisor	25
District Agriculturist/ Horticulturist	23
Packing house or Processor Field Representative	22
Independent Consultant	14
Agriculture Canada staff	12
Other	0.5
University or College Staff	0.2

Note: Based on 100 cases
[a] Refers to a minimum of one visit

QUESTION 2

Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you obtained information relating to a farm matter by talking to each person on the telephone.

Table 18 reports the frequency with which the farmers used each information source. The level of contact between farmers and veterinarians has increased 10% as compared to farm visits. The level of contact for the Bank Manager/Financial Advisor and District Agriculturist is almost double what it was for farm visits. The relative ranking of the different individuals remains very similar to that of farm visits except that the category "other provincial specialists", which was in third place, has switched places with the district agriculturist/horticulturist which was previously in fifth place.

Table 18
Frequency of Phone Calls

Information Source	Phone Calls[a] (%)
Sales Representative	61
Veterinarian	61
District Agriculturist/ Horticulturist	47
Bank Manager/Financial Advisor	47
Other Provincial Specialist	37
Packing house or Processor Field Representative	34
Agriculture Canada Staff	22
Independent Consultant	20
Other	8
University or College Staff	7

Note: Based on 100 cases
[a] Refers to a minimum of one phone call

QUESTION 3

Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you visited each person at their office to obtain information relating to a farm matter.

Table 19 lists the level of contact farmers had with the various individuals at their office. The most important change in the ranking of contact frequency as compared with the previous sources, is with the bank manager/financial advisor who ranks the highest in office visits up from fourth place in both of the previous forms of contact. A notable difference can also be seen in the comparison of district agriculturist or horticulturist with provincial specialists. The level of contact between these two categories differs by 50%. This is probably due to the physical accessibility of provincial specialists, as most of them are concentrated in a few offices, while a district agriculturist or horticulturist is located in every district office in the province.

Table 19
Frequency of Office Visits

Information Source	Office Visits[a] (%)
Bank Manager/Financial Advisor	58
Veterinarian	49
Sales Representative	47
District Agriculturist/ Horticulturist	38
Packing house or Processor Field Representative	24
Other Provincial Specialist	18
Agriculture Canada Staff	15
Independent Consultant	11
Other	5
University or College Staff	1

Note: based on 100 cases
[a] Refers to a minimum of one office visit

QUESTION 4

Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you have heard each person make a presentation or speak at a meeting or field day on an agricultural topic.

B.C. Ministry of Agriculture staff lead the way over all other sources in providing information in the workshop or field day format, as shown in Table 20. Well over half of the farmers surveyed attended a workshop or field day. Agriculture Canada staff often serve as guest speakers at these types of meetings. It is interesting to observe that sales representatives rank higher than Agriculture Canada staff. It is expected that the reason for this level of contact is that many companies put on their own demonstrations, field days, or meeting presentations where specific products and services are being marketed.

Table 20
Frequency of Talks at Meetings or Field Days

Information Source	Presentation[a] (%)
Other Provincial Specialist	55
District Agriculturist/ Horticulturist	54
Sales Representative	40
Agriculture Canada Staff	36
Veterinarian	35
University or College Staff	19
Packing house or Processor Field Representative	18
Bank Manager/Financial Advisor	17
Independent Consultant	16
Other	9

[a] Based on 100 cases and refers to a minimum of one presentation

QUESTION 5

Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you have received information from each person by mail, fax, or computer.

Since the selection of farmers for this survey was done through Ministry of Agriculture mailing lists, it should be no surprise that Ministry of Agriculture staff top the list, as shown in Table 21.

Table 21
Frequency of Information Received by Mail, Fax, or Computer

Information Source	Information[a] (%)
District Agriculturist/ Horticulturist	80
Other Provincial Specialist	60
Sales Representative	60
Agriculture Canada Staff	50
Bank Manager/Financial Advisor	43
Veterinarian	31
Packing house or Processor Field Representative	23
Independent Consultant	15
University or College Staff	14
Other	5

Note: based on 100 cases
[a] Refers to a minimum of one piece of information received

To determine which of the previous five types of contact is the most used, all the positive responses can be added for each question. The totals are listed in Table 22 below and are graphically presented in Figure 2.

Figure 2: Frequency of All Forms of Contact

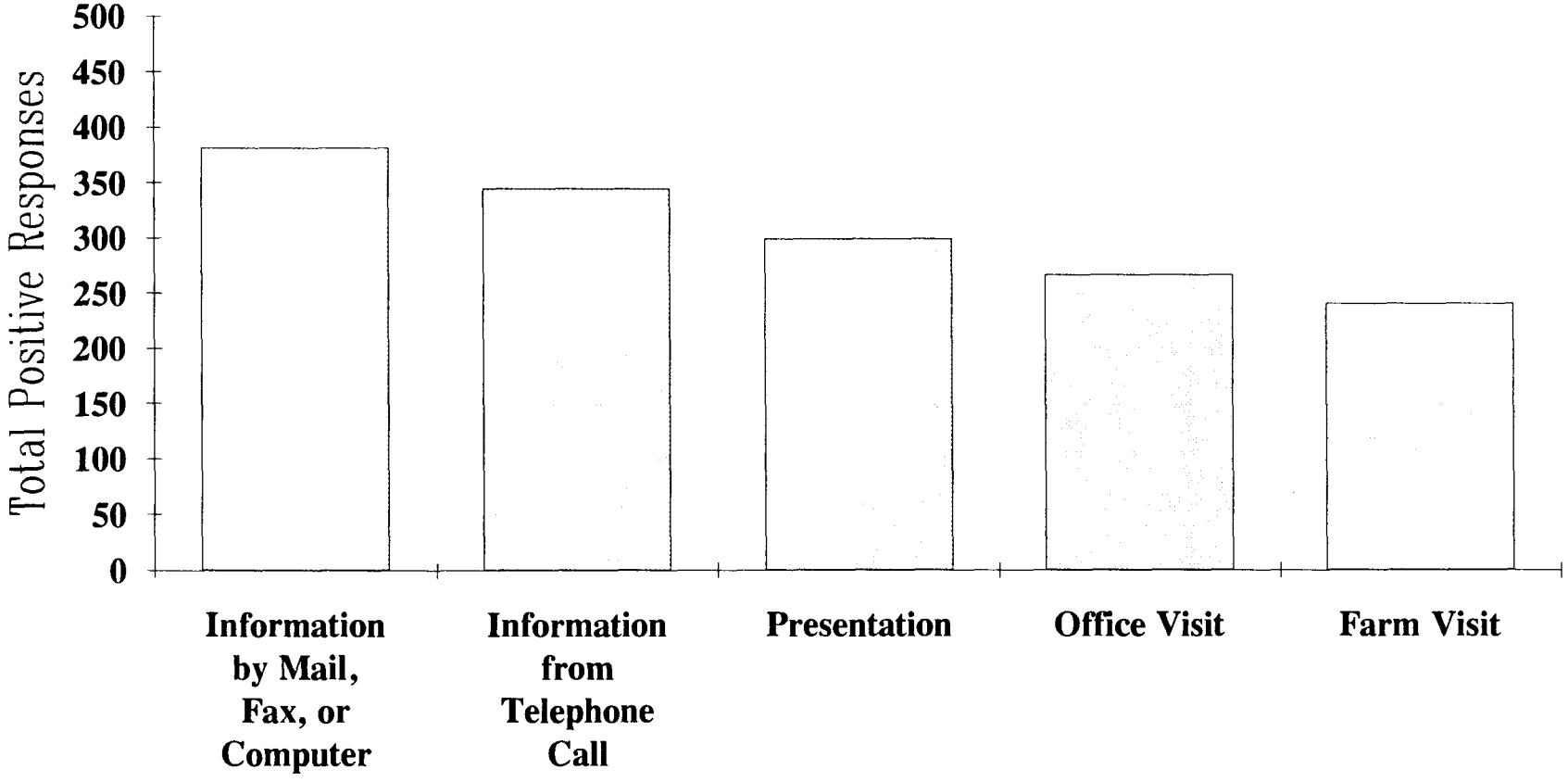


Table 22
Frequency of All Forms of Contact

Type of Contact	Total Positive Responses[a]
Information by Mail, Fax, or Computer	381
Information from Telephone Call	344
Presentation	299
Office Visit	266
Farm Visit	240

[a] Out of possible 500

Looking at the order in which these forms of contact are ranked, it can be seen that the highest number of contacts between farmers and extension providers occur with inexpensive mass distribution methods and decreases as the form of contact becomes more and more personalized. The lowest level of contact is through farm visits, with 48% of the farmers reporting that someone visited them on their farm. The highest level of contact is through mail, fax, or computer, with 76% reporting receiving information.

Tables 23 through 32 list the frequency of contact for each individual information provider by the method of contact. Table 23 below lists the results for the five different forms of contact with district agriculturists and horticulturists.

Most farmers (80%) are receiving information from their district agriculturist or horticulturist by mail as indicated in Table 23. Over half of all farmers are obtaining information in the workshop/meeting format. A quarter to half of the farmers are obtaining information in one-on-one situations, such as phone calls or individual meetings on the farm or at the office.

Table 23
Frequency of Contact with District Agriculturist or Horticulturist

Method of Contact	Yes (%)
Information Sent by Mail, Fax, or Computer	80
Presentations	54
Telephone Calls	47
Office Visits	38
Farm Visits	23

[a] Based on 100 cases and refers to a minimum of one contact/year

Table 24 indicates that the results for the provincial specialists are very similar to that of Table 23 except that the level of contact is about 10 to 20% less. Presentations are the only exception. Evidently, the specialists, as individuals with specific commodity information, are very involved with presentations, although they are not as widely available geographically throughout the province.

Table 24
Frequency of Contact with Other Provincial Specialists

Method of Contact	Yes[a] (%)
Information Sent by Mail, Fax, or Computer	60
Presentations	55
Telephone Calls	37
Farm Visits	25
Office Visits	18

[a] Based on 100 cases and refers to a minimum of one contact/year

British Columbia universities and colleges do not have active extension programs designed to reach out to the farming community. There are linkages between the university and the Ministry of Agriculture which are generally research oriented, such as the various Science Lead Committees. These joint committees between the Ministry and the University of British Columbia identify and publish a list of research priorities. The most common involvement of university staff is to act as an expert

resource for workshops, field days, or meetings. Thus, it is not surprising that this form of contact ranks the highest as shown in Table 25. Given the location of British Columbia's universities in South Coastal B.C., a 19% contact rate during the past year is better than might be expected. It is not clear what information the universities or colleges have sent the 14% of farmers.

Table 25
Frequency of Contact with University or College Staff

Method of Contact	Yes[a] (%)
Presentations	19
Information Sent by Mail, Fax, or Computer	14
Telephone Calls	7
Farm Visits	2
Office Visits	1

[a] Based on 100 cases and refers to a minimum of one contact/year

Much of Agriculture Canada's activities are research and regulatory oriented. Table 26 indicates that Agriculture Canada does make an important contribution in the provision of information to farmers. A comparison can be made between Agriculture Canada staff and British Columbia Ministry of Agriculture specialists, as they both can be considered experts in their respective fields of specialization. The level of contact with Agriculture Canada staff ranges from a low of 12% for farm visits to a high of 50% for information sent by mail, fax, or computer. The level of contact with provincial specialists indicated in Table 24 ranges from a low of 18% for office visits to a high of 60% for information sent by mail, fax, or computer. These levels of contact appear to be quite similar to each other.

Table 26
Frequency of Contact with Agriculture Canada Staff

Method of Contact	Yes[a] (%)
Information Sent by Mail, Fax, or Computer	50
Presentations	36
Telephone Calls	22
Office Visits	15
Farm Visits	12

[a] Based on 100 cases and refers to a minimum of one contact/year

Sales Representatives have the highest overall level of contact with farmers as compared to all the others surveyed. The level of contact shown in Table 27 for each type is quite similar for telephone calls (61%), information sent by mail, fax, or computer (60%),and farm visits (58%). This is consistent with the role of the sales representatives, as they are phoning, visiting, and generally pursuing farmers in order to convince them to purchase their products. In addition, farmers are also active in going to the sales representative's place of business to seek information.

Table 27
Frequency of Contact with Sales Representatives

Method of Contact	Yes[a] (%)
Telephone Calls	61
Information Sent by Mail, Fax, or Computer	60
Farm Visits	58
Office Visits	47
Presentations	40

[a] Based on 100 cases and refers to a minimum of one contact/year

The role of financing in today's agricultural operations is evident from the relatively high level of contact between farmers and their financial advisors or bank managers, as seen in Table 28. These people are more active than one would expect with 25% of the farmers having been visited at their farm.

Table 28
Frequency of Contact with Bank Manager or Financial Advisor

Method of Contact	Yes[a] (%)
Office Visits	58
Telephone Calls	47
Information Sent by Mail, Fax, or Computer	43
Farm Visits	25
Presentations	17

[a] Based on 100 cases and refers to a minimum of one contact/year

Packing house and processor field representatives are individuals who represent the companies purchasing the farmer's crop and provide a variety of services. These individuals typically work for organizations purchasing tree fruit products and certain vegetable crops. When Table 5 was discussed, it was noted that 55.1% of the farmers produced livestock products. Conversely, 44.9% of the farmers are involved with non-livestock crops, such as vegetables, forages, and tree fruits. Interpretation of the level of contact with packing house or processor field representative should be made on this smaller group. Therefore, when looking at Table 29, the level of contact by a packing house or processor field representative should be based on the 44.9% of the farmers not raising livestock crops. Thus, the level of contact for phone calls would then be 75.5% rather than 34%.

Table 29
Frequency of Contact with Packing House or Processor Field Representative

Method of Contact	Yes[a] (%)
Telephone Calls	34
Office Visits	24
Information Sent by Mail, Fax, or Computer	23
Farm Visits	22
Presentations	18

[a] Based on 100 cases and refers to a minimum of one contact/year

Table 30 shows the level of contact reported with veterinarians. Using the logic presented with Table 29, it can be seen that the level of contact with veterinarians is very high. In fact, more people (61%) reported that they obtained information from a veterinarian over the phone than reported having livestock (55.1%). Apparently some farmers who are not livestock producers have some contact with veterinarians. This may result because of inquiries relating to domestic pets.

Table 30
Frequency of Contact with Veterinarian

Method of Contact	Yes[a] (%)
Telephone Calls	61
Farm Visits	52
Office Visits	49
Presentations	35
Information Sent by Mail, Fax, or Computer	31

[a] Based on 100 cases and refers to a minimum of one contact/year

Over the past several years, the British Columbia Ministry of Agriculture has stopped supplying a number of services, such as rangeland seeding, preparation of plans for farm buildings, and irrigation and drainage system design. These functions have been picked up by various consultants or other companies. Independent consultants, shown in Table 31, have the lowest overall level of contact with farmers, with the exception of the miscellaneous category shown next in Table 32.

Table 31
Frequency of Contact with Independent Consultant

Method of Contact	Yes[a] (%)
Telephone Calls	20
Presentations	16
Information Sent by Mail, Fax, or Computer	15
Farm Visits	14
Office Visits	11

[a] Based on 100 cases and refers to a minimum of one contact/year

The miscellaneous category was included in the survey should the previous nine groups used not cover all the possible groups of people offering extension services. A very low level of contact is reported in Table 32, indicating that the other nine categories did represent the groups of extension providers quite well. Respondents were asked to indicate who the 'other' was, but most failed to write anything down. Some of the individuals reported were breed stock company representatives, hatchery sales representatives, the Western Indian Agricultural Corporation, other farmers, cattle buyers, a retired commercial sheep breeder, British Columbia Hydro, Agricultural Research & Development Corporation (ARDCORP) book-keeping program, and Customs and Excise Canada.

Table 32
Frequency of Contact with Other Miscellaneous People

Method of Contact	Yes[a] (%)
Presentations	9
Telephone Calls	8
Farm Visits	5
Office Visits	5
Information Sent by Mail, Fax, or Computer	5

[a] Based on 100 cases and refers to a minimum of one contact/year

Totaling all forms of contact for each group provides the results shown in Table 33 and Figure 3. Sales representatives have the highest overall level of contact, however the district agriculturist or horticulturist is close behind.

Table 33
Total Number of Contacts with all Sources

Nature of Contact	Total Number of All Contacts
Sales Representatives	266
District Agriculturist/ Horticulturist	242
Veterinarian	228
Provincial Specialists	195
Bank Manager or Financial Advisor	190
Agriculture Canada Staff	135
Packing House or Processor Field Representative	121
Independent Consultant	76
University or College Staff	43
Other	32

[a] Out of Possible 500

The rest of the survey (questions 6 through 16, excepting 9(a) and 11) asked the same question regarding the frequency at which the farmer obtained information from a variety of sources. The categories ranged from never to once per day, as can been seen by referring to Appendix 1. The responses are presented in Table 34 and Figure 4, and have been ranked in descending order by lumping all the positive responses to the use of the information sources together into one category, labeled "sometimes".

