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THE CROP SURVEYS AT STATISTICS CANADA

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ABSTRACT

Statistics Canada redesigns its agricultural surveys every five years following the Census of Agriculture. The agricultural statistics program includes, among others, separate surveys covering crops, livestock and farm finances. The redesigned crop surveys are carried out on six occasions during a year with the first occasion using this new design in December 1997. The paper briefly reviews the key features of the new design, namely the use of a stratified list frame and the use of replicates to manage the sample over the various survey occasions. The overlap between the crops samples and samples for other major agricultural surveys is controlled by using the method of collocated sampling. Some evaluation of the results from the first year of crop surveys are highlighted and discussed.

KEY WORDS: Agricultural surveys; Survey design; Frame maintenance; Collocated sampling.

RÉSUMÉ

Statistique Canada remanie ses enquêtes agricoles à tous les cinq ans à la suite du recensement de l'agriculture. Le programme de statistique agricole comprend, entre autres, des enquêtes séparées couvrant les cultures, le bétail et les données financières. Les enquêtes de cultures sont menées lors de six occasions au cours d'une année et la première occasion d'enquête employant le nouveau plan de sondage a eu lieu en décembre 1997. L'article présente les principaux éléments du nouveau plan d'enquête, dont l'emploi d'une base de sondage de type liste stratifiée et l'emploi de répliques pour gérer les échantillons des différentes occasions d'enquêtes. Le chevauchement entre les échantillons de l'enquête des cultures et celles des autres enquêtes d'envergure est contrôlé en employant la méthode d'échantillonnage coordonné. Des résultats provenant de la première année complète d'enquêtes de cultures sont présentés et discutés.

MOTS-CLÉS : Enquêtes agricoles; plan de sondage; entretien de base de sondage; échantillonnage coordonné.

1. INTRODUCTION

Statistics Canada redesigns its agricultural surveys every five years following the Census of Agriculture. Section 2 of this paper presents how the survey designs have evolved considerably since the 1980s compared to the period spanning the 1950s to the 1970s. The agricultural statistics program includes separate surveys covering crops, livestock and farm finances. The new design for the crop survey, presented in Section 3, is comparable, in many aspects, to the previous design. Crop surveys are carried out on six occasions during a year. In addition, the survey population, the list frame, the frame stratification and sample allocation methods and the use of replicates to manage the samples across the six survey occasions are very similar to the previous design. However, a few changes have been very important ones, namely having dropped the area frame and the evaluation of the methods and procedures used to maintain the list frame.

The first crop survey occasion using the new design was conducted in December 1997. Section 4 provides some results that show that, in terms of precision, the new design produces as expected. The results also show that, in terms of level or coverage, the removal of the area frame has had an impact. Section 5 discusses some of the challenges that were addressed by the new design and the issues that have arisen as a result of the new design. Section 6 concludes with

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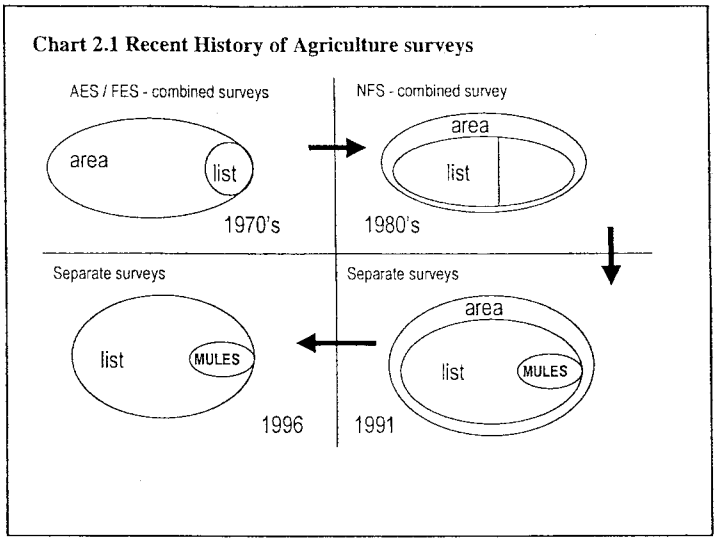


summary of the current situation and the work or research needed to address the new issues.