Figure 3: Total Number of Contacts with All Sources

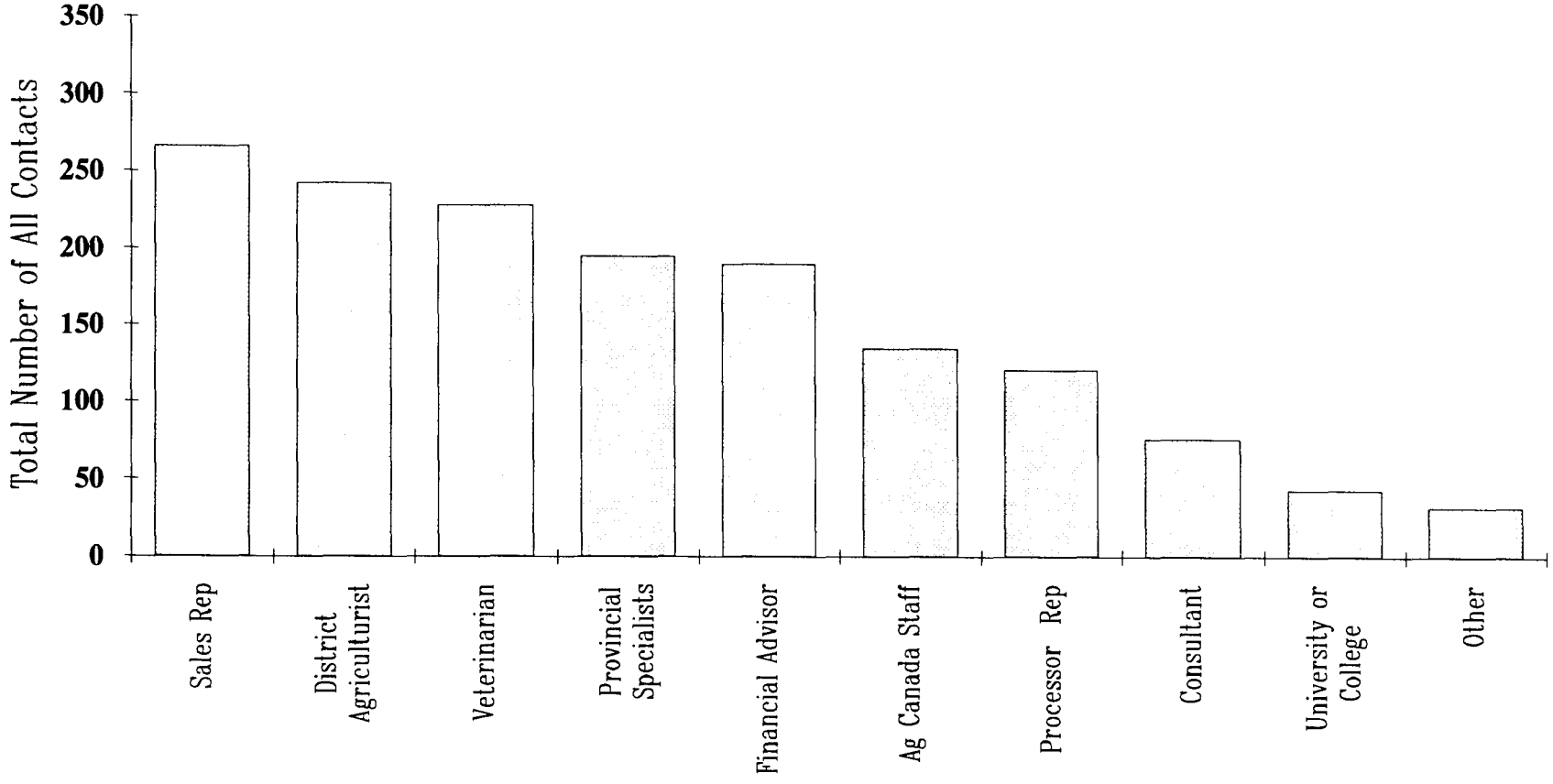


Table 34
Frequency of Information Use

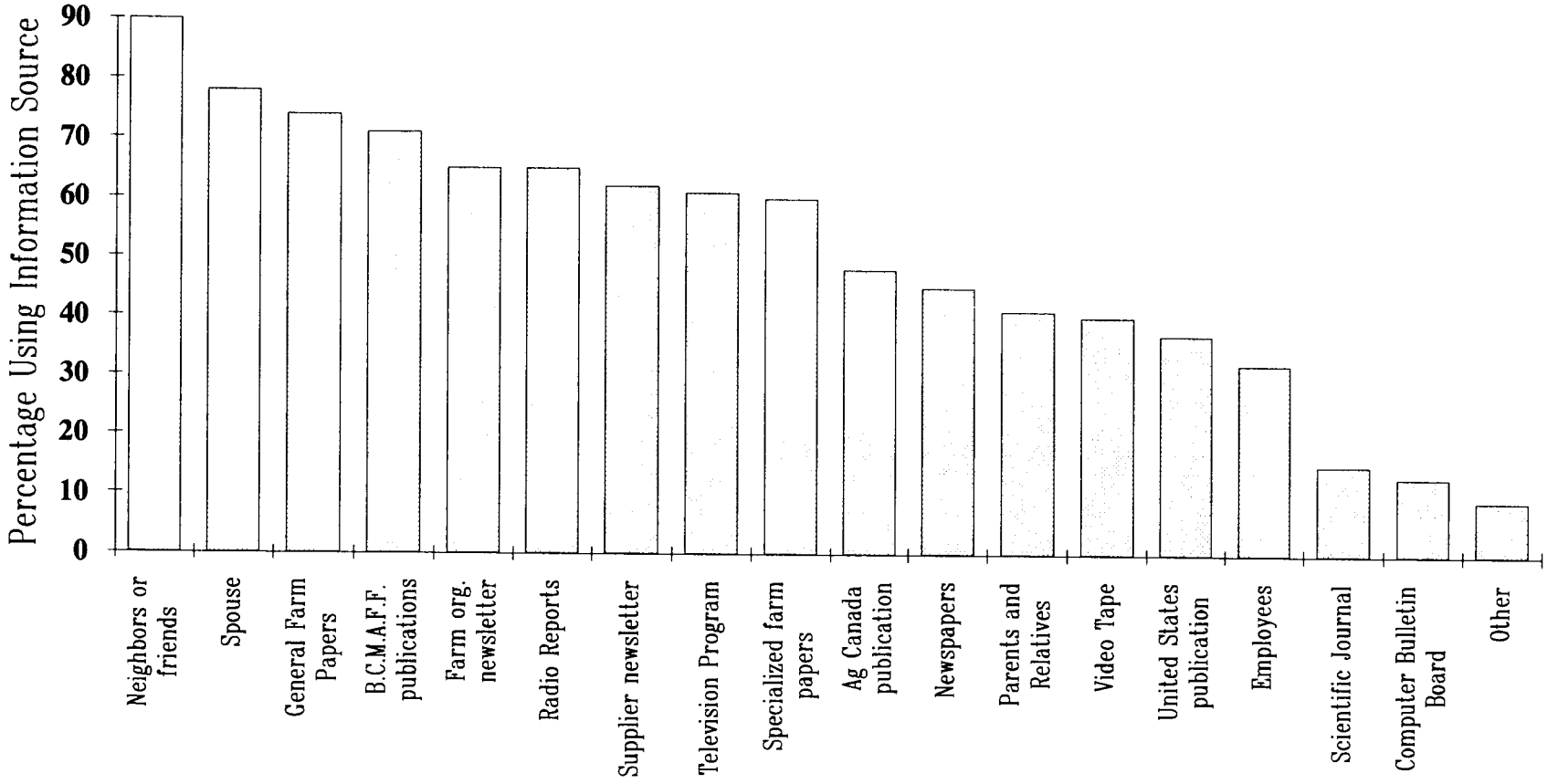
Information Source	Sometimes[a] (%)
Information from neighbors or friends	90
Information from Spouse	78
General Farm Paper or magazines	74
B.C. Ministry of Agriculture publication	71
Newsletter by farm organization	65
Radio Reports	65
Newsletter by commercial supplier	62
Television Program	61
Specialized farm paper or magazine	60
Agriculture Canada publication	48
Provincial or Local Newspaper	45
Information from Parents and Relatives	41
Video Tape	40
United States publication	37
Information from Employees	32
Scientific Journal	15
Computer Bulletin Board	13
Other	9

[a] Refers to a minimum use of once per year

Ninety percent of the farmers surveyed indicated that they had obtained information useful in making a farm management decision from neighbors or friends. The three least used sources of information were the 'Other' category, along with computer bulletin boards and scientific journals.

Farmers were asked in question 9 whether or not they had received information relating to a farm matter from watching a video tape. A total of 40% of the respondents had received information from a video tape at least once during the past year. The tapes were obtained from the sources listed in Table 35 below. As some

Figure 4: Frequency of Information Use



individuals had seen video tapes from more than one source, a frequency count is provided for each box they checked. Of the 40 individuals indicating they had seen a video tape, 39 answered the second part of this question.

Table 35
Source of Video Tapes

Tape Source	Number of Times[a]	Percentage (%)
B.C. Ministry of Agriculture	14	27.5
Commercial Supplier	18	35.3
University or College	2	3.9
Agriculture Canada	4	7.8
Other	13	25.5
Total	51	100.0

[a] Based on 39 of the 40 users reporting

Question 11 asked farmers if they had taken any courses in agriculture or farm business management during the past 12 months. Fifteen farmers indicated that they had taken a such a course.

Question 16 asked farmers if they had obtained information about a farm matter while visiting any of a list of places. Table 36 indicates that 81% of farmers had found information useful to them while visiting another farm. This is shown quite dramatically in Figure 5.

Table 36
Visits to Various Sites

Location	Percentage of Visits (%)
Another Farm	81
Agriculture Canada Experimental Station	19
B.C. Ministry of Agriculture Demonstration Site	23
Travel to a Foreign Country	23
Other	3
None of the Above	11

a based on 100 cases

Value of Various Sources of Information

Question 17 of the questionnaire asked the following:

We would like your opinion on the value of all the information sources that are available to you, whether or not you have used them in the past 12 months. Please put a check mark in the box to the right of each information source that best indicates how valuable you feel each source is. If you are not familiar with the source, having never used it before, please check "DOES NOT APPLY".

In addition to "Does Not Apply", five other categories were available for choice. These were: "Of No Value"; Of Little Value"; "Undecided"; "Valuable"; "Highly Valuable". There were 32 different information sources to be rated. The results of this are presented in Table 37. To enable the interpretation of all the various scores, a weighted average is used to reduce the choices down to a single value which could be compared against other values. Table 37 and Figure 6 rank all the information sources in descending order of the weighted average value that farmers placed on each source. The weighted average is calculated by assigning a value of 1 to

Figure 5: Visits to Various Sites

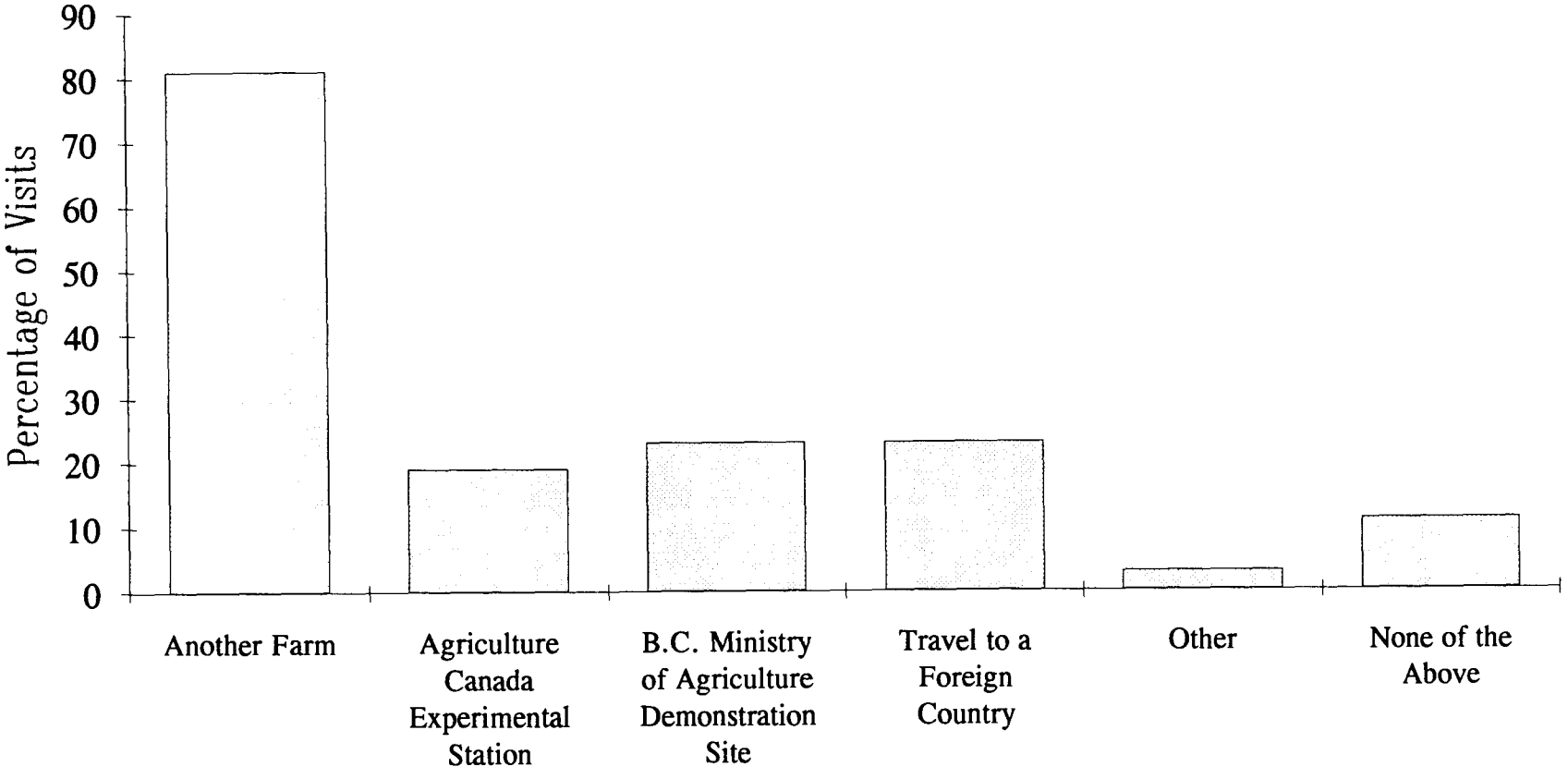
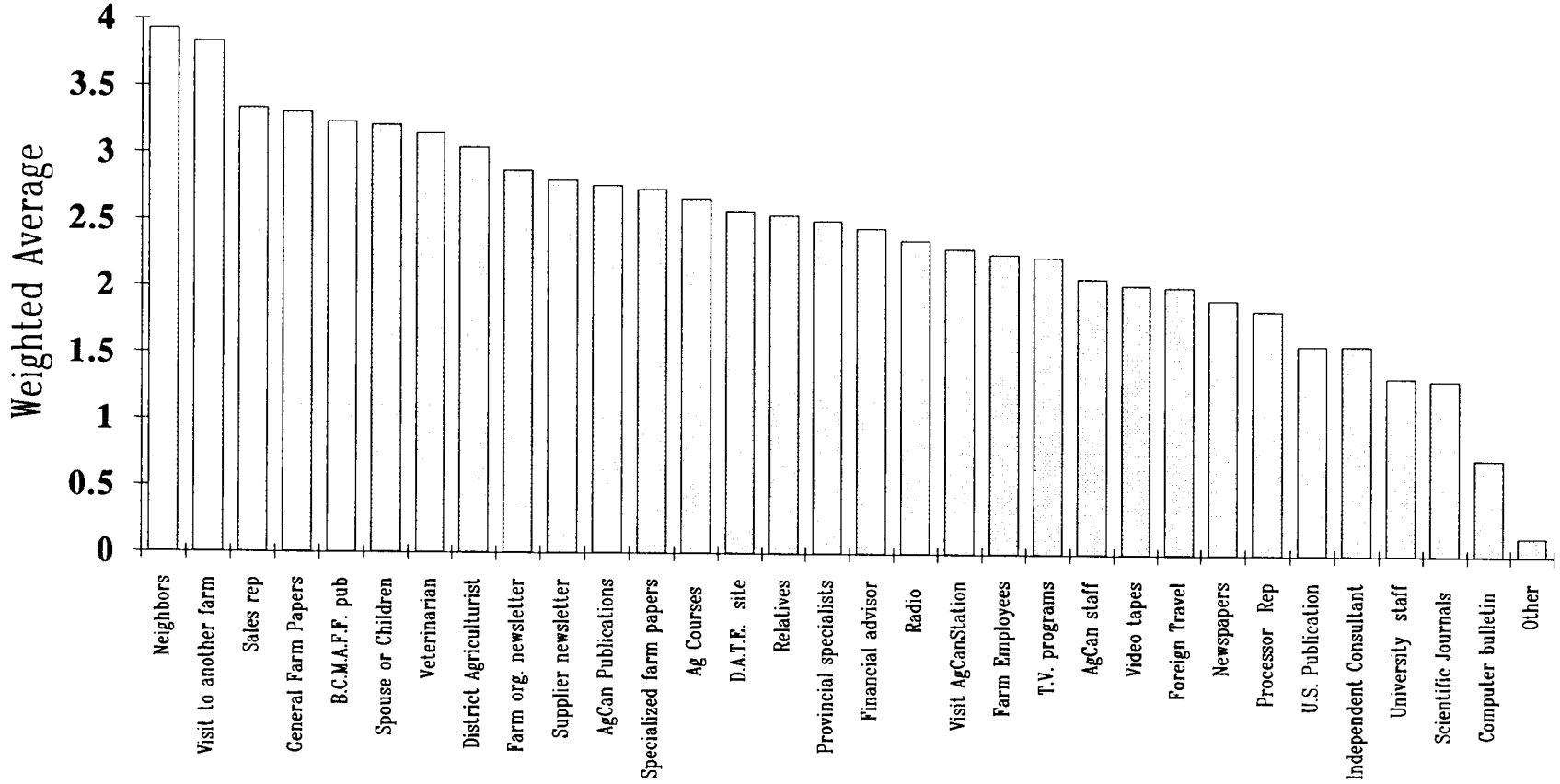


Table 37
Value by Rank of All Information Sources

Information Source	Weighted Average
Neighbors, friends, other farmers	3.93
Visit to another farm	3.83
Sales representative (feed, fertilizer, equipment, etc.)	3.33
General farm papers or magazines (Country Life, B.C. Farmer, etc.)	3.30
B.C. Ministry of Agriculture publications	3.23
Spouse or Children	3.21
Veterinarian	3.15
District Agriculturist or Horticulturist	3.04
Newsletter published by farm organization (B.C. Blueberry Co-op, B.C. Cattleman's Association, etc.)	2.87
Newsletter published by commercial supplier (feed, fertilizer, equipment, etc.)	2.80
Agriculture Canada Publications	2.76
Specialized farm papers or magazines (Greenhouse Manager, B.C. Dairy Digest, etc.)	2.73
Courses on agriculture	2.66
Visit to a B.C. Ministry of Agriculture demonstration site	2.57
Relatives, including parents	2.54
Other Provincial government specialists	2.50
Bank Manager or financial advisor	2.44
Radio programs or announcements	2.35
Visit to Agriculture Canada Experimental Station	2.29
Farm Employees	2.25
Television programs	2.23
Agriculture Canada staff	2.07
Video tapes	2.02
Foreign Travel	2.01
Provincial or local newspapers (Vancouver Sun, Similkameen Spotlight, etc..)	1.91
Packing house or processor field representative	1.83
Publication from a United States government or university source	1.57
Independent Consultant	1.57
University or college staff	1.33
Scientific Journals (Journal of Plant Science, etc.)	1.31
Computerized bulletin board	0.72
Other	0.14

the response "Of No Value", a 2 to "Of Little Value", and so on, finishing with a 5 for "Highly Valuable". The percentage of responses in each column is multiplied as its

Figure 6: Value by Rank of All Information Sources



decimal value times the value assigned to that column. The sum of the six calculations is summed resulting in a single value.