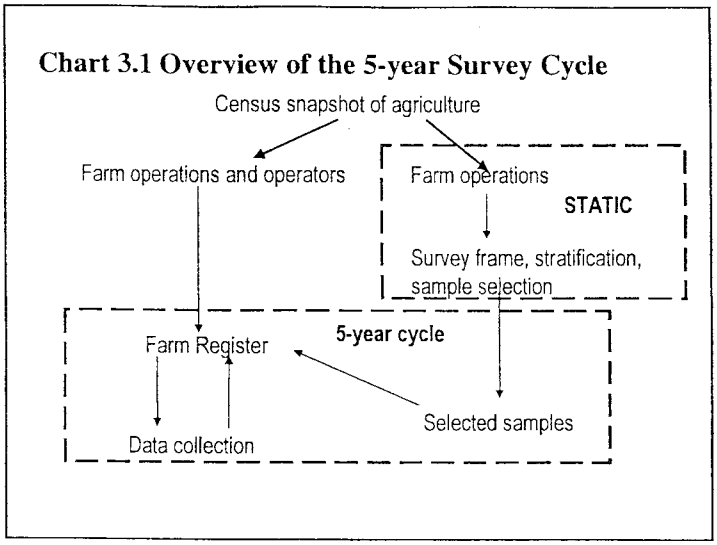
2. RECENT HISTORY

The major agricultural surveys undergo a redesign every five years following each Census of Agriculture. From the 1950s to the late 1970s, area frame designs were used for the regular agriculture surveys at Statistics Canada in the intercensal years (FAO, 1998). Chart 2.1 presents an overview of the evolution of the design of the major agricultural surveys over the last 30 years. Two major surveys in the 1970s, the Agriculture Enumeration Survey (AES) and the Farm Expenses Survey (FES) were based on an area frame supplemented by a small list frame of the larger farms that were selected with probability close to one. The AES collected information on crops, livestock and a few financial variables while the FES collected detailed information on farm income and expenses.

In the 1980s, the AES and FES were combined into one multi-purpose National Farm Survey (NFS) that also introduced the use of multiple survey frames (Ingram and Davidson, 1983; Julien and Maranda, 1990). The NFS combined a large list frame created from the census data and an area frame. Multivariate stratification based on livestock and crops variables was used to stratify the larger farms and simple stratification based on crop area was used to stratify the rest of the list farms. The NFS collected crops, livestock and financial variables.

Following the 1991 census, the NFS was broken into separate crops and livestock surveys (Trépanier and Théberge, 1993). The same list and area frames were used, but each survey had its own stratification scheme: multivariate stratification for the livestock survey and simple stratification for the crop survey. Each survey collected its specific commodity data and the crop survey also collected some financial data. During that period, a tax data program was developed using administrative data to cover detailed financial information, as well as a biennial Farm Financial Survey (FFS) that focused on farm capital, assets and debts. In order to control the respondent burden placed on certain farms selected for many surveys, a project called MULES (for MUlti-operation and Large Enterprise Statistics) was set up at Statistics Canada to profile and contact farms with multiple operations and the very large farms.

Prior to the most recent redesign that followed the 1996 Census, it was decided to drop the area frame for cost-benefit reasons and to redesign/redevelop the infrastructure that maintains the list frame (Farm Register). As a result, since December 1997, the crop surveys are using the new design, which is summarised, in the following section.



3. SURVEY REDESIGN

3.1 Overview of the 5-year Survey Cycle

The agricultural surveys at Statistics Canada go through a five-year cycle that starts with the Census of Agriculture that is conducted at the same time as the Census of Population. The five-year cycle presented in Chart 3.1 can be described as follows. The census provides a fairly complete and accurate snapshot of the agricultural sector. The most recent census took place on May 14, 1996. Two key elements were used in the redesign of the major agriculture surveys; first, the list of all farm operations that were enumerated and their operator(s) on Census Day was used to update Statistics Canada's Farm Register. The Farm Register is a database used to manage a large amount of dynamic information on farm operations, farm operators, survey samples and survey activities. Second, the commodity and financial information reported for those farms was used to build survey frames, to stratify the farms and to select samples. The redesign of the crops and livestock surveys, like the update of the Farm Register, is conducted only once at the start of the survey cycle. The crops and livestock survey designs are static and are kept intact for the whole cycle.