Neighbors and friends ranked as the most valued source of information followed closely by visits to other farms and sales representatives. The category 'Other' ranked last along with computerized bulletin boards and scientific journals. Comparison of the sources farmers value corresponds closely to the acutual sources they use. Visits to other farms ranked as the second most valuable source and 81% of farmers reported that they obtained information during a farm visit. Comparison of Table 33 with Table 37 shows that of the individuals who are formal extension providers, sales representatives rank the highest. Frequency of use of publications and that of extension providers all parallel in ranking that reported in the value of the sources. On the basis of the ranking procedures used, there are no sources of information that farmers report as being of value that they are not using to the same extent. It can be generally concluded that if a farmer uses as source of information it is because he values it, not because he has no other alternative.

This chapter concludes the presentation of the questionnaire results. The following section will analyze the results to determine what significance they have.

CHAPTER 5

ANALYSIS AND DISCUSSION

The previous chapter reported on the types of information sources farmers are currently using and the sources they value. The following sections of chapter five will attempt to determine and analyze any trends that exist in why certain groups do or do not use certain kinds of information sources. The first section will utilize correlation methods to determine if the use of certain information sources can be predicted by demographic characteristics. Section two will use the techniques of hypothesis testing to determine if there are any significant differences in the demographic characteristics of those who do and do not use British Columbia government extension services. Finally, section three will compare the level of contact between district agriculturists and horticulturists in 1969 and 1991 to see if there have been any changes.

Demographic Characteristics and Information Use

The second objective of the thesis was to determine if the use of different information sources can be correlated to demographic characteristics. There are a number of techniques available.

The simplest method of determining relationships between sets of data is with the Pearson correlation coefficient, abbreviated as "r". This coefficient is a measurement of how linear two variables are when plotted against each other on an x-y axis. Studies such as Dent (1968), Alleyne (1968), and Akinbode (1969), based much of their analysis on the use of Pearson partial correlation coefficients. The Pearson

correlation method has a number of limitations. Partial correlation coefficients provide only limited information as each factor can only be looked at in isolation with another factor, making it difficult to draw generalized conclusions. Frequently more than one factor is responsible for the behavior of a particular item of interest. Many variables such as age or number of years as a farmer are highly correlated with each other. It can be difficult to make interpretations when the relationships between the predictor variables are unknown.

The use of a large data set will result in a large number of correlations. This makes it difficult to provide any meaningful interpretation. The previously mentioned studies reported on every statistically significant correlation they found. As such, these reports contained a number of comments about correlations such as the relationship between a farmer's age and the number of children he or she had. This information is not very useful in understanding a farmer's use of information sources.

Pearson correlations were calculated between the frequency of use of each information source and the demographic data. A total of 292 correlation coefficients were found to be significant at the 95% confidence level. These coefficients are not presented, as techniques providing more meaningful results were available.

Multiple correlation methods provide a better look at the interaction between questionnaire results and demographic data. The terms "independent variables" will be used for frequency and values of information sources, and "dependent variables" for the demographic data, in order to simplify the discussion, however none of the variables are truely dependent or independent of the others. When multiple correlation techniques are used, the ability to make predictions is improved. This occurs because the use of a number of different variables, i.e. demographic, for the prediction of

another, i.e. use of newspapers, uses the different dimensions of each variable, such as age, income, etc., to better predict the use of an information source. A multiple correlation coefficient will never be less than the highest correlation between just two of the values. For example, if the reason a farmer refers to an Agriculture Canada publication is related to his age and farm size, the inclusion of farm size to the correlation coefficient of age, will increase its value as the two combined better predicts the use of the publication than either one by itself.

The one drawback with some multiple correlation methods is that they do not take into account the effect that internal correlations have on the outcome of multiple correlation coefficients. What is the effect on the correlation coefficient in the above example if age and farm size have some relationship of their own? For this reason, Canonical Analysis was chosen as the "multiple correlation" method to use. Canonical Analysis is a multivariate technique which analyzes and takes into account the correlations that exist within the dependent and independent variables. The technique also contains a number of checks to ensure the data is suitable for this type of analysis.

Canonical Analysis is not available on personal computers due to the size and complexity of the software program. In addition, the number of mathematical calculations required to conduct the analysis would mean that a personal computer would involve significant processing times . Canonical Analysis is available on the University of British Columbia mainframe computer system, through a statistical package known as BMDP6M. The survey data which had been summarized in SPSS/PC+ format was transferred onto the mainframe computer, and proved to be usable without any major alterations.

Canonical correlation analysis is a full statistical analysis package. In addition to producing canonical variates, a number of statistical values are calculated including kurtosis, skewness, standardized scores, multicollinearity, and F-values. The purpose of calculating these values is to allow the data to be evaluated for its suitability for canonical analysis and to ensure that no assumptions fundamental to the mathematics are violated. An example of how the data is interpreted is provided in Appendix 2.

Application of the canonical analysis procedure to the questionnaire data was done by breaking the survey up into eight sections. This allowed the analysis to be performed on sets of data that formed complete units. These units are:

1. Frequency of obtaining information from farm visits
2. Frequency of obtaining information from phone calls
3. Frequency of obtaining information from visits to their office
4. Frequency of obtaining information from presentations or talks at meetings and field days
5. Frequency of receiving information by mail, fax, or computer
6. Frequency of obtaining information from the use of publications
7. Frequency of finding information from a number of miscellaneous sources
8. Opinions held on the value of various possible sources of information

A total of 13 different questions were asked concerning demographic data about the respondents. Only eleven were used for the canonical correlation analysis. Question #28 regarding farm size, proved to be too difficult to summarize in consistent quantifiable terms. Question #24 asked about membership in various farm organizations. This was excluded for two reasons. Canonical analysis does not work properly if data are missing. Only 88 individuals responded to this question out of the

100 questionnaires returned. The second reason, as outlined earlier, was that it was apparent that people did not fully understand the question.

Table 38 provides a guide for assessing the significance of canonical correlation scores. "As a rule, "loadings" in excess of 0.30 are eligible for interpretation, whereas lower ones are not. A correlation of 0.30 indicates that there is a 9% overlap in the variance between the variable being examined and the demographic factor responsible. Choice of the cutoff of size of loading to be interpreted is a matter of researcher preference" (Tabachnick & Fidell, 1983, p.411).

Table 38
Interpretation of Canonical Statistics

Canonical Correlation Loadings	Variance	Magnitude of Variance
0.71	50%	Excellent
0.63	40%	Very Good
0.55	30%	Good
0.45	20%	Fair
0.32	10%	Poor

Extension Providers

Questions one through five in the survey asked farmers about the frequency with which they obtained information from a list of 10 different groups or types of people in the business of providing extension information. Each one of the five questions asked about a different type of contact with these people. Since this set of questions was asked in a similar format, the results and interpretation are done together. As mentioned previously, a separate analysis was conducted on each data set.

Because of the amount of information generated from this analysis and the difficulty in presenting the information, the following procedure is used. The symbols used to report the results of the analysis are presented in Tables 39 and 40. Table 39 lists the independent variables used for canonical analysis.

Table 39
Independent Variables Used for Canonical Analysis

Symbol	Independent Variable	Symbol	Independent Variable
Y1	District Agriculturist or Horticulturist	Y6	Bank manager or financial advisor
Y2	Other provincial agricultural specialist	Y7	Packing house or processor field rep.
Y3	University or College staff	Y8	Veterinarian
Y4	Agriculture Canada staff	Y9	Independent Consultant
Y5	Sales rep (feed, fertilizer, etc..)	Y10	Other

Table 40 lists the dependent variables used. These symbols are used for all of the individual canonical analyses used.

Table 40
Dependent Variables for Canonical Analysis

Symbol	Dependent Variable
X1	Age
X2	Sex
X3	Marital status
X4	Mother tongue
X5	Number of children
X6	Highest level of Education
X7	Years on current farm
X8	Years as a farmer
X9	Income earned off-farm
X10	Total farm sales
X11	Farm type

Table 41 reports the results of the canonical correlations for the five forms of contact.

Table 41
Canonical Correlation Results - Forms of Contact by Individuals

Nature of Contact	Significant Pairs	Correlation	Variance	Y Values[a]	Demographic Values[b]
Farm Visits	one	0.750	0.562	Y1=0.538 Y2=0.470 Y5=0.881 Y6=0.629	X9=-0.505 X10=0.822
Phone Calls	one	0.694	0.482	Y2=0.585 Y4=0.574 Y5=0.775 Y6=0.747	X1=0.491 X10=0.798
Office Visits	one	0.691	0.477	Y5=0.665 Y6=0.844	X9=-0.456 X10=0.891
Field Days	none	none	none	none	none
Mail, Fax, Computer	one	0.710	0.505	Y3=0.480 Y5=0.901 Y6=0.633	X1=-0.614 X10=0.802

[a] Refer to Table 39
[b] Refer to Table 40

Table 41 is interpreted in the following manner. Column two reports the number of statistically significant pairs of canonical variates that exist between each form of contact with the farmer and the demographic data. The statistically significant pair of canonical variates are values, one which represents all the different types of people who may have contacted the farmer, i.e. all the "x" values, and the second part that represents all of the demographic variables, i.e. all the "y" values. More than one pair of canonical variates can exist if there is more than one statistically significant link between the data. For example a significant link may be found between sales representatives and a combination of farm size and the farmer's age, while a second significant link may be found between the number of children a farmer has and Agriculture Canada and university staff.

The first form of contact "farm visits" shown in Table 41 is interpreted in the following manner. Only one statistically significant link was found between the individuals who visited a farmer and the farmer's demographic characteristics. This link is expressed by a pair of canonical variates. This pair has a correlation coefficient of 0.75. The variance (56.2%) is the square of the correlation coefficient. This coefficient suggests that there is a strong correlation between how often certain people visited a farm and certain demographic characteristics of the farmer. The Y-values and X-values are the individual components of that correlation that significantly contributed to the linkage. The percentage given for each one is a measure of how strongly each of the original variables is correlated to the canonical variate. Thus, the District Agriculturist/Horticulturist, provincial specialists, sales representatives, and bank managers are the original independent variables that are strongly correlated to the "x" part of the pair of canonical variates, while farm sales and income earned off-farm are the demographic variables that are strongly correlated to the other half of the pair of canonical variates. The interpretation of these statistics would be that district agriculturists/horticulturists, provincial specialists, sales representatives, and bank managers pay more farm visits to farmers with higher farm sales. In addition, because income earned off-farm is a negative correlation, their farm visits decrease as off-farm income rises.

The remaining four types of contact can now be easily interpreted. Phone calls from farmers show similar results. The provincial specialists, Agriculture Canada staff, sales representatives, and bank managers tend have increased contact with the farmer as the size of farm sales increases. Also correlated, but to a lessor extent, is that this contact increases with the farmer's age.

A correlation for office visits only exists for sales representatives and bank managers. The level of contact with the farmer through an office visit increases with farm size and decreases as off-farm income increases.

No correlations were obtained by presentations and talks by individuals at field days and workshops. This can be interpreted positively as it says that farmers of all demographic characteristics are obtaining information equally from the field day or meeting method.

Information received by mail, fax, or computer is significantly correlated to university or college staff, sales representatives, and bank managers. The amount of information received from these individuals increases with farm sales and decreases with increasing age.

The results of these five categories indicate that sales representatives, bank managers, and, to a lesser extent, provincial government extension staff, have more contact with farmers with larger farms as indicated by their farm sales. The magnitude of the canonical correlations indicate that this conclusion is quite strong. In the cases where off-farm income was significant, increases in off-farm income had a negative effect on the amount of information farmers received. The affect of the farmer's age had a positive correlation in one case, and a negative one in another. It could be concluded that the older the farmers were, the more likely they were to phone someone for information while the younger farmers were more likely than the older farmers to get information by mail, fax, or computer.

Comparing this information with that in Tables 17 through 21, it can be seen that sales representatives, veterinarians, provincial specialists, district agriculturists and

horticulturists, and bank managers have the most frequent contacts with farmers as compared to the other five individuals listed. Through canonical analysis, all of these individuals tend to favor the bigger farmer except the veterinarian. There are no correlations between the frequency at which information is obtained from a veterinarian and the farm size. As discovered earlier, virtually every farmer with livestock had obtained information from a veterinarian during the past year.

Publications

Farmers were asked to indicate how often, on average, during the past 12 months, they received information useful in making a farm management decision from each publication. Canonical analysis found the results shown in Table 42.

Table 42
Canonical Correlation Results - Use of Publications

Nature of Contact	Significant Pairs	Correlation	Variance	Y Values[a]	Demographic Values[b]
Publications	one	0.658	0.433	Y7[a]=0.781	X10[b]=0.723

[a] Y7 = Newsletter or magazine from a commercial supplier
[b] X10 = Total farm sales

Canonical correlation of different publications with the demographic characteristics of farmers indicates only one significant pair of canonical variates. Variables highly correlated with the pair of canonical variates are newsletters and magazines from commercial suppliers and farm sales. The canonical correlation coefficient and the correlation of the individual values with the canonical variate are all

quite strong. This indicates that the use of newsletters and magazines from a commercial supplier increase as the value of farm sales increases.

Miscellaneous Sources

Canonical analysis of all the remaining sources of information is shown in Table 43.

Table 43
Canonical Correlation Results - Use of Miscellaneous Sources

Nature of Contact	Significant pairs	Correlation	Variance	Y Values	Demographic
Various methods	two	0.665	0.442	$Y5^a = 0.891$	$X10^b = 0.757$
		0.663	0.440	$Y7^c = 0.834$	$X1^d = -0.732$

a Y5 = Farm employees
b X10 = Total Farm Sales
c Y7 = Parents or relatives
d X1 = Age

Two sets of canonical variates were discovered in this category. The larger the farm in terms of farm sales, the more they utilized their employees for making farm management decisions. In addition, the older the farmers, the less they obtained information from parents or relatives. Given that the mean age of farmers in this survey was 49.5 years, these farmer's parents may not be available for consultation.

Value of Information Sources

Farmers were asked to give their opinion on the value of different sources of information, whether or not they had used those sources during the past twelve months. Since demographic data had been collected in the survey, it is possible to use the canonical analysis procedure on this information to see if there are any connections between the opinions people have and their demographic characteristics. Table 44 presents the results of the canonical analysis.

Table 44 Canonical Correlation Results - Value of Information Sources

Nature of Contact	Number of links	Correlation	Variance	Y Values	Demographic
Value of different sources	two	0.847	0.718	Y6[a]=0.625 Y10[b] = 0.520 Y19[c] = 0.599	X10[e]=0.745 X1[f]=-0.448
		0.798	0.636	Y11[d] = 0.507	X1=-0.432

[a] Y6 = Sales Representative
[b] Y10 = Relatives including parents
[c] Y11 = Farm employees
[d] Y19 = Newsletter from commercial supplier
[e] X10 = Total Farm Sales
[f] X1 = Age

Two significant linkages were observed between demographic characteristics and the farmers' opinions of different sources of information. In the first link, sales representatives, relatives, and newsletters from commercial suppliers were the information sources strongly correlated to the significant canonical variate. Farm sales was the most significant demographic characteristic while age was also moderately correlated. These correlations suggest that as the magnitude of farm sales increases, the more the farmer values information obtained from sales people, relatives, and newsletters from commercial suppliers more. The negative correlation for age indicates

that the value farmers place on the previous three groups of people decreases as the age of the farmer increases.

The second canonical linkage is quite strong as well. However, demographic variables correlating with the canonical variate are not as strong as in the first link. This linkage suggests that older farmers value farm employees less than younger farmers.

British Columbia Government Extension Users

Objective #3 of this project was to determine if there were any significant differences in the demographic characteristics of farmers who use B.C. Ministry of Agriculture Extension services and those who do not. Questions asked in the survey about use of government extension services were:

1. Was the farmer visited by a district agriculturist or horticulturist?
2. Was the farmer visited by some other provincial agricultural specialist?
3. Did the farmer obtain information from a district agriculturist or horticulturist by telephone?
4. Did the farmer obtain information from a provincial agricultural specialist by telephone?
5. Did the farmer obtain information from a district agriculturist or horticulturist by visiting at his/her office?
6. Did the farmer obtain information from a provincial agricultural specialist by visiting at his/her office?

7. Did the farmer obtain information from a district agriculturist or horticulturist from a presentation made at a meeting or field day?
8. Did the farmer obtain information from a provincial agricultural specialist from a presentation made at a meeting or field day?
9. Did the farmer obtain information from a district agriculturist or horticulturist by mail, fax, or computer.
10. Did the farmer obtain information from a provincial agricultural specialist by mail, fax, or computer.
11. Did the farmer obtain information from a B.C. Ministry of Agriculture publication?
12. Did the farmer obtain information while visiting a B.C. Ministry of Agriculture demonstration site?

Summarizing the data will result in two groups of farmers. Those who have used B.C. Ministry of Agriculture extension services and those who have not. Within each group, there will be an average value for the farmers' age, income, number of children, et cetera. As it is not likely that each average value or mean is exactly the same, it must be determined through statistical testing whether the differences in the means is due to the natural variability of the sample, or because each group of farmers is different from another. The procedure for determining this is known as hypothesis testing.

The null hypothesis states that farmers who use government extension services have the same characteristics as those who do not. Testing the hypothesis is done by use of the z-test or the t-test. Since the actual standard deviation of population means for various demographic characteristics is not known, the t-test must be used. The z-test assumes that the population standard deviation is known and that the population

distribution is normal. The *t*-test uses an estimate for the standard deviation of the total population.

The *t*-test analysis consisted of the comparison of 11 selected demographic variables, as outlined in the discussion associated with Table 40, against 12 forms of contact with the British Columbia Ministry of Agriculture. The *t*-test analysis compares the mean demographic values for the user and non-user group and determines the probability that their differences is just due to random variations. Since the differences in the means is due to the variation of each of the individual values averaged, it is necessary to compare the variance of each group as the *t*-test assumes that there is equality of variance. This assumption is reasonable since the two groups are sampled from the same population and should only have differences due to random variations. SPSS/PC+ provides two set of results from the *t*-test analysis: one is the probability of there being no difference between the mean demographic values if the variances are the same, and the other if the variance is not. The F-value, gives the ratio of the variance of each group. Selection of the correct set of results depends on the magnitude of the F-value. The closer this value is to one, the more similar the variances are. SPSS/PC+ also calculates the probability of observing an F-value of at least that size if the variances are equal. From the 132 t-test calculations, the following list, shown in Table 47, was selected for further examination on the basis of probabilities that fell within the 90% level of confidence. The 90% level has been selected in this case to identify any trends that may lie just outside of the 95% level of confidence.