During the next five years, i.e. until the next census, the farms selected for a given survey and occasion are provided to the Farm Register where the most up-to-date information on the farm and its operator(s) is maintained. This information is provided to Statistics Canada's regional office staff who are responsible for collecting survey data. Data collection for the majority of agricultural surveys starts with a front-end module that records changes to the farm and its operator(s) (change in operating status, change in ownership, change of the farm operators, etc.). These changes are fed back to the Farm Register staff at the head office who update the Farm Register within 4 to 6 weeks of the completion of data collection. The new information is then available for the next survey occasion. Note that during the intercensal period, only the farms that are selected for surveys are subject to being updated on the Farm Register. There are no procedures to update all farms on the Farm Register other than the Census. Also note that, during the first year of the survey cycle, over 40% of the farms were selected for at least one survey occasion.

3.2 Survey Design

The target population for the crop surveys is made up of agricultural operations (farms) located in all provinces, except the Atlantic Provinces. The farms located in the Atlantic Provinces are covered by a multipurpose survey much like the NFS used in the 1980s. Note that a farm is defined as an agricultural operation producing agricultural products for sale.

The following units are excluded from the target population:

- community pastures;
- institutional farms;
- farms located on Indian reserves;
- farms that produce exclusively Christmas trees;
- hatcheries that reported no livestock inventory or field crop areas in the Census;

Table 3.1 Survey frame counts

Province	Census counts	Exclusions	Frame counts
Québec	35,991	1,115	34,876
Ontario	67,520	3,567	63,953
Manitoba	24,383	1,005	23,378
Saskatchewan	56,995	1,295	55,700
Alberta	59,007	2,165	56,842
British Columbia	21,835	1,744	20,091
Total	**265,731**	**10,891**	**254,840**

- farms with under $1,000 in sales in 1995, but excluding sheep farms under this limit;

These units are excluded because of conceptual problems that make their data irrelevant to survey objectives, or because of their small contribution to the estimates. As part of the redesign, the estimates obtained from each survey **are not adjusted** to take the exclusions into account. These generally represent 0.05% to 2.5% of the estimates of the main variables for field crops and livestock. Given that the census was both the most complete and up-to-date source available at the time of the redesign, the list frames include all census farms in the provinces covered, with the exception of the exclusions listed above. The survey frame counts are presented in Table 3.1.

In each province, the farms were first divided by estimation regions. For example, in Manitoba, Saskatchewan and Alberta, the estimation regions are the Crop Districts. The estimation regions were then grouped into sub-provincial strata. For example, in Saskatchewan, the 20 crop districts were grouped into 10 sub-provincial strata. The farms were then further stratified taking into account the following considerations:

- The sample is designed to obtain good estimates for several **variables of interest**, according to region (hay, oats, barley, corn, soy and winter wheat in Quebec and Ontario; wheat, oats, barley, hay and canola in Manitoba, Saskatchewan and Alberta). The chosen stratification must therefore allow for a homogeneous grouping of farms with various crops of interest (i.e., good correlation between the stratification variable and the variables of interest). It is important to note that growing speciality crops are becoming a more common practice and, thus, the variables of interest are expanding.
- The sample design developed will be used throughout the intercensal period, i.e., five years. The choice of stratification variable and the number of strata selected must allow for sample design **robustness** throughout the period in which it will be in effect.
- The estimates produced must be **accurate,** i.e., the coefficients of variation must be relatively low for the variable of interest, both provincially and in the estimation regions. This requires a high correlation between the stratification variable and the variables of interest. Generally, accuracy increases with the number of strata. However, the higher the number of strata, the greater the risk that the strata become obsolete in terms of the stratification variables (loss of robustness).
- Usually, a high number of strata results in more accurate estimates. However, there are restrictions as to the **minimum number of units per stratum**. Because replicates are created within each stratum (see below), a sufficient number of units is required to create those replicates. Also, rotation has been introduced in the new sample design, requiring a sufficient number of units in each combination of strata and replicates.

The recent redesign used a single variable to stratify the farms within substrata. The previous design had used total reported cropland, which included field crops, fruits and vegetables, and greenhouse, nursery and sod areas. After having evaluated the estimates from the previous design and tested several variables available from the 1996 census, it was decided to use the reported area of field crops in Quebec and Ontario, and the reported area of field crops and summerfallow in the other provinces. While some other variables would produce better estimates based on census data (for example area of major crops or other crop specific variables), it is expected that the variables used will

Table 3.2 Stratification

Province	Sub-provincial Strata	Sub-strata	Specified farms
Québec	7	36	4
Ontario	5	32	9
Manitoba	6	29	3
Saskatchewan	10	50	11
Alberta	8	42	9
B.-C. Peace River	1	4	2
B.-C. (rest)	1	7	12

provide a more robust design for the 5-year cycle because the number and area of the different crops actually seeded vary from one year to the other.

The crop surveys have a slightly asymmetric population with respect to field crop areas and thus, some units were selected with certainty. These units, referred to as specified units, were identified using the sigma-gap rule described in the next paragraph.

Let $X_1, X_2, ..., X_N$ be the stratification variable X for unit i $(i = 1, 2, ... N)$ ranked in ascending order for $X_i > 0$. Let k, if it exists, be the smallest number, where $X_k > MED$ and $X_k - X_{k-1} > \sigma$, where σ represents the standard error of the $X_i > 0$ and MED the median of the X_i. The farms having $X_i > X_k$ are said to be specified and placed in a special stratum.

The remaining units (non-specified) were divided into the number of strata determined for each sub-provincial region of stratification by using Sethi's algorithm (1963) to calculate the boundaries for each stratum. As this algorithm employs the Neyman, or optimum, allocation method, the boundaries calculated minimise the coefficient of variation at the provincial level. The number of sub-provincial strata, sub-strata and specified farms identified by the sigma-gap rule are presented in Table 3.2.

Crop surveys are carried out on 6 occasions during a year. The sample size by province and occasion are similar to the last designs. The crop survey sample design uses a replicate approach. Each farm in a population stratum was randomly ordered and systematically assigned to a replicate. For example, there are 20 replicates in Quebec, Ontario, Manitoba, Saskatchewan and Alberta. The overall sample size required to cover the six survey occasions make up the master sample. The portion of the master sample allocated to a stratum is evenly split across the 20 replicates. The sample is selected within each stratum and replicate. As a result, 20 samples are selected and each can represent the population.

For a given survey occasion, a certain number of replicates are chosen. Using such a sample design, it is easy to manage overlap among the various survey occasions. For example, if an overlap is desired between two survey occasions, the same or a part of the same replicates are selected for the two occasions. Otherwise, different replicates are selected. The challenge was to find the combination of the number of replicates and the size of each replicate which respects as much as possible the previously-calculated sample sizes and the required overlap between each survey period. Various tests were conducted to arrive at the best possible solution. Table 3.3 shows the survey occasions, the number of selected farms per replicate and the number of replicates per occasion. The sample size for a given occasion can be derived by multiplying the number of replicates by the replicate size. The sample size ranges from less than 11,000 in March and July to close to 32,000 in November. A new feature to the recent redesign is having divided the population into replicates before sample selection. This allows for sample rotation within the replicates.

Table 3.3 Survey occasions and sample sizes

Province (Number of farms per replicate)		QC (390)	ON (780)	MB (550)	SK (1000)	AB (775)	BC-Peace (100)	BC-rest (250)
Survey Occasion	Topic	Number of replicates						
March	Stocks	3	3	3	3	3	1	1
June	Stocks & seeding intentions	8	8	9	9	9	3	2
July	Seedings	3	3	3	3	3	1	1
September	Stocks	9	9	5	5	5	2	0
November	Yields	0	0	9	9	9	3	0
December	Yields	3	3	6	6	6	2	2

As mentioned earlier, the replicates are used to control the amount of overlap/independence between the survey occasion. Each province is divided into 20 replicates whose sample makes up the master sample. The chart provided in the appendix presents an example of how the replicates are used for the samples in Manitoba, Saskatchewan and Alberta. The March, June and July survey occasions are non-overlapping samples. The September sample is a subset of June. The November sample is a combination of the March and July samples, plus three more replicates and a follow-up to some farms contacted for the June occasion. Finally the December sample is a combination of the March and June samples. Altogether, a farm can be contacted for a maximum of three times during a year. However, due to having several separate surveys, some of these farms are also subject to being contacted for a livestock or financial survey. The challenge of controlling the respondent burden is discussed in section 5.1.