Table 45
Results of *t*-test Analysis

Form of Contact	Demographic Statistic	F-Value	F-Value Probability	Pooled Variance Probability	Separate Variance Probability	Level of Significance Hypothesis Rejected
1. Visit by District Agriculturist	Sales	1.27	0.459	0.034	0.051	94.9%
	Education	1.41	0.274	0.065	0.099	90.1%
2. Visit by Other Provincial Specialist	Age	1.53	0.246	0.070	0.047	95.3%
	Education	1.63	0.178	0.115	0.078	92.2%
3. Phone Call from District Agriculturist	Marital Status	12.39	0.000	0.053	0.045	95.5%
	Education	1.26	0.417	0.064	0.066	93.4%
4. Phone Call from Other Provincial Specialist	Children	1.79	0.395	0.049	0.034	96.3%
	Education	1.3	0.061	0.002	0.002	99.8%
5. Office Visits to District Agriculturist	Education	1.48	0.176	0.035	0.045	99.5%
	Off-farm Income	1.03	0.927	0.015	0.015	98.5%
6. Office Visits to Provincial Specialist	Years as a Farmer	1.72	0.223	0.072	0.038	96.2%
	Education	1.07	0.930	0.071	0.074	92.6%
7. Presentation by Provincial Specialist	Sales	1.44	0.245	0.008	0.007	99.3%
	Education	1.97	0.018	0.090	0.099	90.1%
8. Mail from District Agriculturist	Marital Status	6.13	0.000	0.007	0.106	89.4%
	Years on current farm	2.41	0.033	0.093	0.034	96.6%
9. Mail from Provincial Specialist	Years as a Farmer	1.13	0.661	0.008	0.092	90.8%

Selection of the appropriate *t*-test probability is based on the magnitude of the F-value and its probability of being the same as that shown if the variances are equal.

The criterion of the F-value being close to 1.0 and a probability of 95% that it will be close to that value is used to determine if the variance is to be considered as "pooled" or "separate". "In general, it's a good idea to use the separate variance *t*-test whenever you suspect that the variances are unequal" (Norusis, 1988, p.211). This will then determine which of the above statistical values will be considered statistically significant. Examination of the data presented in Table 45 indicates that the separate variance probability should be used for all cases. The final column of Table 45 indicates the level of significance that the hypothesis, that there is no difference, can be rejected.

Table 46 lists in more detail the forms of contact and details of the demographics that meet the 95% confidence level criterion. Six different types of contact by extension individuals showed statistically significant differences in certain demographic characteristics. A statistical difference was shown for marital status in Table 45, however because the choices of martial status given on the questionnaire do not represent a progressive scale, such as sales, the mean values of marital status cannot be interpreted.

Table 46
Significant Demographic *t*-test Probabilities at 95%

Type of Contact	Demographic Statistic	Mean Values Non-User	User	Level of Significance
Visit by Other Provincial Specialist	Age	50.6 years	45.9 years	95.3%
Phone Call from Other Provincial Specialist	Children	2.92	2.32	96.6%
	Education	Nine to Eleven years	Minimum of High School with some college	99.8%
Office Visits to District Agriculturist or Horticulturist	Education	Nine to Eleven Years	Minimum of High School with some college	95.5%
	Off-farm Income	$8,150	$21,100	98.5%
Office Visits to Provincial Specialist	Years as a Farmer	23.4 years	17.0 years	96.2%
Presentation by Provincial Specialist	Sales	$56,799	$97,199	99.3%
Mail from District Agriculturist or Horticulturist	Years on current farm	14.0 years	20.4 years	96.6%

The t-test procedure calculated mean values for each of the demographic characteristics based on how they were categorized, as shown in Tables 6 through 16. These mean numerical values were then converted to the actual characteristics that they represented. For example, the mean values of farm sales for presentations made by the provincial specialist was 3.84 and 5.86. These values correspond to a range of farm sales. Category 3 referred to farm sales between $40,000 and $59,999 while category

5 referred to the range $80,000 to $99,999. The value for each group was taken by calculating the point indicated by the fractional part of the mean value.

Farmers visited by provincial specialists are on average 4.7 years younger than those they do not visit. Those who phoned provincial specialists for information and visited the district agriculturist at the office have a more education than the group that does not. In addition, those who are phoning the provincial specialists have fewer children. Those who visited the district agriculturist or horticulturist at their office earn more than double the amount of off-farm income than those who did not. Farmers visiting the provincial specialist at their office have been farming 5.4 years less than those who do not. Farmers attending presentations by provincial specialists also have close to double the amount of farm sales. Farmers receiving information by mail, fax, or computer have been on the same farm for an average of 20 years while those that did not receive such information have been on their farm for an average of 14 years. It is not certain what the significance of this is, hopefully this does not mean that it takes 20 years to get onto the ministry's mailing list!

While education was only present in two of the forms of contact at the 95% level of significance, it showed up in seven of the groups shown in Table 45 at the 90% level of significance. This clearly indicates a trend that farmers making contact with the Ministry of Agriculture, have higher levels of education than those who do not.

Extension Contacts: 1991 Compared with 1969

The fourth objective of the thesis project was to determine if the level of contact between district agriculturists and horticulturists and farmers had changed over time.

The only published information about previous levels of contact on a provincial basis dates back to the 1967 Agricultural Regional Development Agreement (ARDA) socio-economic research project conducted by Dr. Coolie Verner and reported in Akinbode (1969). This was based on personal interviews conducted with 256 farmers throughout British Columbia during the summer of 1967. Alleyne (1968) conducted similar research but only on farmers in the Lower Fraser Valley.

The survey used for this thesis project was designed to ask similar questions about levels of different types of contact with district agriculturists and horticulturists, as was done by Verner in 1967. The questions in 1967 read as follows (Verner, 1967):

1. Have you visited your District Agriculturist in his office during the past year?
2.Have you consulted your District Agriculturist about a farm matter over the telephone during the past year?
3. Did your District Agriculturist visit you during the past year about a farm matter?
4. Have you attended local meetings or field days sponsored by the District Agriculturist during the past year?

The only other difference in the wording was that the 1991 questionnaire considered the District Horticulturist to be the same type of contact as the District Agriculturist.

The levels of contact as reported by Akinbode (1969) and Alleyne (1968) can then be compared with the results of 1991, as presented in Table 47 and Figure 7.

Table 47
Extension Contacts 1969 vs. 1991

	Level of Contact[a]		
	Alleyne (1968)	Akinbode (1969)	1991
Visits to Office	43%	35%	38%
Telephone Calls	63%	17%	47%
Visits to Farm	56%	16%	23%
Attendance at Meetings	-	34%	54%
Average	54%	26%	41%

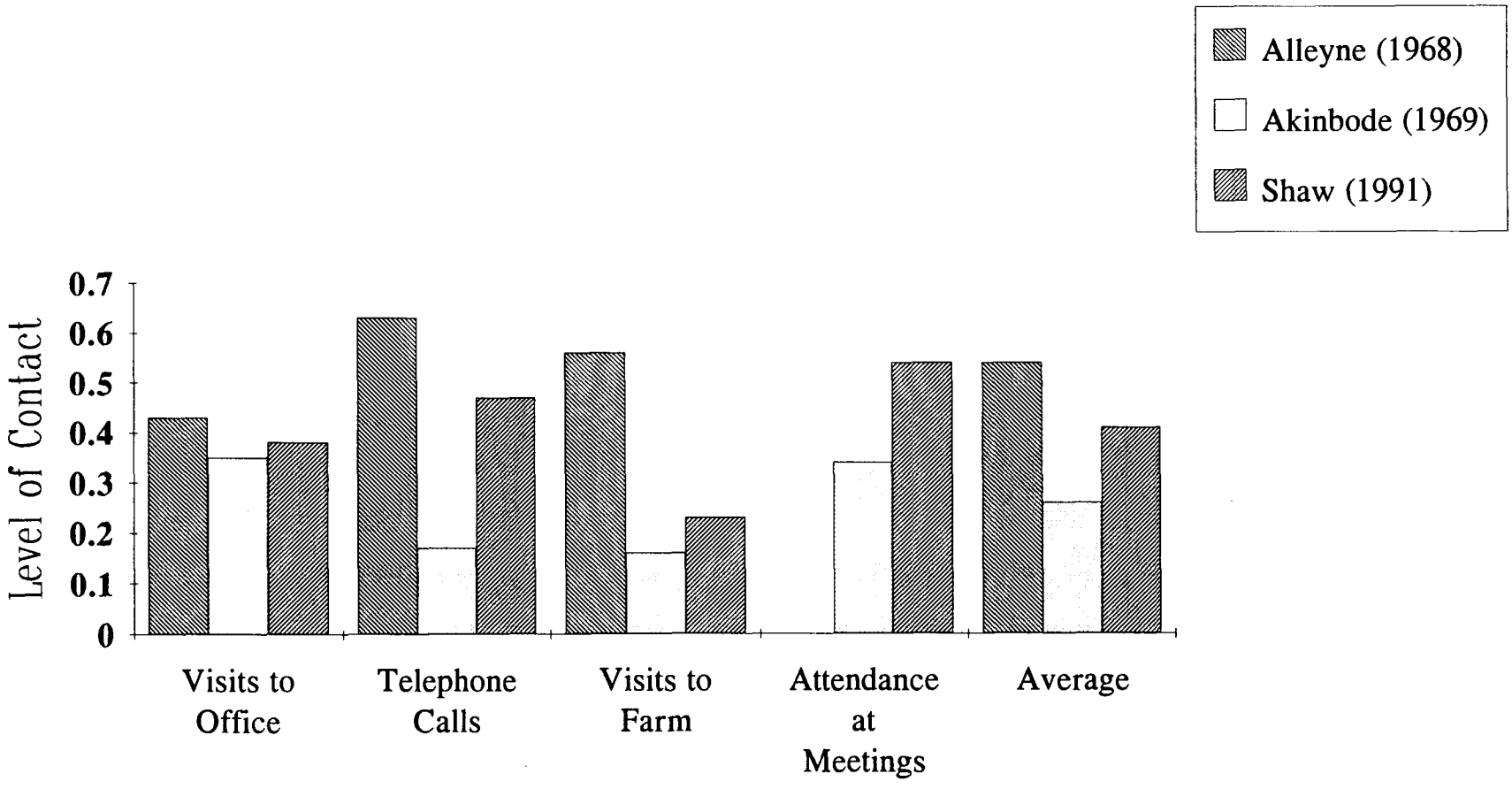
[a] Refers to a minimum of one contact/year

The use of hypothesis testing to determine if a statistical difference between results exists cannot easily be used in this case. Each of the individual questionnaire responses would have to be set up in SPSS/PC+ format to conduct the analysis. As a result, conclusions drawn from the comparison can only be drawn by inference.

On a provincial basis, these statistics indicate that there has been little change in the level of contact in visits to the district agriculturist's or horticulturists office. However, all other categories show increases. The number of telephone calls to the office have more than doubled. Farm visits have a modest increase of 7%, from 16% to 23%. The number of farmers reporting that they obtained information from meetings and field days has increased 20%. Averaging out all forms of contact indicates that about 15% more farmers are obtaining information from their district agriculturist or horticulturist than they were in 1969.

Comparison of Alleyne (1968) to the 1991 results show declines in all categories. Averaging out all forms of contacts indicates a 13% drop in contact. The differences in the results is likely due to the fact the Akinbode study was done province-wide, while the Alleyne study was just of strawberry growers in the Lower Fraser Valley. The Ministry of Agriculture may be doing a better job of servicing all

Figure 7: Extension Contacts 1969 vs. 1991



farmers in general, while back in 1968 only those farmers close to the major centers were getting a high level of service. It is difficult to draw conclusions from a comparison between the Alleyne study and the findings of this research because one study covers the general population, while the Alleyne study was on a sub-group.

CHAPTER 6
SUMMARY AND CONCLUSIONS

The focus of this study has been on the collection and analysis of information about farmers who do or do not value as well as use or do not use various sources of information. The result of this research provides a very detailed "snapshot" of farmers in British Columbia. The purpose of this chapter is to summarize some of the major findings and to delve into the significance of them.

Detailed statistical analysis of the response to the survey has shown that the information gathered meets the tests of being statistically significant and representative of British Columbia farmers. This is stated with one qualification: berry growers were not well represented in the survey due to the lack of a mailing list.

The farmers surveyed were predominately male (91%) and had an average age of 49.5 years. A significant number are married (93%) and have at least two children. Seventy per cent speak English as their first language and only 30% have less than a high school education. Another 30% have some form of post-secondary training. Over 70% have been farming at the same location for at least 10 years and over 85% have been farmers for at least 10 years. Many of the farm families earn some portion of their income off the farm. Only 28.1% reported not earning any of their income off-farm. Many of the farmers run small operations, with 28% reporting less than $19,999 in farm sales.

The most frequent method that farmers obtain information from individuals in the business of providing information is by mail, fax, or computer. The least frequent

was the "one on one" farm visit. In general, the more "personal" the form of contact between the farmer and the extension provider, the lower the level of contact. This meets general expectations as it is easier to contact more farmers in a shorter period of time by mailing them a newsletter as compared to visiting them individually. When looking at the total number of contacts between extension providers and farmers, had, sales representatives have the highest overall level of contact at a rate of 53.2%. The district agriculturist/horticulturist is the second choice of farmers at a rate 4.8% less. This position is due in part to the relatively high level of contact these ministry staff have through the mail, fax, or computer method. Veterinarians, provincial specialists, and bank managers or financial advisors are the next three highest levels of contact.

Non-formal extension providers are also of importance to farmers. Ninety percent of farmers reported obtaining information from neighbors and friends with their spouse being of secondary importance at a level of 78%. Published materials mostly frequently referred to were general farm papers or magazines (74%) , British Columbia Ministry of Agriculture publications (71%), and farm organization newsletters (65%). A large number of farmers reported that they obtained information from visits to other farms (81%). Video tapes were also utilized with 40% of farmers reporting that they had obtained information from one.

When asked to rate the value of all information sources, farmers reported that neighbors, friends, and other farmers were the most valuable. Other valuable sources, in order, were visits to other farms, sales representatives, general farm papers and magazines, and Ministry of Agriculture publications.

Canonical analysis, a multiple correlation technique, was used to identify significant demographic factors that are strongly linked with the use of the information

sources. The value of farm sales was positively correlated with the use the information sources in almost all cases. Age and off-farm income were also found to be important predictors of use for some circumstances. The level of contact between sales representatives, provincial extension agents, Agriculture Canada staff, and bank or financial advisors increased with farm sales. As farm sales increase, greater use is made of newsletters and magazines from commercial suppliers. No correlations were found between extension providers and those that obtained information at field days or meetings. It would appear that while other methods of contact that extension providers have with farmers tends to favor the larger producer, the field day/ meeting method is successful in reaching all demographic groups. As many farmers reported that they found information from visiting other farms, field days that involve tours to other farms and discussion of the techniques being used would appear to be a valuable technique. The study has also illustrated the effectiveness of utilizing a multiple correlation technique to isolate the factors of importance. This technique is suitable for use with many forms of survey research not isolated to that of agriculture.

The data was analyzed to determine if British Columbia Ministry of Agriculture extension staff are serving all farmers equally. Statistically significant differences were found in the average demographic statistics of those who use extension services and those who do not. In general, the farmers using extension services were younger, had more education, higher off-farm income, higher farm sales, and had been farming for a shorter period of time.

Comparison of the level of contact between farmers and the provincial extension service was made between a 1969 survey (Akinbode) and the survey results. On a provincial basis, the level of contact is higher in 1991 for farm visits, phone calls, and visits to the office as was observed in 1969. Caution must be exercised in interpreting

a straight line trend between these two dates. The level of extension staffing has fluctuated significantly over the years and the nature and type of extension programs delivered has varied. It is difficult to determine whether or not the increase in the level of contact between Ministry extension staff and farmers is adequate to meet the needs of the farmer in the 1990's or whether the level of contact is too high. The answer to this question depends on the values held by the respondent. On one hand farmers are faced with an increasingly competitive global marketplace and are facing increased environmental and economic pressures. On the other hand, farmers are better educated and have more resources available to them to solve their own problems. The 1991 Extension Program Review conducted by Sork (1991) deals with this question in more detail.

The study has shown that farmers obtain information from a variety of sources and that the Ministry of Agriculture is one of the more important sources. It is also evident that commercial suppliers play a major role in the provision of information to farmers. Canonical analysis showed that farmers obtain information more frequently and place greater value on information obtained from commercial suppliers as farm sales increase. The implication of this to commercial suppliers is that their customers consider them to be valuable sources of information, and that information can be an important marketing tool. The supplier that does a good job of providing quality information and linking that to the supply of their product will earn that farmer's business. Given the overall level of contact these suppliers have with farmers, it would appear that an opportunity exists for Ministry of Agriculture extension staff to utilize this in some circumstances. If the Ministry is attempting to improve certain practices of farmers that are related to the products that commercial suppliers provide, then directing some of their extension efforts towards those suppliers may prove to be of benefit. For example, nitrates in the groundwater in the Abbotsford area of British

Columbia are of concern to the Ministry. The source of the nitrates is speculated to be related to the handling and disposal of manure as well as the application of commercial fertilizer. Commercial fertilizer sales personnel work closely with their customers in developing fertilizer recommendations. Extension efforts directed toward that sales person would have an impact on what the farmer does in the field as that salesman would have considerable influence and contact with the farmer. This suggestion does not mean that the Ministry should refocus extension efforts toward commericial suppliers, but that the Ministry might better achieve some of its objectives by considering its influence on other persons providing extension information.

The fact that commercial suppliers tend to spend more time with larger farmers means that smaller farmers tend to get overlooked. The data indicates that Ministry of Agriculture extension staff also tend to spend more time with the larger farmers. Who should the Ministry be serving? Should they apply the 80/20 rule as commercial supplier do, or do they define their clientele in a different fashion. While smaller farmers may not be making a large contribution to the economy, they do hold and maintain land in an agricultural state. This land could be considered as an important inventory for future food production or in providing greenbelt space. This study cannot provide these answers, however they make interesting points which could be elaborated upon in future studies.

As this study has covered the use of all types of information for all groups of farmers, further research in this area should be more specific. The study was not a diffusion/adoption study and there is no information about how innovative the farmers were who responded to the survey. Future work could look at which information sources are utilized at each of the different stages of the adoption process. For example, are farmers learning about new techniques at the Lower Mainland

Horticultural Improvement Association short course held in Abbotsford every February, or are a large number of farmers learning them from a farm visit by a commercial supplier who attended the lectures at that course? Specific research of this nature will provide answers to extension providers as to the effectiveness of their programs or how best to target them.

The study has a number of important limitations that must be taken into account when drawing conclusions about how farmers use information. The sample was under-represented by berry growers due to a lack of a mailing list. The accuracy of the Ministry of Agriculture mailing list is not known and it was not possible to precisely identify how large the sample had to be to represent the whole population. The questionnaire only asked farmers to indicate which sources of information they use and value. No information collected that would give insight into why farmers were consulting the various sources or how they made their judgements of the "value" of sources. Because farmers frequently get information from commercial suppliers does not mean that the Ministry services are redundant or should be re-oriented to include those suppliers. Each information source has its own characteristics as to availability, cost, reliability, and appropriateness. It is not likely that farmers would look to an independant consultant to keep them up to date on technological advances, however it is more likely that a consultant would be called in to provide specific services such as the design of a new structure. No information was collected as to the adoptor group that the farmer may have belonged to. It is not known if the farmers who replied to the survey were evenly distributed amongst the adoptor groups or skewed in some direction.