4. EVALUATION

4.1 Observed CV versus Expected CV

Based on the census data used to redesign the crop survey, the expected coefficient of variation (CV) of the more common or major crops like oats, wheat, barley and canola are very low, around 1.5% and 2.5%. Given the simple and robust stratification scheme, the expected CV is very closely related to the acreage estimated, low estimates of acreage usually have high CVs and high estimates of acreage have low CVs. As in the previous redesigns, the first estimates of CV produced by the new design, at the December 1997 occasion, were slightly higher than the expected CV. The ratio of the observed CV to the expected CV ranged from 1.25 to 3.

4.2 CV Before and After the Redesign

As mentioned in the previous section, the observed CV is closely related to the acreage of the crop estimated. To show this the log of the estimated CV was plotted against the estimated acreage for the more than 560 estimates of acreage produced during the first full year of the redesign surveys, from March 1998 to December 1998 (see Chart 4.1). Note that a Log (CV)=2 indicates a CV of 100% and a Log (estimate)=6 indicates an estimate of 1,000,000 acres. The plot presents a clear linear relationship of the type Log (CV) = $\alpha + \beta$ * Log (estimates). This indicates that the robust design provides estimates of similar estimated standard error for any crop in any province.

The estimated parameters α and β are presented in Table 4.1. These parameters were also calculated using the estimates produced with the old design in 1995 (at the middle of the survey cycle) and in 1997 (the year before the new design). The estimates produced at the beginning of the old design are not available. The parameters show that the new design produced slightly more precise estimates than those produced at the end of the old design (the β parameter is the lowest in 1998), which is expected. This is particularly the case for the estimates of the more common or major crops. The parameters calculated for 1995 and 1997 show that the old design was quite robust, with the parameters in 1997 just slightly lower than in 1995. Given the similarity between the new and old design, the new design is expected to be as robust. This will be monitored every year until the next redesign that will follow the 2001 Census and be implemented in 2003.

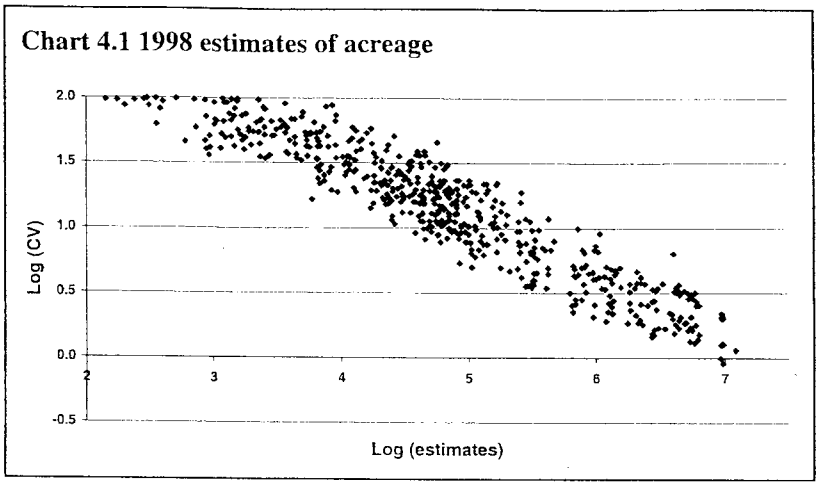
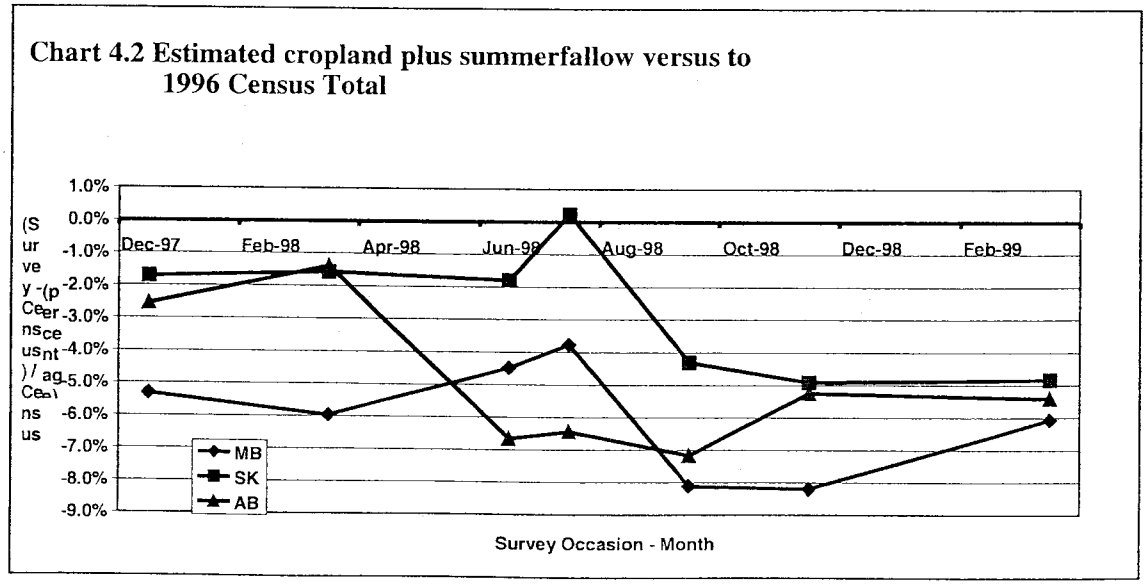


Table 4.1 Parameters of the linear relationship

Year	α	β
1995	3.16	-0.411
1997	3.13	-0.406
1998	3.19	-0.424

4.3 Estimates of Land Balance (Coverage)

The biggest change from the previous design is having dropped the area frame. This decision puts the onus on maintaining an accurate and timely list frame. This is one of the challenges discussed in the following section. In order to monitor how the current list frame only design is covering crop production, we compare the estimated cropland plus summerfallow to that of the total counted at the 1996 census. Chart 4.2 presents the percentage difference between the survey estimates produced since December 1997 and the Census total. The more recent estimates are 5% to 6% lower than the census total. One must consider that total cropland plus summerfallow tends to decrease due to urban development, that the survey estimates are subject to sampling and non-sampling error and that the census total themselves are also subject to non-sampling error. This said, such a decrease in cropland and summerfallow is more than expected and, thus, some of the decrease is due to frame deterioration.



5. CHALLENGES

5.1 Respondent Burden

One of the features of the current agricultural statistics program is to have several surveys instead of one large integrated survey like the National Farm Survey in the 1980s. As a result, some farms, especially the larger ones are subject to being contacted several times during the year for various small, medium or large surveys. In order to deal with this substantial respondent burden, in the early 1990s, Statistics Canada's Agriculture Division set up a special unit responsible for all survey activity (profiling, contacts, etc.) involving the larger farms. This unit makes special arrangements with the data providers in order to make contact at an appropriate time and to ask them for information on all surveys for which they are chosen. Presently, some 550 to 600 farming operations are dealt with using these special procedures.

The recent redesign used collocated sampling to control the respondent burden for the other 250,000 or so farms not covered by this special unit. The challenge was to spread the overall respondent burden of the major surveys among as many farms as possible. The overall respondent burden is substantial considering the six crop survey occasions have over 115,000 contacts per year, the four livestock-hogs survey occasions have 40,000 contacts per year and the Farm Financial Survey has 15,000 contacts.

A flexible method was required, with good statistical properties that would allow samples to be selected simultaneously, meaning with no priority given to either survey when selecting samples. The collocated sampling method was therefore used (see Grondin, 1997). Collocated sampling is a method used to co-ordinate the selection of several samples from the same sampling frame.

Using this method, a permanent random number (PRN) is first assigned from the uniform distribution [0,1) to each survey frame unit. The records are then ordered in each stratum (meaning here each stratum and replicate for the crop survey) in ascending PRN order, and the PRNs are then made equidistant as follows:

Let R_{ih} be the rank of unit i in stratum h;
ϵ_h be a random number from the uniform distribution [0,1) assigned to stratum h;
N_h be the number of units in stratum h.