A considerable amount of data was collected in this project which could be analyzed further to answer additional questions. While the study attempted to look at

all the information that was gathered, it was analyzed in view of the original four objectives. For example, detailed analysis could be performed on the differences between those farmers who use video tapes and those who don't. A follow-up study could be performed to determine why just as many farmers reported obtaining information from a British Columbia Ministry of Agriculture demonstration site, as those who travelled to foreign countries. Work could be performed on the type of information or stage of adoption the Ministry should be involved in and what should be turned over to other individuals. In conclusion, the findings of this study raises as many questions as it answers and sets the stage for the next study.

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Appendix One

INFORMATION SOURCES IN BC AGRICULTURE: A PRODUCERS' SURVEY

INSTRUCTIONS

Part I of the survey consists of questions about the different sources of information that farmers use to solve problems and make decisions. The questions will ask you how often you have used various information sources. When thinking about how you may have received information relating to a farm matter, remember that it can be anything that helps you make a decision about your farm business. Examples are: fertilizer recommendations, methods to improve the ventilation in your barn, or even how to take the GST into consideration in your financial accounts.

Part II of the survey includes several questions asking for general information such as your age and what type of farm you have. The purpose of these questions is to categorize your answers with other farmers in British Columbia so that the different information requirements of different groups of farmers can be determined. Answering both parts of the questionnaire is very important to give us a clear picture of what information sources are used by different types of farmers throughout the Province.

Thank you for investing the time to help improve British Columbia's extension service.

Please mail the completed survey in the enclosed preaddressed, stamped envelope by

July 15, 1991

1991 Extension Program Review
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FAX: (604) 822-6679

PART I

1. Please put a check in the box to the right of each information source that best indicates how often during the past 12 months each person visited your farm and provided you with information pertaining to a farm matter.

	INFORMATION SOURCE	NO FARM VISITS	1 OR 2 VISITS	3 OR 4 VISITS	5 OR MORE VISITS
a.	District Agriculturist or Horticulturist	77%	11%	7%	5%
b.	Other provincial agricultural specialist	75%	18%	3%	4%
c.	University or college staff	98%	1%	0%	1%
d.	Agriculture Canada staff	88%	7%	1%	4%
e.	Sales rep. (feed, fertilizer, etc.)	42%	22%	8%	28%
f.	Bank manager or financial advisor	75%	19%	2%	4%
g.	Packing house or processor field representative.	78%	10%	3%	9%
h.	Veterinarian	48%	18%	12%	22%
i.	Independent consultant	86%	10%	2%	2%
j.	Other, please specify:	95%	2%	1%	2%

2. Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you obtained information relating to a farm matter by talking to each person on the telephone.

	INFORMATION SOURCE	NO PHONE CALLS	1 OR 2 CALLS	3 OR 4 CALLS	5 OR MORE CALLS
a.	District Agriculturist or Horticulturist	53%	27%	7%	13%
b.	Other provincial agricultural specialist	63%	17%	11%	9%
c.	University or college staff	93%	5%	1%	1%
d.	Agriculture Canada staff	78%	15%	4%	3%
e.	Sales rep. (feed, fertilizer, etc.)	39%	18%	14%	29%
f.	Bank manager of financial advisor	53%	20%	10%	17%
g.	Packing house or processor field representative	66%	10%	6%	6%
h.	Veterinarian	39%	24%	13%	24%
i.	Independent consultant	80%	9%	7%	4%
j.	Other, please specify:	92%	1%	2%	5%

3. Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you visited each person at their office to obtain information relating to a farm matter.

INFORMATION SOURCE	NO OFFICE VISITS	1 OR 2 VISITS	3 OR 4 VISITS	5 OR MORE VISITS
a. District Agriculturist or Horticulturist	62%	24%	9%	5%
b. Other provincial agricultural specialist	82%	12%	3%	3%
c. University or college staff	99%	1%	0%	0%
d. Agriculture Canada staff	85%	12%	1%	2%
e. Sales rep. (feed, fertilizer, etc.)	53%	26%	6%	15%
f. Bank manager or financial advisor	42%	30%	13%	15%
g. Packing house or processor field representative	76%	14%	2%	8%
h. Veterinarian	51%	31%	6%	4%
i. Independent consultant	89%	10%	0%	1%
j. Other, please specify:	95%	0%	3%	2%

4. Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you have heard each person make a presentation or speak at a meeting or field day on an agricultural topic.

INFORMATION SOURCE	NEVER	1 OR 2 TIMES	3 OR 4 TIMES	5 OR MORE TIMES
a. District Agriculturist or Horticulturist	46%	41%	8%	5%
b. Other provincial agricultural specialist	45%	47%	5%	3%
c. University or college staff	81%	15%	4%	0%
d. Agriculture Canada staff	64%	34%	1%	1%
e. Sales rep. (feed, fertilizer, etc.)	60%	32%	5%	3%
f. Bank manager of financial advisor	83%	15%	1%	1%
g. Packing house or processor field representative	82%	12%	4%	2%
h. Veterinarian	65%	31%	3%	1%
i. Independent consultant	84%	13%	2%	1%
j. Other, please specify:	91%	5%	1%	3%

5. Please put a check in the box to the right of each information source that best indicates how often during the past 12 months you have received information from each person by mail, fax or computer.

	INFORMATION SOURCE	NEVER	1 OR 2 TIMES	3 OR 4 TIMES	5 OR MORE TIMES
a.	District Agriculturist or Horticulturist	20%	18%	36%	26%
b.	Other provincial agricultural specialist	40%	28%	17%	15%
c.	University or college staff	86%	11%	3%	0%
d.	Agriculture Canada staff	50%	26%	14%	10%
e.	Sales rep. (feed, fertilizer, etc.)	40%	23%	16%	21%
f.	Bank manager or financial advisor	57%	22%	9%	12%
g.	Packing house or processor field representative	77%	9%	5%	9%
h.	Veterinarian	69%	17%	9%	5%
i.	Independent consultant	85%	12%	1%	2%
j.	Other, please specify:	95%	2%	1%	2%

[PLEASE CONTINUE TO THE NEXT PAGE]

6. Please put a check mark in the box to the right of each information source to indicate how often on average, during the past 12 months, you have received information useful in making a farm management decision from each publication. PLEASE CHECK ONE BOX FOR EACH INFORMATION SOURCE.

INFORMATION SOURCE	NEVER	ONCE A YEAR	ONCE EVERY 6 MONTHS	ONCE EVERY 3 MONTHS	ONCE A MONTH	ONCE A WEEK	EVERY DAY
a. B.C. Ministry of Agriculture publications	29%	19%	14%	25%	9%	3%	1%
b. Agriculture Canada publications	52%	15%	12%	13%	8%	0%	0%
c. General farm paper or magazine (*Country Life, B.C. Farmer*, etc.)	26%	11%	12%	13%	30%	8%	0%
d. Specialized farm paper or magazine (*Greenhouse Manager, B.C. Dairy Digest, Vegetable Grower*, etc.)	40%	10%	7%	14%	24%	5%	0%
e. Scientific Journal (*Journal of Plant Science, Journal of Animal Science*, etc.)	85%	8%	3%	2%	2%	0%	0%
f. Provincial or Local newspaper (*Vancouver Sun, Similkameen Spotlight*, etc.)	55%	12%	8%	5%	5%	8%	7%
g. Newsletter or magazine published by a commercial supplier (feed, fertilizer, equipment, etc.)	38%	11%	17%	18%	15%	1%	0%
h. Newsletter or magazine published by a farm organization (B.C. Blueberry Coop, B.C. Cattlemen's Assoc., etc.)	35%	14%	15%	18%	16%	2%	0%
i. Publication from a United States government or university source	63%	19%	5%	3%	10%	0%	0%
j. Other, please specify:	91%	1%	2%	3%	1%	2%	0%

PLEASE CHECK THE ANSWER WHICH BEST CORRESPONDS TO HOW OFTEN YOU HAVE USED AN INFORMATION SOURCE

7. On average, how often during the past 12 months have you received information relating to a farm matter, other than the weather report, from a radio program or announcement?

35%	never	18%	once per month
8%	once during the last year	9%	once per week
12%	once every six months	6%	every day
12%	once every three months		

8. On average, how often during the past 12 months have you received information relating to a farm matter, other than the weather report, from a television program?

39%	never	19%	once per month
6%	once during the last year	7%	once per week
14%	once every six months	1%	every day
14%	once every three months		

9. On average, how often during the past 12 months have you received information relating to a farm matter from watching a video tape?

60%	never	1%	once per month
24%	once during the last year	1%	once per week
8%	once every six months	0%	every day
6%	once every three months		

9(a). If you have watched a video tape, what was the source of the tape? Please check all that apply.

35.9% Ministry of Agriculture
46.2% Commercial supplier
5.1% University or college
10.3% Agriculture Canada
33.3% Other, please specify:_____

10. On average, how often during the past 12 months have you received information related to a farm matter from a computerized bulletin board?

87%	never	3%	once per month
3%	once during the last year	0%	once per week
5%	once every six months	0%	every day
2%	once every three months		

11. Have you taken any courses in agriculture or farm business management during the past 12 months?

15% yes
85% no

11(a). If you answered "yes" above, please indicate who offered the course(s):

12. On average, how often during the past 12 months have you received information relating to a farm matter from an employee before making a farm management decision?

68%	never	3%	once per month
6%	once during the last year	3%	once per week
4%	once every six months	7%	every day
9%	once every three months		

13. On average, how often during the past 12 months have you received information relating to a farm matter from your spouse or children before making a farm management decision?

22%	never	17%	once per month
3%	once during the last year	17%	once per week
10%	once every six months	20%	every day
11%	once every three months		

14. On average, how often during the past 12 months have you received information relating to a farm matter from your parents or other relatives before making a farm management decision?

59%	never	3%	once per month
8%	once during the last year	5%	once per week
10%	once every six months	4%	every day
11%	once every three months		

15. On average, how often during the past 12 months have you received information relating to a farm matter from a neighbour, friend or other farmer?

10%	never	33%	once per month
10%	once during the last year	7%	once per week
14%	once every six months	1%	every day
25%	once every three months		

16. Have you obtained information about a farm matter while visiting any of the following places during the past 12 months? Please check all that apply.

81%	another farm
19%	Agriculture Canada Experimental Station
23%	B.C. Ministry of Agriculture demonstration site
23%	travel to a foreign country
3%	other, please specify:_____
11%	none of the above

[PLEASE CONTINUE TO NEXT PAGE]

17. We would like your opinion on the value of all the information sources that are available to you, whether or not you have used them in the past 12 months. Please put a check mark in the box to the right of each information source that best indicates how valuable you feel each source is. If you are not familiar with the source, having never used it before, please check "DOES NOT APPLY."

INFORMATION SOURCE	DOES NOT APPLY	OF NO VALUE	OF LITTLE VALUE	UNDECIDED	VALUABLE	HIGHLY VALUABLE
a. District Agriculturist or Horticulturist	15%	5%	13%	12%	38%	17%
b. Other Provincial government specialists	29%	4%	12%	8%	37%	10%
c. University or college staff	54%	7%	9%	12%	18%	0%
d. Agriculture Canada staff	35%	8%	9%	16%	27%	5%
e. Neighbours, friends, other farmers	3%	0%	4%	7%	66%	20%
f. Sales rep. (feed, fertilizer, equipment, etc.)	16%	1%	5%	8%	52%	18%
g. Bank manager or financial advisor	22%	12%	15%	12%	29%	10%
h. Packing house or processor field rep.	46%	6%	10%	6%	21%	11%
i. Veterinarian	30%	1%	0%	0%	31%	38%
j. Relatives, including parents	31%	6%	8%	2%	39%	14%
k. Farm employees	38%	3%	7%	9%	34%	9%
l. Spouse or children	18%	2%	11%	3%	42%	24%
m. B.C. Ministry of Agriculture publications	11%	1%	15%	9%	55%	9%
n. Agriculture Canada publications	19%	3%	17%	12%	42%	7%
o. General farm papers or magazines (*Country Life, B.C. Farmer*, etc.)	11%	2%	10%	14%	49%	14%
p. Specialized farm papers or magazines (*Greenhouse Manager, B.C. Dairy Digest*, etc.)	29%	3%	6%	7%	38%	17%
q. Scientific journals (*Journal of Plant Science*, etc.)	57%	5%	8%	12%	16%	2%
r. Provincial or Local newspapers (*Vancouver Sun, Similkameen Spotlight*, etc.)	25%	17%	25%	12%	17%	4%

INFORMATION SOURCE	DOES NOT APPLY	OF NO VALUE	OF LITTLE VALUE	UNDECIDED	VALUABLE	HIGHLY VALUABLE
s. Newsletter published by commercial supplier (feed, fertilizer, equipment, etc.)	21%	2%	14%	8%	49%	6%
t. Newsletter published by a farm organization (B.C. Blueberry Coop, B.C. Cattlemen's Assoc., etc.)	24%	3%	6%	3%	57%	7%
u. Publication from a United States government or university source	51%	5%	11%	8%	19%	6%
v. Radio programs or announcements	23%	6%	23%	13%	31%	4%
w. Television programs	27%	7%	20%	12%	30%	4%
x. Video tapes	41%	2%	11%	13%	26%	7%
y. Computerized bulletin board	72%	3%	9%	13%	3%	0%
z. Courses on agriculture	34%	0%	3%	5%	45%	13%
A. Visit to an Agriculture Canada Experimental Station	37%	1%	11%	6%	37%	8%
B. Visit to a B.C. Ministry of Agriculture demonstration site	33%	0%	5%	8%	47%	7%
C. Foreign travel	46%	2%	7%	4%	32%	9%
D. Independent Consultant	54%	3%	8%	10%	17%	8%
E. Visit to another farm	9%	0%	5%	0%	57%	29%
F. Other, please specify:	97%	0%	0%	0%	1%	2%

[PLEASE CONTINUE TO THE NEXT PAGE]

PART II

In order to categorize your answers with those of other farmers across B.C., we would like to ask you some general questions.

18. In what year were you born? see Table 6

19. Please indicate your sex.

91%	Male
9%	Female

20. What is your marital status?

92%	Married (including common-law marriages)
4%	Widowed, divorced, separated
3%	Never been married

21. What is your Mother tongue, that is the first language you learned which you still understand?

70%	English	9%	Dutch
1%	French	12%	German
1%	Chinese	0%	Punjabi
0%	Japanese	1%	A Native language (North American Native or Inuit)
0%	Korean	2%	Scandinavian language
0%	Spanish	0%	Ukrainian
1%	Italian	2%	Other, please
1%	Portuguese		specify:_____

22. How many children do you have?

9%	None	28%	Three
8%	One	12%	Four
29%	Two	13%	Five or more

23. What is the highest level of education that you have completed and received credit for?

2%	less that 5 years
10%	5-8 years
20%	9-11 years
30%	High school diploma (Grade 12 or 13)
23%	College or technical diploma (1-2 year program)
9%	Bachelor's degree
4%	Master's degree
1%	Doctorate
1%	Other, please

specify:_____

24. Are you a member or is a group you belong to a member of any of the following farm organizations? Please check all that apply.

60% B.C. Federation of Agriculture
10% A Farmer's or Women's Institute
1% Alliance of B.C. Organic Producers' Association
6 B.C. Fair Association
3% Horse Council of B.C.
23% Commodity marketing board
36% Breed organization
15% Packing house or crop marketing co-op
5% A farm or rural women's group
16% Others, please specify:_____

25. How many years have you been on this farm? see Table 13

26. For how many years have you been a farmer? see Table 14

27. How much income did you and your spouse together earn outside the farm last year?

27%	none	12%	$30,001-40,000
12%	less than $5,000	7%	$40,001-50,000
9%	$ 5,001-10,000	4%	$50,001-60,000
6%	$10,001-20,000	5%	$60-001-70,000
8%	$20,001-30,000	6%	$70,000 plus

28. What is the size of your farm? Please report the unit of measurement that is most appropriate for your type of operation. For example, the number of acres if you grow crops, the number of cattle if you have a feed lot, the size of your egg quota, etc.

29. What was the total value of sales from all your agricultural operations last year? $_____

30. What is the principal agricultural product sold? Please check one only.

Beef	Tree fruits
Dairy	Sheep
Swine	Grapes
Poultry	Forage
Grain and oilseeds	Floriculture
Bee products	Nursery
Vegetables	Other, please specify:_____
Berries	

-- THANK YOU AGAIN FOR TAKING THE TIME TO COMPLETE THIS SURVEY --

Appendix Two

Appendix two presents an example of the data output of a canonical analysis and interprets the output line by line. This example is based on the correlation done between the frequency with which farmers talked to extension providers on the telephone with the farmers' demographic data.

Lines 19 through 29 contain the command lines which tell BMDP6M which variables to use and correlation against. In this example there are a total of 21 variables, 10 of which are Y1 to y10, and eleven of which are X1 to X11. The Y's are the 10 different possible information sources to whom a farmer might call on the telephone. The X's are the eleven categories of demographic data used. The format statement and variables to be used are checked to ensure that everything matches. The next part of interest begins at line 133 titled Univariate Summary Statistics.

Information reported in this category provides checks that the data is correct through statistics such as the mean, smallest value, and largest value. In addition, the kurtosis and skewness evaluates the shape of the curve with respect to the normal distribution. Canonical correlation does not require that the variables be normally distributed, however the analysis is enhanced when it is (Tabachnick & Fidell, 1983, p. 149). Results from multivariate analysis cannot be tested for normality, however the likelihood of it being so is much greater when the independent and dependent variables are normally distributed. Data can be used even if it is skewed providing that it is not badly skewed and the sample size is large. There must be at least more cases analyzed than there are dependent variables. As there are 100 cases with the survey and only 11

dependent variables, the sample size can therefore be considered quite large. The Central Limit Theorem can also be used to justify the use of skewed variables.

The normality of the data is assessed by the value of the skewness coefficient. If the skewness $s_s=0$ then there is perfect symmetry about the mean. Ideally values of skewness should be less than 3.

Line 167 list univariate correlation coefficients between the variables.

Line 341 list the squared multiple correlation coefficients of each variable with all the other variables. This indicates how much of the variance of each variable is accounted for by all the other variables. Squared multiple correlations check for the condition of multicollinearity and singularity. Multicollinearity occurs when two variables are highly correlated with each other. Singularity occurs when one score is a linear or almost linear combination of the others. Since the mathematics of canonical correlation involve matrix algebra and the inversion of matrices, variables that are highly correlated with each other mean that the discriminate of their matrices is almost zero. Since matrix inversion is the mathematical equivalent of division, the result is huge fluctuations with only minor changes in the correlation. Any values of squared multiple correlations greater than 0.95 will indicate that two variables are highly correlated and therefore one of them is redundant. For example, if the demographic data included a question about age and another about how long that person had been male or female, it would be expected that the results would be highly correlated. In terms of using this information for predicting the value of something else, the goal of canonical correlation, it would only be necessary to use one of them. It is also desirable to have the variance between variables to be greater than 10% so that there is some connection between them.

Barletts test calculates the eigenvalues of each matrix and the canonical correlation is calculated by taking the square root. The number of significant links that will exist between the independent and dependent variables is given by the number of eigenvalues with a statistically low possibility of making a type 1 error. That is there is a very low probability of being overly optimistic that a link exists. The first eigenvalue indicates that the probability is 0.05% while the probability of making a mistake in assuming that a second link exists is 10.58%. Using the standard significance tests of 95% we would thus conclude that there is only one significant link. As the eigenvalues were calculated by taking a linear composite of both the independent and dependent variables there thus exists a pair of canonical variates. As the value of the eigenvalue is 48% we can then state that these two canonical variates share 48% of the variance between them. More simply put, 48% of the variance in who farmer phoned for information (y set) can be accounted by the demographic data (x set). In this example it can be seen that the one link that exists between the demographic data and phone calls to people is a very good link.

Interpretation of the canonical variates proceeds best by looking at the full canonical correlations. The standardized canonical coefficients are only partial coefficients. Proceeding to line 886 titled Canonical Variable Loadings, only $CNVRF1_1$ can be used for interpretation as it has been found that only one significant link exists. Use of $CNVRF2_2$ means that interpretations drawn are subject to a high degree of error. To determine how strongly each of the original variables is correlated to the canonical variate, the values of the full correlations of the independent and dependent variables are examined as seen at line 886.

The next section at line 909 lists squared multiple correlations. These value describe which of the correlations of the original variables can be considered to be statistically significant as given by the P-value. In addition the proportion of the variance of each of the independent variables that can be accounted for by the demographic data is given.

```
Listi    r -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

     1
     2     1PAGE    1  BMDP6M
     3
     4      BMDP6M - CANONICAL CORRELATION ANALYSIS
     5      BMDP STATISTICAL SOFTWARE, INC.
     6      1964 WESTWOOD BLVD. SUITE 202
     7      (213) 475-5700
     8      PROGRAM REVISED OCTOBER 1983
     9      MANUAL REVISED -- 1983
    10      COPYRIGHT (C) 1983 REGENTS OF UNIVERSITY OF CALIFORNIA
    11
    12      TO SEE REMARKS AND A SUMMARY OF NEW FEATURES FOR
    13      THIS PROGRAM, STATE NEWS. IN THE PRINT PARAGRAPH.
    14
    15      FEB 12, 1992        AT 20:29:14
    16
    17      PROGRAM CONTROL INFORMATION
    18
    19      PROBLEM TITLE IS 'CA ANALYSIS1'./
    20      INPUT VARIABLES=21.
    21            FORMAT IS '(13X,10F1.0/55X,F2.0,2F1.0/F2.0,2F1.0,10X,3F2.0,
    22            1X,2F2.0)'.
    23            UNIT=8./
    24      VARIABLE NAMES ARE Y1,Y2,Y3,Y4,Y5,Y6,Y7,Y8,Y9,Y10,X1,X2,X3,X4,X5,X6,X7
    25      ,X8,X9,X10,X11./
    26      CANONICAL FIRST ARE Y1,Y2,Y3,Y4,Y5,Y6,Y7,Y8,Y9,Y10.
    27                SECOND ARE X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11./
    28      PRINT MATRICES ARE CORR,CANV,COEFF,LOAD./
    29      END/
    30
    31      PROBLEM TITLE IS
    32      CA ANALYSIS1
    33
    34      NUMBER OF VARIABLES TO READ IN. . . . . .        21
    35      NUMBER OF VARIABLES ADDED BY TRANSFORMATIONS. .   0
    36      TOTAL NUMBER OF VARIABLES . . . . . .            21
    37      NUMBER OF CASES TO READ IN. . . . . . TO END
    38      CASE LABELING VARIABLES . . . . . .
    39      MISSING VALUES CHECKED BEFORE OR AFTER TRANS. . NEITHER
    40      BLANKS ARE. . . . . MISSING
    41      INPUT UNIT NUMBER . . . . . .                     8
    42      REWIND INPUT UNIT PRIOR TO READING. . DATA. . .  YES
    43      NUMBER OF WORDS OF DYNAMIC STORAGE. . . . . .  14998
    44      NUMBER OF CASES DESCRIBED BY INPUT FORMAT . . .    1
    45
    46      VARIABLES TO BE USED
    47           1 Y1          2 Y2          3 Y3          4 Y4          5 Y5
    48           6 Y6          7 Y7          8 Y8          9 Y9         10 Y10
    49          11 X1         12 X2         13 X3         14 X4         15 X5
    50          16 X6         17 X7         18 X8         19 X9         20 X10
    51          21 X11
    52     1PAGE    2  BMDP6M CA ANALYSIS1
    53
    54     0INPUT FORMAT IS
    55      (13X,10F1.0/55X,F2.0,2F1.0/F2.0,2F1.0,10X,3F2.0,  1X,2F2.0)
    56
    57      MAXIMUM LENGTH DATA RECORD IS   59 CHARACTERS.
    58     1PAGE    3  BMDP6M CA ANALYSIS1
```

```
Listing of -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

 59
 60     0I N P U T   V A R I A B L E S . . . . .
 61          VARIABLE     RECORD    COLUMNS     FIELD  TYPE              VARIABLE     RECORD    COLUMNS     FIELD  TYPE
 62        INDEX   NAME     NO.   BEGIN  END    WIDTH                  INDEX   NAME     NO.   BEGIN  END    WIDTH
 63        ----- --------  ----   -----  -----  -----  ----            ----- --------  ----   -----  -----  -----  ----
 64            1 Y1           1     14     14     1     F                12 X2           2     58     58     1     F
 65            2 Y2           1     15     15     1     F                13 X3           2     59     59     1     F
 66            3 Y3           1     16     16     1     F                14 X4           3      1      2     2     F
 67            4 Y4           1     17     17     1     F                15 X5           3      3      3     1     F
 68            5 Y5           1     18     18     1     F                16 X6           3      4      4     1     F
 69            6 Y6           1     19     19     1     F                17 X7           3     15     16     2     F
 70            7 Y7           1     20     20     1     F                18 X8           3     17     18     2     F
 71            8 Y8           1     21     21     1     F                19 X9           3     19     20     2     F
 72            9 Y9           1     22     22     1     F                20 X10          3     22     23     2     F
 73           10 Y10          1     23     23     1     F                21 X11          3     24     25     2     F
 74           11 X1           2     56     57     2     F
 75
 76      FIRST SET OF VARIABLES
 77      ----------------------
 78
 79         1 Y1          2 Y2          3 Y3          4 Y4          5 Y5
 80         6 Y6          7 Y7          8 Y8          9 Y9         10 Y10
 81
 82      SECOND SET OF VARIABLES
 83      -----------------------
 84
 85        11 X1         12 X2         13 X3         14 X4         15 X5
 86        16 X6         17 X7         18 X8         19 X9         20 X10
 87        21 X11
 88
 89      NUMBER OF VARIABLES IN FIRST SET. . . . . .      10
 90      NUMBER OF VARIABLES IN SECOND SET . . . . .      11
 91      TOTAL NUMBER OF VARIABLES USED. . . . . .        21
 92      MAXIMUM NUMBER OF CANONICAL VARIABLES . . . .    10
 93      MINIMUM CANONICAL CORRELATION TO BE USED. . .  0.000
 94      CASE WEIGHT VARIABLE. . . . . .
 95      PRECISION . . . . . .  DOUBLE
 96      TOLERANCE FOR MATRIX INVERSION. . . . . .  0.0001000
 97      EIGENVALUE LIMIT. . . . . .  0.000000
 98     0BASED ON INPUT FORMAT SUPPLIED    3 RECORDS READ PER CASE.
 99     1PAGE   4  BMDP6M CA ANALYSIS1
100
101
102      DATA AFTER TRANSFORMATIONS FOR FIRST    5 CASES
103      CASES WITH ZERO WEIGHTS AND MISSING DATA NOT INCLUDED.
104
105
106     0 C A S E            1         2         3         4         5         6         7         8         9         1
         0
107       NO. LABEL        Y1        Y2        Y3        Y4        Y5        Y6        Y7        Y8        Y9       Y10
108                          11        12        13        14        15        16        17        18        19        2
         0
109                       X1        X2        X3        X4        X5        X6        X7        X8        X9       X10
110                         21
111                       X11
112      ----- --------  ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- -----
         -----
113          1              1         2         1         1         1         1         2         2         2
```

```
      4
114                    46        1        2       12        1        5        6       28        4
      1
115                    12
116         2           1        1        1        1        4        4        4        4        1
      1
117                    29        1        1        9        2        5        2        2        6
      8
118                     4
119         3           1        3        1        1        1        1        1        1        1
      1
120                    55        1        1        1        5        3        0        0        5
      1
121                     1
122         4           3        1        1        1        2        2        1        4        1
      4
123                    38        1        1        9        8        4        5        4        5
      1
124                     2
125         5           3        2        1        1        2        1        1        4        4
      3
126                    42        2        1        1        4        5       17       30        6
      7
127                     1
128
129   NUMBER OF CASES READ. . . . . .                100
130   1PAGE   5  BMDP8M CA ANALYSIS1
131
132
133   UNIVARIATE SUMMARY STATISTICS
134   ----------------------------
135
136
137                                                                                  SMALLEST  LARGEST
138        VARIABLE          MEAN     STANDARD      COEFFICIENT     SMALLEST     LARGEST STANDARD STANDARD  SKEWNESS
      KURTOSIS                      DEVIATION     OF VARIATION        VALUE       VALUE    SCORE    SCORE
139
140      1 Y1            1.80000       1.04447         0.580259     1.00000     4.00000    -0.77     2.11     1.08
        -0.14
141      2 Y2            1.66000       0.99717         0.600703     1.00000     4.00000    -0.66     2.35     1.25
         0.21
142      3 Y3            1.10000       0.41439         0.376716     1.00000     4.00000    -0.24     7.00     4.89
        26.52
143      4 Y4            1.32000       0.69457         0.526188     1.00000     4.00000    -0.46     3.86     2.35
         5.19
144      5 Y5            2.33000       1.26375         0.542383     1.00000     4.00000    -1.05     1.32     0.23
        -1.63
145      6 Y6            1.91000       1.14676         0.600396     1.00000     4.00000    -0.79     1.82     0.85
        -0.83
146      7 Y7            1.76000       1.18168         0.671408     1.00000     4.00000    -0.64     1.90     1.12
        -0.49
147      8 Y8            2.22000       1.20252         0.541677     1.00000     4.00000    -1.01     1.48     0.41
        -1.41
148      9 Y9            1.35000       0.78335         0.580259     1.00000     4.00000    -0.45     3.38     2.18
         3.89
149     10 Y10           1.20000       0.71067         0.592224     1.00000     4.00000    -0.28     3.94     3.38
         9.89
150     11 X1           49.45000      11.25048         0.227512    14.00000    74.00000    -3.15     2.18    -0.14
```

	0.10								
151	12 X2	1.09000	0.28762	0.263875	1.00000	2.00000	-0.31	3.16	2.82
	6.03								
152	13 X3	1.09000	0.40440	0.371005	0.00000	3.00000	-2.70	4.72	3.41
	13.48								
153	14 X4	3.59000	4.22617	1.177206	1.00000	15.00000	-0.61	2.70	1.16
	-0.30								
154	15 X5	3.70000	1.46680	0.396434	1.00000	8.00000	-1.84	2.93	0.12
	-0.21								
155	16 X6	4.16000	1.46142	0.351304	1.00000	9.00000	-2.16	3.31	0.44
	0.50								
156	17 X7	18.89000	15.16568	0.802842	0.00000	70.00000	-1.25	3.37	1.11
	1.09								
157	18 X8	21.85000	13.57313	0.621196	0.00000	61.00000	-1.61	2.88	0.65
	-0.14								
158	19 X9	4.08000	2.99387	0.733791	0.00000	10.00000	-1.36	1.98	0.48
	-1.05								
159	20 X10	4.49000	3.75915	0.837227	0.00000	14.00000	-1.19	2.53	0.53
	-0.95								
160	21 X11	6.93000	5.72828	0.826592	1.00000	16.00000	-1.04	1.58	0.40
	-1.50								

161

162 VALUES FOR KURTOSIS GREATER THAN ZERO INDICATE DISTRIBUTIONS
163 WITH HEAVIER TAILS THAN THE NORMAL DISTRIBUTION.
164 1PAGE 6 BMDP6M CA ANALYSIS1

165

166

167 CORRELATIONS
168 ------------

169

170

171 Y1 Y2 Y3 Y4 Y5 Y6 Y7 Y8 Y9 Y10 X1 X2
X3

172 1 2 3 4 5 6 7 8 9 10 11 12
13

173

174	Y1	1	1.000										
175	Y2	2	0.681	1.000									
176	Y3	3	0.327	0.328	1.000								
177	Y4	4	0.368	0.275	0.414	1.000							
178	Y5	5	0.425	0.459	0.149	0.247	1.000						
179	Y6	6	0.187	0.282	0.210	0.290	0.578	1.000					
180	Y7	7	0.264	0.359	0.153	0.427	0.338	0.409	1.000				
181	Y8	8	0.027	0.071	0.158	-0.097	0.344	0.403	-0.048	1.000			
182	Y9	9	0.247	0.296	0.358	0.163	0.311	0.395	0.179	0.411	1.000		
183	Y10	10	0.150	0.054	0.103	-0.131	-0.108	-0.114	0.010	0.137	0.145	1.000	
184	X1	11	-0.123	-0.174	-0.125	-0.134	-0.359	-0.208	-0.201	-0.084	-0.130	-0.147	1.000
185	X2	12	0.061	-0.033	-0.076	-0.044	-0.083	-0.098	-0.203	0.088	0.083	0.010	-0.069
186	X3	13	-0.100	-0.074	-0.054	-0.104	-0.098	-0.135	-0.039	0.042	-0.037	0.042	-0.073
	1.000												
187	X4	14	-0.158	-0.184	-0.115	-0.189	-0.082	-0.001	-0.058	0.044	0.083	0.017	0.160
	-0.020												
188	X5	15	-0.059	-0.195	-0.100	-0.123	-0.022	-0.010	-0.071	0.055	-0.040	-0.048	0.234
	-0.295												
189	X8	16	0.240	0.294	0.073	0.307	0.188	0.099	0.104	0.031	0.083	0.037	-0.118
	0.044												
190	X7	17	-0.023	0.042	0.040	-0.030	-0.077	0.097	-0.012	0.069	0.012	-0.151	0.341
	-0.007												

```
Listir     -A at 20:44:24 on FEB 12, 1992 for CCId=KENS on G

   191      X8          18   -0.104   -0.104   -0.075   -0.100   -0.055   -0.051   -0.158    0.177    0.021    0.018    0.369   -0.144
               -0.038
   192      X9          19    0.089    0.043    0.042   -0.017   -0.108   -0.151   -0.189    0.015    0.009    0.140    0.065    0.168
               0.002
   193      X10         20    0.221    0.250    0.288    0.260    0.450    0.528    0.231    0.235    0.181   -0.082   -0.115   -0.181
               -0.038
   194      X11         21    0.212    0.187    0.224    0.153   -0.037   -0.178    0.136   -0.259    0.228    0.100   -0.077    0.077
               0.020
   195
   196
   197                        X4       X5       X6       X7       X8       X9       X10      X11
   198                          14       15       16       17       18       19       20       21
   199
   200      X4          14    1.000
   201      X5          15    0.136    1.000
   202      X6          16   -0.153   -0.086    1.000
   203      X7          17   -0.064    0.098   -0.237    1.000
   204      X8          18    0.005    0.217   -0.208    0.683    1.000
   205      X9          19   -0.135   -0.031    0.366   -0.287   -0.157    1.000
   206      X10         20    0.114    0.058    0.169    0.265    0.137   -0.280    1.000
   207      X11         21   -0.069   -0.197    0.075   -0.188   -0.330    0.046   -0.216    1.000
   208     1PAGE   7  BMDP8M CA ANALYSIS1
   209
   210
   211
   212
   213      ABSOLUTE VALUES OF CORRELATIONS IN SHADED FORM
   214      ----------------------------------------------
   215
   216     +   1 Y1        X
   217     +               0
   218     +               *
   219
   220     +   2 Y2        XX
   221     +               00
   222     +               **
   223
   224     +   3 Y3        ++X
   225     +                 0
   226     +                 *
   227
   228     +   4 Y4        X+XX
   229     +                   0
   230     +                   *
   231
   232     +   5 Y5        XX.-X
   233     +                N  0
   234     +                   *
   235
   236     +   6 Y6        -+-+XX
   237     +                   00
   238     +                    *
   239
   240     +   7 Y7        +X.X+XX
   241     +                  N  0
   242     +                     *
   243
   244     +   8 Y8          ..XX X
```

```
Listing of -A at 20:44:24 on FEB 12, 1992 for CCId=KENS on G

  245     +                        O
  246     +                        •
  247
  248     +   9 Y9         -+X.+X-XX
  249     +                      O
  250     +                      •
  251
  252     +  10 Y10        . .... ..X
  253     +                       O
  254     +                       •
  255
  256     +  11 X1         .-..X-- ..X
  257     +                       O
  258     +                       •
  259
  260     +  12 X2               .-.   X
  261     +                            O
  262     +                            •
  263
  264     +  13 X3         .  ...     +X
  265     +                            O
  266     +                            •
  267
  268     +  14 X4         .-.-       .. X
  269     +                             O
  270     +                             •
  271
  272     +  15 X5          -..       --+.X
  273     +                             O
  274     +                             •
  275
  276     +  16 X6         -+ +...    .  ..X
  277     +                             O
  278     +                             •
  279
  280     +  17 X7               .    .X.  .-X
  281     +                             O
  282     +                             •
  283
  284     +  18 X8         .. .  .-  X.   --XX
  285     +                             OO
  286     +                             ••
  287
  288     +  19 X9         .    ..-   . . . X+.X
  289     +                               O
  290     +                               •
  291
  292     +  20 X10        --++XX--- .- . .+.+X
  293     +                 NO              O
  294     +                                 •
  295
  296     +  21 X11        ---. -.+-.     - -+ -X
  297     +                                   O
  298     +                                   •
  299
  300
  301
  302
```

```
Listi   f -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

    THE ABSOLUTE VALUES OF
    THE MATRIX ENTRIES HAVE BEEN PRINTED ABOVE IN SHADED FORM
    ACCORDING TO THE FOLLOWING SCHEME

+
+
+                 LESS THAN OR EQUAL TO        0.085
+     .         0.085  TO AND INCLUDING        0.171
+
+
+     -         0.171  TO AND INCLUDING        0.256
+
+
+     +         0.256  TO AND INCLUDING        0.341
+
+
+     X         0.341  TO AND INCLUDING        0.427
+
+
+     X         0.427  TO AND INCLUDING        0.512
+    N
+
+     X         0.512  TO AND INCLUDING        0.597
+     O
+
+     X                    GREATER THAN        0.597
+     O
+     *
1PAGE   8  BMDP8M CA ANALYSIS1


 SQUARED MULTIPLE CORRELATIONS OF EACH VARIABLE IN
 SECOND SET WITH ALL OTHER VARIABLES IN SECOND SET

            VARIABLE
       NUMBER     NAME    R-SQUARED

           11 X1            0.27870
           12 X2            0.15797
           13 X3            0.14094
           14 X4            0.14294
           15 X5            0.20251
           16 X6            0.28962
           17 X7            0.57249
           18 X8            0.54052
           19 X9            0.30040
           20 X10           0.31611
           21 X11           0.17123


 SQUARED MULTIPLE CORRELATIONS OF EACH VARIABLE IN
```