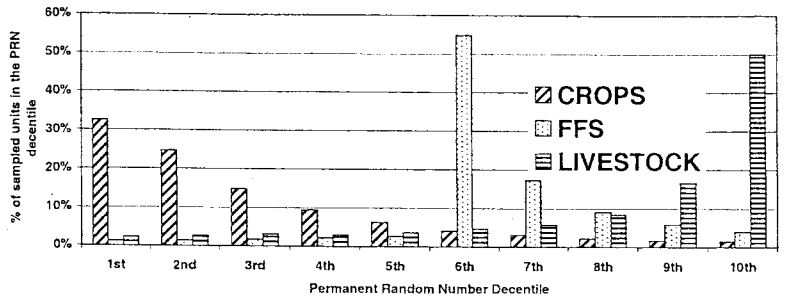
$$\text{Equidistant PRN} = \frac{R_{ih} + \varepsilon_h - 1}{N_h}$$

An interval of length 'f' between 0 and 1 is selected, where 'f' is the sampling fraction of the stratum. All records with the transformed PRN in the interval are thus selected. Overlap between the two surveys is managed by carefully choosing the intervals for each survey. Also, to rotate a sample, the selected interval is simply moved by r%, where r is the desired rotation rate.

To ensure good sub-provincial representation within the samples, some manipulation of the PRN was required. First, records are sorted by stratum, agricultural region and PRN. The PRNs in each agricultural region for each stratum were then made equidistant. This new random number was called the 'equidistant RN per region.' The next step was to resort by stratum and 'equidistant RN per region' which were interleaved the records for the various agricultural regions within the strata. Finally, the 'equidistant RNs per region' were made 'equidistant per stratum.' Thus, whatever the interval selected in a stratum, there will be good representation of all agricultural regions and the size of the sample will be stable over time.

The selection intervals were carefully chosen to minimise overlap between the crop and livestock surveys throughout the intercensal period, taking into account sample rotation. Various scenarios were simulated, using various selection intervals, for example, $[0,f_l)$ and $(1-f_l, 1]$,$[0,f_c)$ and $[0.60, 0.60+f_l)$ (where f_c is the sampling fraction of the crop survey and f_l is the sampling fraction of the livestock survey) and various sample rotation hypotheses. The option chosen uses the interval $[0,f_c)$ for the crop survey and the other end of the interval for the livestock survey, i.e., interval $[1-f_l, 1)$. Overlap is thus minimised for the first year, as well as for the five-year cycle. The sample for the Farm Financial Survey (FFS) was chosen starting at 0.50 to control the overlap with the other two major surveys. Dividing the farms decentiles according to their PRN, Chart 5.1 shows the distribution of the samples chosen for the 1998 crop survey, livestock survey and FFS. The crops sample is mostly concentrated among the lower percentiles, the livestock sample among the higher percentiles and the FFS sample among the middle percentile. As the year

Chart 5.1 Collocated sampling - Selection of samples for Crops, FFS and Livestock surveys



go by, the livestock sample will rotate to the left, towards the lower percentile, thus increasing the overlap with the crops sample.

5.2 Frame Maintenance

Having dropped the area frame puts additional pressure on keeping the list frame as accurate and up-to-date as possible. The census identified a list of farm operations and their operator(s). During the subsequent 5-year survey cycle, the challenge is to maintain the status of the farms (still in operation or not) and maintain our links to them (i.e. the farm operators). All but a few agricultural surveys used Computer-Assisted Telephone Interviewing (CATI). A standard front-end module was added to the CATI system a few months before implementing the new survey design. This module asks for and records changes to the farm's status and its operator(s). Some examples of changes it records are whether a farm operation is out-of-business, permanently (and under which circumstances) or temporarily (and when the farming activity will resume) or transactions between farm operators. If a selected farm was sold, the front-end will ask and record the information on the purchaser. In addition to changing the CATI front end, the procedures used to process the front-end data were also reviewed. As a result, Farm Register staff now review all the information provided by the front-end module before applying changes to the farm register. Usually, changes reported by respondents are put on the Farm Register and available for the next survey occasion within four to six weeks.