FIRST SET WITH ALL OTHER VARIABLES IN FIRST SET

VARIABLE NUMBER	NAME	R-SQUARED
1	Y1	0.55406
2	Y2	0.54203
3	Y3	0.31940
4	Y4	0.40872
5	Y5	0.50500
6	Y6	0.50260
7	Y7	0.35897
8	Y8	0.38060
9	Y9	0.32871
10	Y10	0.17201

EIGENVALUE	CANONICAL CORRELATION	NUMBER OF EIGENVALUES	BARTLETT'S TEST FOR REMAINING EIGENVALUES		
			CHI-SQUARE	D.F.	TAIL PROB.
			184.89	110	0.0005
0.48219	0.69440	1	107.07	90	0.1058
0.31804	0.56395	2	73.39	72	0.4323
0.25289	0.50288	3	47.73	56	0.7762
0.20691	0.45487	4	27.33	42	0.9609
0.15433	0.39284	5	12.58	30	0.9978
0.06198	0.24896	6	6.95	20	0.9968
0.04775	0.21852	7	2.65	12	0.9976
0.02082	0.14428	8	0.80	6	0.9922
0.00693	0.08325	9	0.18	2	0.9121
0.00209	0.04569				

BARTLETT'S TEST ABOVE INDICATES THE NUMBER OF CANONICAL VARIABLES NECESSARY TO EXPRESS THE DEPENDENCY BETWEEN THE TWO SETS OF VARIABLES. THE NECESSARY NUMBER OF CANONICAL VARIABLES IS THE SMALLEST NUMBER OF EIGENVALUES SUCH THAT THE TEST OF THE REMAINING EIGENVALUES IS NON-SIGNIFICANT. FOR EXAMPLE, IF A TEST AT THE .01 LEVEL WERE DESIRED, THEN 1 VARIABLES WOULD BE CONSIDERED NECESSARY. HOWEVER, THE NUMBER OF CANONICAL VARIABLES OF PRACTICAL VALUE IS LIKELY TO BE SMALLER.

COEFFICIENTS FOR CANONICAL VARIABLES FOR FIRST SET OF VARIABLES

	CNVRF1	CNVRF2	CNVRF3	CNVRF4	CNVRF5	CNVRF6	CNVRF7	CNVRF8

		1	2	3	4	5	6	7	8
Y1	1	-0.847574E-01	0.448147E-01	-0.201114	0.110307	0.801584	-0.225197	-0.830778	-0.251964 E-02
Y2	2	0.188111	-0.141545	-0.471261	0.832127	-0.621537	0.389238	0.838411	-0.887793 E-01
Y3	3	0.829387	-0.195619	-0.458229	-1.51671	0.788922	1.86332	-0.265540	0.837376
Y4	4	0.280169	-0.337391	0.183684	1.20852	-0.656682	-0.308533	-0.308752	0.589496 E-01
Y5	5	0.394264	-0.217087	0.713146	-0.310529	-0.220885	-0.473521E-01	-0.272625	-0.291718 E-01
Y6	6	0.396379	0.696658	-0.309953	-0.125036E-01	0.325874	-0.340023E-01	0.228684	-0.718975
Y7	7	-0.106794E-01	-0.499574E-01	-0.153085	-0.569704	-0.303002	-0.294252	0.531329E-01	0.552055
Y8	8	-0.138312	0.344614	0.262621	0.464482	-0.476397E-02	0.122940	0.103864	0.756152
Y9	9	-0.239187	-0.873990	0.828764E-01	-0.610415E-01	0.678783	-0.817052	0.610947	-0.426102 E-01
Y10	10	0.183847	-0.407511	0.748881	0.900754E-02	-0.404408	0.514217	0.237706	-0.793041

		CNVRF9 9	CNVRF10 10
Y1	1	0.714358	-0.316231
Y2	2	0.171685	0.490670
Y3	3	-0.665442	0.105029
Y4	4	-0.956593	-0.516727
Y5	5	-0.924447E-01	0.567998
Y6	6	-0.648994E-01	-0.330881
Y7	7	0.398325	-0.349190
Y8	8	0.214311	-0.224141
Y9	9	-0.279773	0.119487
Y10	10	0.135879	-0.706247

STANDARDIZED COEFFICIENTS FOR CANONICAL VARIABLES FOR FIRST SET OF VARIABLES

(THESE ARE THE COEFFICIENTS FOR THE STANDARDIZED VARIABLES - MEAN ZERO, STANDARD DEVIATION ONE.)

		CNVRF1 1	CNVRF2 2	CNVRF3 3	CNVRF4 4	CNVRF5 5	CNVRF6 6	CNVRF7 7	CNVRF8 8	CNVRF9 9	CNVRF10 10
Y1	1	-0.089	0.047	-0.210	0.115	0.837	-0.235	-0.868	-0.003	0.746	-0.330
Y2	2	0.188	-0.141	-0.470	0.630	-0.620	0.388	0.836	-0.089	0.171	0.489
Y3	3	0.344	-0.081	-0.190	-0.629	0.327	0.772	-0.110	0.347	-0.276	0.044
Y4	4	0.195	-0.234	0.128	0.839	-0.456	-0.214	-0.214	0.041	-0.664	-0.359
Y5	5	0.498	-0.274	0.901	-0.392	-0.279	-0.060	-0.345	-0.037	-0.117	0.718
Y6	6	0.455	0.799	-0.355	-0.014	0.373	-0.039	0.262	-0.824	-0.074	-0.379
Y7	7	-0.013	-0.059	-0.181	-0.673	-0.358	-0.348	0.063	0.652	0.471	-0.413
Y8	8	-0.166	0.414	0.316	0.559	-0.006	0.148	0.125	0.909	0.258	-0.270
Y9	9	-0.187	-0.685	0.065	-0.048	0.532	-0.640	0.479	-0.033	-0.219	0.094
Y10	10	0.131	-0.290	0.532	0.006	-0.287	0.365	0.169	-0.564	0.098	-0.502

COEFFICIENTS FOR CANONICAL VARIABLES FOR SECOND SET OF VARIABLES

		CNVRS1	CNVRS2	CNVRS3	CNVRS4	CNVRS5	CNVRS6	CNVRS7	CNVRS8
		1	2	3	4	5	6	7	8
X1	11	-0.248645E-01	0.176673E-01	-0.479708E-01	0.144355E-01	0.701834E-02	0.299714E-02	-0.430244E-01	0.141826E-01
X2	12	-0.497958	0.996118E-01	0.458377	1.76179	2.18412	-1.38498	-0.432249	-0.177180
X3	13	-0.553802	0.402720E-01	0.329216	-0.619149	-0.380305	0.551678	0.161181	1.82227
X4	14	-0.600340E-01	-0.997042E-02	0.331188E-01	-0.257982E-01	0.630947E-01	-0.926368E-01	0.174540	-0.837270E-01
X5	15	-0.101621	0.492647E-01	0.129813	-0.142884	0.232188	-0.230808	-0.345933	0.202716
X6	16	0.476452E-01	-0.122634	-0.100158	0.503975	-0.338179	-0.394124	0.100396	0.504011
X7	17	-0.155817E-02	0.191602E-01	-0.822020E-01	0.372740E-02	0.151817E-01	-0.214843E-02	0.467461E-01	0.318045E-02
X8	18	-0.894835E-02	-0.388778E-01	0.744352E-01	0.260708E-01	-0.110774E-02	0.850929E-02	0.107359E-01	0.278015E-01
X9	19	0.129682E-01	-0.300908E-01	0.209518E-01	0.201020E-01	0.176198	0.305801	0.448016E-01	-0.972685E-01
X10	20	0.217469	0.353472E-01	0.347348E-01	-0.237330E-01	0.161002	0.571983E-01	-0.521863E-01	0.627245E-01
X11	21	0.215230E-01	-0.164288	-0.245235E-01	-0.418621E-01	0.640329E-01	-0.138058E-01	-0.569757E-02	0.452093E-01

		CNVRS9	CNVRS10
		9	10
X1	11	-0.826634E-01	-0.321857E-01
X2	12	0.409156	1.46151
X3	13	0.802200	-0.893465
X4	14	0.529470E-02	-0.984943E-01
X5	15	0.416778	-0.154048
X6	16	0.147936	-0.250227
X7	17	0.523986E-01	0.143288E-01
X8	18	-0.472901E-01	0.980702E-02
X9	19	0.958769E-01	-0.103951
X10	20	-0.958499E-01	-0.606277E-01
X11	21	-0.175840E-01	-0.269248E-02

STANDARDIZED COEFFICIENTS FOR CANONICAL VARIABLES FOR SECOND SET OF VARIABLES

(THESE ARE THE COEFFICIENTS FOR THE STANDARDIZED VARIABLES - MEAN ZERO, STANDARD DEVIATION ONE.)

			CNVRS1	CNVRS2	CNVRS3	CNVRS4	CNVRS5	CNVRS6	CNVRS7	CNVRS8	CNVRS9	CNVRS10
			1	2	3	4	5	6	7	8	9	10
X1	11		-0.280	0.199	-0.540	0.162	0.079	0.034	-0.484	0.160	-0.705	-0.362
X2	12		-0.143	0.029	0.132	0.507	0.628	-0.398	-0.124	-0.051	0.118	0.420
X3	13		-0.224	0.016	0.133	-0.250	-0.154	0.223	0.065	0.737	0.324	-0.361
X4	14		-0.254	-0.042	0.140	-0.109	0.267	-0.391	0.738	-0.354	0.022	-0.416
X5	15		-0.149	0.072	0.190	-0.210	0.341	-0.339	-0.507	0.297	0.611	-0.226
X6	16		0.070	-0.179	-0.148	0.737	-0.494	-0.576	0.147	0.074	0.216	-0.366
X7	17		-0.024	0.291	-0.943	0.057	0.230	-0.033	0.709	0.048	0.795	0.217
X8	18		-0.121	-0.528	1.010	0.354	-0.015	0.115	0.148	0.377	-0.642	0.133
X9	19		0.039	-0.090	0.063	0.060	0.528	0.916	0.134	-0.291	0.287	-0.311
X10	20		0.817	0.133	0.131	-0.089	0.605	0.215	-0.196	0.236	-0.360	-0.228
X11	21		0.123	-0.941	-0.140	-0.240	0.367	-0.078	-0.033	0.259	-0.101	-0.015

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CANONICAL VARIABLE SCORES

LABEL	CASE NO.	WEIGHT	CNVRF1	CNVRF2	CNVRF3	CNVRF4	CNVRF5	CNVRF6	CNVRF7	CNVRF8	CNV
RF9											
		CNVRS10									
		CNVRS10									
	1	1.000	-0.539	-2.099	1.377	0.063	-1.487	1.130	2.282	-1.720	0
.288											
		-1.374									
		-1.374									
	2	1.000	1.035	2.187	0.948	-1.715	-0.832	-0.572	0.302	1.163	0
.742											
		-0.715									
		-0.715									
	3	1.000	-0.514	-0.438	-1.533	0.834	-1.268	0.965	1.639	-0.695	-0
.280											
		-0.238									
		-0.238									
	4	1.000	-0.132	0.225	2.445	0.888	0.457	1.566	-0.718	-1.381	1
.698											
		-0.775									
		-0.775									
	5	1.000	-1.242	-2.827	1.784	1.340	1.951	-0.976	1.487	-0.086	0
.959											
		1.366									
		1.366									
	6	1.000	-0.335	-0.250	0.744	-1.046	0.029	-0.305	-1.256	0.730	0
.519											
		0.544									
		0.544									
	7	1.000	1.465	1.585	-0.458	-0.805	-1.069	-0.141	1.044	0.226	1
.586											
		1.138									
		1.138									
	8	1.000	0.770	-0.523	0.692	1.464	-0.651	-0.785	-1.802	-1.179	-2
.072											
		0.163									
		0.163									

Listing of -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

567		9	1.000	1.519	-1.772	1.009	-0.829	-1.942	1.162	0.269	-2.321	3
	.294											
568			0.157									
569			0.157									
570		10	1.000	-0.941	-1.171	-0.979	0.141	0.034	-0.241	1.412	-0.649	-0
	.732											
571			-1.038									
572			-1.038									
573		11	1.000	0.121	0.700	0.379	0.608	0.031	0.468	-0.139	0.126	0
	.441											
574			-0.117									
575			-0.117									
576		12	1.000	-0.808	-0.352	-1.589	-0.827	-0.449	-0.238	0.077	0.495	1
	.059											
577			0.868									
578			0.868									
579		13	1.000	0.575	-0.230	0.710	0.145	-0.798	-0.251	-0.663	-1.236	-1
	.830											
580			1.687									
581			1.687									
582		14	1.000	0.689	-1.090	0.607	-0.098	-1.929	0.823	0.822	-0.783	-0
	.558											
583			1.030									
584			1.030									
585		15	1.000	0.169	-0.011	1.193	1.408	-1.141	0.968	0.302	1.483	0
	.800											
586			0.839									
587			0.839									
588		16	1.000	-0.377	0.201	-0.259	1.843	-0.497	0.435	2.518	0.783	-0
	.074											
589			-0.174									
590			-0.174									
591		17	1.000	-0.238	1.583	-0.948	0.009	0.624	0.241	0.524	-1.199	-0
	.539											
592			1.063									
593			1.063									
594		18	1.000	1.377	-0.198	-0.103	-0.442	-1.031	-2.327	0.258	-1.001	-2
	.001											
595			-1.442									
596			-1.442									
597		19	1.000	0.299	1.935	-1.520	-0.468	0.954	0.084	0.649	-2.674	-0
	.818											
598			0.015									
599			0.015									
600		20	1.000	0.330	1.538	0.540	-0.037	0.979	0.044	-0.748	-0.504	0
	.205											
601			0.063									
602			0.063									
603		21	1.000	-0.787	-0.252	-1.283	0.312	0.157	0.350	-0.030	-0.609	0
	.263											
604			-1.974									
605			-1.974									
606		22	1.000	0.761	1.436	0.415	0.896	2.739	-0.792	-0.901	-0.632	1
	.582											
607			-0.336									
608			-0.336									
609		23	1.000	-0.323	0.714	-0.126	-0.178	0.879	0.003	-0.808	-0.512	0
	.148											

610			1.098								
611			1.098								
612		24	1.000	-0.060	-2.351	0.878	2.249	1.187	-1.550	-0.550	0.698	0
	.498											
613			-1.063								
614			-1.063								
615		25	1.000	-0.845	-0.218	0.421	0.043	-0.432	0.824	0.304	-0.554	-0
	.274											
616			0.659								
617			0.659								
618		26	1.000	0.773	0.440	-1.811	1.358	-0.192	-0.204	-0.093	-1.556	0
	.368											
619			0.100								
620			0.100								
621		27	1.000	0.062	-0.876	0.205	-2.494	0.148	2.387	-0.448	0.592	0
	.708											
622			-0.278								
623			-0.278								
624		28	1.000	-0.393	-0.469	-0.550	0.002	-0.084	0.303	-0.302	-0.638	0
	.170											
625			-1.491								
626			-1.491								
627		29	1.000	1.819	-1.420	-0.215	2.137	-2.077	-1.695	-2.209	0.324	-0
	.154											
628			-0.668								
629			-0.668								
630		30	1.000	0.542	1.099	0.328	-1.182	-0.121	-0.148	0.032	-0.706	-0
	.326											
631			-0.809								
632			-0.809								
633		31	1.000	0.135	-0.594	-2.546	-1.032	0.823	2.083	-0.234	0.689	0
	.881											
634			-0.198								
635			-0.198								
636		32	1.000	-0.912	-0.255	-0.896	-1.570	-0.629	-0.402	0.069	0.587	0
	.173											
637			-0.578								
638			-0.578								
639		33	1.000	-0.378	1.014	0.338	0.176	0.072	0.351	0.126	0.247	-0
	.352											
640			-0.307								
641			-0.307								
642		34	1.000	-0.658	-0.128	0.079	-1.416	-0.855	-0.327	-0.100	1.314	0
	.295											
643			-0.225								
644			-0.225								
645		35	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
646			0.535								
647			0.535								
648		36	1.000	0.954	0.236	0.477	0.567	0.089	-0.839	3.094	-0.204	-0
	.270											
649			0.445								
650			0.445								
651		37	1.000	1.801	-0.368	-1.591	0.266	-0.055	-1.574	0.315	-1.363	1
	.521											
652			0.419								
653			0.419								

654		38	1.000	-0.120	1.141	1.314	0.330	-0.153	0.426	-0.042	0.974	-0
	.230											
655			1.054									
656			1.054									
657		39	1.000	2.837	-0.449	-1.177	0.274	3.098	2.587	0.547	0.881	-0
	.642											
658			-0.082									
659			-0.082									
660		40	1.000	-0.512	-0.785	1.509	1.268	-1.066	2.139	0.891	-1.476	1
	.098											
661			0.527									
662			0.527									
663		41	1.000	-0.781	1.181	-0.528	-0.083	-0.010	0.104	0.452	0.828	0
	.139											
664			-0.018									
665			-0.018									
666		42	1.000	0.777	0.428	1.102	0.504	1.013	-0.934	2.203	-0.667	-0
	.840											
667			-0.742									
668			-0.742									
669		43	1.000	-1.029	0.189	-0.328	0.034	-0.028	0.309	0.067	0.239	-0
	.409											
670			-2.302									
671			-2.302									
672		44	1.000	-0.238	0.669	0.076	-0.289	0.077	0.228	0.023	-0.509	-0
	.567											
673			0.286									
674			0.286									
675		45	1.000	-0.842	-0.842	-0.866	-0.931	-1.589	-1.005	-0.187	1.198	-0
	.385											
676			0.982									
677			0.982									
678		46	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
679			-0.070									
680			-0.070									
681		47	1.000	-0.975	-0.110	-0.791	-0.320	0.779	-0.039	-0.868	-0.520	0
	.091											
682			0.250									
683			0.250									
684		48	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
685			-0.052									
686			-0.052									
687		49	1.000	0.969	1.231	1.027	2.068	0.276	-0.025	-1.218	0.191	0
	.256											
688			-0.511									
689			-0.511									
690		50	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
691			-0.352									
692			-0.352									

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696 CANONICAL VARIABLE SCORES

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698

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Listin    -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

  699                CASE
  700     LABEL       NO.    WEIGHT     CNVRF1     CNVRF2     CNVRF3     CNVRF4     CNVRF5     CNVRF6     CNVRF7     CNVRF8     CNV
          RF9
  701                        CNVRS10
  702                        CNVRS10
  703
  704                 51       1.000     -0.613     -0.477     -0.538     -2.340     -0.351     -0.969     -0.981      1.107      1
          .193
  705                       -0.829
  706                       -0.829
  707                 52       1.000     -1.167      0.534     -0.065      0.499     -0.033      0.432      0.170      0.995     -0
          .195
  708                       -1.287
  709                       -1.287
  710                 53       1.000      0.464     -0.752     -0.205      1.330     -0.150      0.659     -0.728     -0.123      1
          .972
  711                        0.338
  712                        0.338
  713                 54       1.000      1.514      1.788     -0.667      0.292     -1.695      0.371      1.988      0.894      1
          .972
  714                        0.410
  715                        0.410
  716                 55       1.000      0.274      0.924      2.027      0.019     -0.374      0.379     -0.315      0.944     -0
          .323
  717                       -2.439
  718                       -2.439
  719                 56       1.000     -0.205      1.186      1.113      0.440      0.648      0.201     -0.873      0.971      0
          .484
  720                       -1.361
  721                       -1.361
  722                 57       1.000      0.317     -0.454      1.197     -1.898      1.404     -3.023      2.135      1.035     -0
          .097
  723                       -0.149
  724                       -0.149
  725                 58       1.000     -0.890     -0.155     -0.590     -0.430     -0.023      0.186     -0.037     -0.517     -0
          .824
  726                       -0.399
  727                       -0.399
  728                 59       1.000     -0.378      0.100      1.361     -0.122     -0.474      0.338     -0.375      0.936     -0
          .380
  729                        1.370
  730                        1.370
  731                 60       1.000      0.977     -0.330      1.305     -0.345     -0.320     -1.321      0.061     -0.718     -1
          .654
  732                       -0.351
  733                       -0.351
  734                 61       1.000      1.311      1.478      0.423     -2.644     -0.622     -0.818      0.094     -0.350      0
          .314
  735                       -0.045
  736                       -0.045
  737                 62       1.000      3.956     -2.344     -1.844     -0.595      2.341      2.134      0.435      3.450     -2
          .305
  738                        0.749
  739                        0.749
  740                 63       1.000     -0.281     -0.512     -0.256      1.105     -1.028     -0.177     -0.454      0.729     -0
          .174
  741                        0.378
  742                        0.378
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Listing of -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

743		64	1.000	-1.124	0.184	-0.682	-0.425	0.471	-0.210	-0.711	0.788	0
	.703											
744			0.079									
745			0.079									
746		65	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
747			0.928									
748			0.928									
749		66	1.000	-0.447	-0.935	-0.883	0.388	-1.444	-1.539	-1.326	1.254	-0
	.627											
750			0.056									
751			0.056									
752		67	1.000	-0.616	-0.080	-0.488	0.576	0.733	0.201	-1.029	0.116	1
	.099											
753			1.190									
754			1.190									
755		68	1.000	0.072	0.497	0.588	-0.489	0.658	-0.045	-1.081	-0.541	0
	.055											
756			0.986									
757			0.986									
758		69	1.000	0.472	1.545	0.987	1.636	0.317	-0.141	-0.953	0.311	-0
	.538											
759			0.457									
760			0.457									
761		70	1.000	0.394	-0.252	-0.689	1.162	-1.965	-1.108	-0.428	1.173	-0
	.399											
762			0.439									
763			0.439									
764		71	1.000	-0.695	-0.448	-0.608	0.889	0.122	-0.347	-1.177	-0.461	-0
	.866											
765			0.639									
766			0.639									
767		72	1.000	-0.840	0.048	-0.799	0.668	-0.649	0.699	0.905	0.150	-0
	.238											
768			-0.709									
769			-0.709									
770		73	1.000	0.870	-0.778	0.824	-0.895	-0.337	1.769	-1.053	1.077	-2
	.218											
771			-1.600									
772			-1.600									
773		74	1.000	-1.369	-1.903	-0.425	-0.552	1.335	-1.448	1.185	-0.603	-1
	.183											
774			-0.311									
775			-0.311									
776		75	1.000	0.928	0.832	0.886	-2.062	-0.645	-0.489	-0.188	-0.183	-0
	.020											
777			1.138									
778			1.138									
779		76	1.000	-0.013	-1.688	0.557	-0.460	1.778	-1.059	-1.898	-0.744	1
	.134											
780			-0.263									
781			-0.263									
782		77	1.000	-0.890	-0.155	-0.590	-0.430	-0.023	0.186	-0.037	-0.517	-0
	.624											
783			1.593									
784			1.593									
785		78	1.000	-0.358	-0.455	0.233	-0.720	1.940	-0.584	-3.075	-0.583	1
	.335											

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Listin    -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

  786                    -0.023
  787                    -0.023
  788            79       1.000      0.303     -1.763      2.354     -0.861      1.802      2.020      1.069     -0.627     -0
      .242
  789                    -0.054
  790                    -0.054
  791            80       1.000     -1.305      0.879      0.198      0.963     -0.037      0.555      0.274      1.751      0
      .019
  792                    -2.127
  793                    -2.127
  794            81       1.000     -1.167      0.534     -0.065      0.499     -0.033      0.432      0.170      0.995     -0
      .195
  795                     1.126
  796                     1.126
  797            82       1.000     -0.909      1.575     -0.112      0.951      0.288      0.521      0.503      1.032     -0
      .046
  798                    -0.093
  799                    -0.093
  800            83       1.000     -0.773      0.317      0.848      0.188     -0.253      0.385     -0.102      0.966     -0
      .287
  801                    -2.149
  802                    -2.149
  803            84       1.000      0.293     -0.806      1.549     -1.362     -0.686      0.044     -0.855     -0.605     -0
      .901
  804                     2.152
  805                     2.152
  806            85       1.000      0.432     -0.902     -0.665     -0.379     -1.059     -0.223     -0.569      1.533      3
      .167
  807                     0.146
  808                     0.146
  809            86       1.000     -0.118      2.055      0.291      0.628      0.393      0.440      0.459      0.284     -0
      .203
  810                     0.568
  811                     0.568
  812            87       1.000     -0.634     -0.028      0.385     -0.276     -0.249      0.262     -0.206      0.210     -0
      .502
  813                     0.206
  814                     0.206
  815            88       1.000     -1.167      0.534     -0.065      0.499     -0.033      0.432      0.170      0.995     -0
      .195
  816                     2.450
  817                     2.450
  818            89       1.000      0.837      0.082      1.297     -0.829      0.069     -2.514      1.215      1.136     -0
      .774
  819                    -0.487
  820                    -0.487
  821            90       1.000      1.585      1.187     -0.053     -0.657      0.471      0.108     -0.162     -2.853     -0
      .210
  822                    -0.934
  823                    -0.934
  824            91       1.000     -1.029      0.189     -0.328      0.034     -0.028      0.309      0.067      0.239     -0
      .409
  825                    -0.498
  826                    -0.498
  827            92       1.000     -0.890     -0.155     -0.590     -0.430     -0.023      0.186     -0.037     -0.517     -0
      .624
  828                    -0.509
  829                    -0.509
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 830                  93      1.000      0.016     -0.117      2.074     -0.433     -0.695      0.290     -0.648      0.907     -0
        .472
 831                          0.438
 832                          0.438
 833                  94      1.000     -0.556      1.105     -0.357      2.196      1.438     -0.864      0.203      0.327     -0
        .632
 834                          2.063
 835                          2.063
 836                  95      1.000      3.430     -0.384     -1.784      1.228     -1.259      0.489     -1.179     -0.365     -0
        .778
 837                         -0.236
 838                         -0.236
 839                  96      1.000     -0.890     -0.155     -0.590     -0.430     -0.023      0.186     -0.037     -0.517     -0
        .624
 840                          0.256
 841                          0.256
 842                  97      1.000      0.366     -0.308     -1.654      0.801     -0.821     -0.464     -0.269     -0.285      0
        .831
 843                         -1.642
 844                         -1.642
 845                  98      1.000     -0.578      0.586     -1.101     -0.332      1.104     -0.073     -0.839     -1.239      0
        .026
 846                         -1.608
 847                         -1.608
 848                  99      1.000     -0.890     -0.155     -0.590     -0.430     -0.023      0.186     -0.037     -0.517     -0
        .624
 849                          2.274
 850                          2.274
 851                 100      1.000      0.627     -0.745     -0.821      0.329      1.945     -2.531      2.158      0.761      2
        .561
 852                          0.311
 853                          0.311
 854
 855      NUMERICAL CONSISTENCY CHECK
 856      --------------------------
 857
 858      THE FOLLOWING VARIANCES OF CANONICAL VARIABLES SHOULD ALL BE EQUAL TO ONE
 859
 860      CANONICAL VARIABLE       VARIANCE   RELATIVE ERROR
 861
 862
 863                CNVRF1    0.100000E+01    -0.488498E-14
 864                CNVRF2    0.100000E+01    -0.777156E-14
 865                CNVRF3    0.100000E+01    -0.777156E-14
 866                CNVRF4    0.100000E+01    -0.333067E-14
 867                CNVRF5    0.100000E+01    -0.399680E-14
 868                CNVRF6    0.100000E+01    -0.577316E-14
 869                CNVRF7    0.100000E+01    -0.577316E-14
 870                CNVRF8    0.100000E+01    -0.333067E-14
 871                CNVRF9    0.100000E+01     0.874301E-15
 872                CNVRF10   0.100000E+01    -0.288658E-14
 873                CNVRS1    0.100000E+01    -0.466294E-14
 874                CNVRS2    0.100000E+01    -0.643929E-14
 875                CNVRS3    0.100000E+01    -0.444089E-14
 876                CNVRS4    0.100000E+01    -0.199840E-14
 877                CNVRS5    0.100000E+01    -0.399680E-14
 878                CNVRS6    0.100000E+01    -0.310862E-14
 879                CNVRS7    0.100000E+01    -0.244249E-14
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Listi    -A at 20:44:24 on FEB 12, 1992 for CCid=KENS on G

 880                CNVRS8     0.100000E+01      0.549560E-14
 881                CNVRS9     0.100000E+01      0.000000E+00
 882                CNVRS10    0.100000E+01      0.299066E-13
 883    1PAGE   14  BMDP6M CA ANALYSIS1
 884
 885
 886     CANONICAL VARIABLE LOADINGS
 887     --------------------------
 888     (CORRELATIONS OF CANONICAL VARIABLES WITH ORIGINAL VARIABLES)
 889     FOR FIRST SET OF VARIABLES
 890
 891
 892
 893                    CNVRF1   CNVRF2   CNVRF3   CNVRF4   CNVRF5   CNVRF6   CNVRF7   CNVRF8   CNVRF9   CNVRF10
 894                         1        2        3        4        5        6        7        8        9         10
 895
 896     Y1          1    0.486   -0.346   -0.172    0.305    0.299   -0.021   -0.347   -0.000    0.556   -0.049
 897     Y2          2    0.585   -0.311   -0.321    0.335   -0.078    0.100    0.248    0.044    0.459    0.235
 898     Y3          3    0.545   -0.300   -0.200   -0.129    0.351    0.495    0.013    0.329   -0.240   -0.150
 899     Y4          4    0.574   -0.265   -0.205    0.344   -0.172   -0.215   -0.287    0.169   -0.380   -0.329
 900     Y5          5    0.775    0.014    0.404    0.000    0.018   -0.248   -0.053    0.090    0.200    0.351
 901     Y6          6    0.747    0.429    0.009   -0.000    0.225   -0.285    0.297   -0.102   -0.006   -0.166
 902     Y7          7    0.497   -0.121   -0.219   -0.328   -0.353   -0.398    0.098    0.286    0.283   -0.359
 903     Y8          8    0.176    0.325    0.509    0.298    0.319    0.080    0.368    0.487    0.142   -0.118
 904     Y9          9    0.284   -0.434    0.141    0.062    0.550   -0.324    0.521    0.142   -0.053   -0.070
 905     Y10        10   -0.018   -0.372    0.433   -0.010   -0.042    0.394    0.196   -0.314    0.305   -0.535
 906
 907    ------------------------------
 908
 909     SQUARED MULTIPLE CORRELATIONS OF EACH VARIABLE IN THE
 910     FIRST SET WITH ALL VARIABLES IN THE SECOND SET.
 911
 912
 913                                ADJUSTED        F     DEGREES OF
 914        VARIABLE   R-SQUARED  R-SQUARED  STATISTIC     FREEDOM     P-VALUE
 915
 916        1 Y1       0.200123   0.100139       2.00   11     88     0.0425
 917        2 Y2       0.251345   0.157763       2.69   11     88     0.0064
 918        3 Y3       0.222132   0.124899       2.28   11     88     0.0197
 919        4 Y4       0.229454   0.133136       2.38   11     88     0.0150
 920        5 Y5       0.335520   0.252460       4.04   11     88     0.0001
 921        6 Y6       0.344820   0.262923       4.21   11     88     0.0001
 922        7 Y7       0.169985   0.088733       1.88   11     88     0.0591
 923        8 Y8       0.160209   0.055235       1.53   11     88     0.1435
 924        9 Y9       0.171254   0.067660       1.65   11     88     0.1049
 925       10 Y10      0.106788  -0.004868       0.96   11     88     0.4869
 926    1PAGE   15  BMDP6M CA ANALYSIS1
 927
 928
 929     CANONICAL VARIABLE LOADINGS
 930     --------------------------
 931     (CORRELATIONS OF CANONICAL VARIABLES WITH ORIGINAL VARIABLES)
 932     FOR SECOND SET OF VARIABLES
 933
 934
 935
 936                    CNVRS1   CNVRS2   CNVRS3   CNVRS4   CNVRS5   CNVRS6   CNVRS7   CNVRS8   CNVRS9   CNVRS10
 937                         1        2        3        4        5        6        7        8        9         10
```

X1	11	-0.491	0.182	-0.423	0.175	0.237	0.043	-0.168	0.203	-0.514	-0.310
X2	12	-0.228	-0.075	0.094	0.468	0.424	-0.134	-0.091	-0.019	0.202	0.376
X3	13	-0.213	-0.025	0.104	-0.041	-0.127	0.181	0.204	0.615	0.268	-0.159
X4	14	-0.228	0.094	0.165	-0.283	0.287	-0.393	0.499	-0.260	-0.188	-0.488
X5	15	-0.162	0.226	0.184	-0.178	0.293	-0.281	-0.429	0.133	0.236	-0.283
X6	16	0.332	-0.241	-0.062	0.662	-0.285	-0.147	-0.052	-0.024	0.244	-0.473
X7	17	-0.014	0.284	-0.369	0.103	0.237	0.048	0.443	0.494	-0.054	0.253
X8	18	-0.195	0.135	0.270	0.247	0.144	0.111	0.292	0.488	-0.363	0.148
X9	19	-0.137	-0.216	0.040	0.388	0.194	0.632	-0.121	-0.349	0.288	-0.356
X10	20	0.798	0.306	0.067	0.008	0.286	-0.118	0.137	0.279	-0.175	-0.205
X11	21	0.051	-0.892	-0.326	-0.219	0.139	-0.092	-0.078	0.031	0.017	0.033

SQUARED MULTIPLE CORRELATIONS OF EACH VARIABLE IN THE
SECOND SET WITH ALL VARIABLES IN THE FIRST SET.

VARIABLE	R-SQUARED	ADJUSTED R-SQUARED	F STATISTIC	DEGREES OF FREEDOM		P-VALUE
11 X1	0.191498	0.100856	2.11	10	89	0.0318
12 X2	0.104202	0.003551	1.04	10	89	0.4210
13 X3	0.040155	-0.067692	0.37	10	89	0.9555
14 X4	0.087646	-0.014866	0.85	10	89	0.5778
15 X5	0.071904	-0.032378	0.69	10	89	0.7318
16 X6	0.178051	0.085697	1.93	10	89	0.0515
17 X7	0.085925	-0.016780	0.84	10	89	0.5948
18 X8	0.069130	-0.035463	0.66	10	89	0.7574
19 X9	0.090021	-0.012224	0.88	10	89	0.5544
20 X10	0.354181	0.281617	4.88	10	89	0.0000
21 X11	0.294850	0.215819	3.72	10	89	0.0003

CANON. VAR.	AVERAGE SQUARED LOADING FOR EACH CANONICAL VARIABLE (1ST SET)	AV. SQ. LOADING TIMES SQUARED CANON. CORREL. (1ST SET)	AVERAGE SQUARED LOADING FOR EACH CANONICAL VARIABLE (2ND SET)	AV. SQ. LOADING TIMES SQUARED CANON. CORREL. (2ND SET)	SQUARED CANON. CORREL.
1	0.27209	0.13120	0.11116	0.05360	0.48219
2	0.10081	0.03206	0.10840	0.03448	0.31804
3	0.08931	0.02258	0.05323	0.01346	0.25289
4	0.05403	0.01118	0.09744	0.02016	0.20691
5	0.08304	0.01281	0.06515	0.01005	0.15433
6	0.08700	0.00539	0.06759	0.00419	0.06198
7	0.08109	0.00387	0.07588	0.00362	0.04775
8	0.05948	0.00124	0.10807	0.00225	0.02082
9	0.09581	0.00068	0.07053	0.00049	0.00693
10	0.07736	0.00018	0.09650	0.00020	0.00209

THE AVERAGE SQUARED LOADING TIMES THE SQUARED CANONICAL
CORRELATION IS THE AVERAGE SQUARED CORRELATION OF A
VARIABLE IN ONE SET WITH THE CANONICAL VARIABLE FROM