Maintaining an accurate list frame has been quite a challenge due to the number of changes in farm status and of transactions between farm operators. In fact, in 1998, close to 64,000 different farms were contacted for at least one crop survey occasion and, among these farms, over 6,900 changes and/or transactions were reported, representing over 10% of all farms contacted. The most common situation reported was a change-in-operators (over 2,850 sales, transfers or a change in farm operators). There were only 500 farms that were reported as having gone out-of-business.

As mentioned when presenting the evolution of the survey estimates of cropland plus summerfallow and the 1996 census total, there are some concerns about frame attrition leading to a decrease in coverage. There are some limitations to maintaining the list frame with the current framework and methodology.

First, obtaining complete information on the farm's status and its operator(s) is not always possible. The second most common changes reported in the CATI front-end leads to coding the farm as status unknown due to a lack of information or lack of definite information. There were over 2,100 such situations coded in 1998 by the crop surveys. Examples of such situations are:

- the transaction is in progress, but not finalised
- the old operator of a farm not being able or not willing to provide information on the operator who purchased his farm

While the situation can be clarified and coded accurately at a subsequent contact, the second situation becomes a 'dead-end' where the link between the farm register and the farm operation is broken (i.e. we have lost the farm operator). Since the implementation of the new farm register maintenance procedures, approximately one third of the farms that were coded to an unknown status were subsequently converted to a definite status. As a result, the number of farms remaining with an unknown status is increasing and so is the frame attrition. This situation

highlights one of the limitations of maintaining an agricultural survey list frame 'at a distance', i.e. by telephone surveys.

Second, obtaining accurate information on the farm's status and its operator(s) is not always possible. Farm operators are contacted for various agriculture surveys. Contacting a crop farm operator for a livestock or horticulture survey may cause some confusion leading the farm operator to misreport having ceased to operate or having sold a small livestock or horticulture operation while still operating his current crop farm. This situation could be avoided or minimised by having stricter criteria before changing a farm's status.

Finally, some farms were missed at the last census (census undercoverage) and very few farms have been added to the farm register since. There are surveys that use a dynamic frame and add some farms to the register. These farms are identified from external lists such as lists of potato growers, greenhouse producers or hog producers. The crop surveys have a static frame and no farms are added to it during the survey cycle. Given the static nature of cropland (little cropland is developed), such a source of undercoverage is not expected to affect crop surveys. However, given the current methodology and procedures, there may be situations where some farming activity is not covered by the farm register. This could be the case, for example, when a farm operator sells a part, but not all, of his farm operation to a person who is not already listed as an operator on the farm register. The original farm operator continues to operate his farm, but the transaction is never recorded on the farm register. Research into dealing with this type of frame attrition is currently being conducted at Statistics Canada.

6. CONCLUSION

Altogether, few changes have been made in the recent crop survey design compared to the previous design. The survey population, the list frame, the frame stratification and sample allocation methods and the use of replicates to manage the samples across the 6 survey occasions carried out during the year are very similar to the previous design. However, the few changes that have been made are very important ones, namely having dropped the area frame and evaluation of the methods and procedures to maintain the list frame.

The survey design and the frame maintenance procedures have been in production since November 1997. The survey design is producing estimates slightly more precise than those produced at the middle or at the end of the previous survey cycle. The precision of the estimates is also comparable to what was based on census data. The agricultural survey program has maintained separate surveys on crops, livestock and farm finances, each with large samples. The method of collocated sampling was implemented to control the overlap between the different samples and, thus, spread the total respondent burden on as many farms as possible. As expected, the removal of the area frame has decreased the level of the estimates compared to census totals. The survey estimates of cropland plus summerfallow are between 4% and 6% lower than the census totals. With the renewed Farm Register and frame maintenance procedures, a considerable amount of information has been accumulated tracking the evolution of the farm status and the updates made to the Farm Register. Regular monitoring of this information has already triggered adjustments to the procedures and a closer analysis of the information will lead to further improvements.

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APPENDIX

Use of sample replicates across the crops survey occasions (in Manitoba, Saskatchewan and Alberta)