

Chapter 8:

Zambia's Agricultural Data System: A Review of the Agricultural Time Series Data

by

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Although policymakers and other leaders recognize the need for highly accurate and reliable data in order to make sound agricultural development decisions, they do not always give high priority to providing the resources necessary to collect and publish such data. This chapter focuses on the importance of sustaining and improving Zambia's agricultural data system. After presenting a brief summary of four criteria to be used in evaluating an agricultural data system, the two main sources of agricultural data in Zambia are reviewed. In the final section, some suggestions are offered on ways the system might be improved.

It is extremely difficult to initiate and maintain an agricultural data system. High-quality agricultural data are particularly difficult to collect due to the extensive nature of farming areas and the seasonality of production. Maintaining a data series requires sustained dedication by the data collection staff and continued commitment from government. It is with considerable appreciation for the time and energy put into the Zambian agricultural data system that the following comments are made. The data managers and their staff should be recognized for their sustained efforts in producing data series that span years of erratic climatic conditions and rapidly changing economic times.

I. Criteria for evaluating an agricultural data system

The continued production of accurate agricultural estimates needed to build meaningful time series requires the cooperation of many actors in a government setting. Cost-effectiveness, efficiency, accuracy, and timeliness are necessary qualities and criteria for judging the outcome of these interactions.

A. Cost-effectiveness

A data system should be of the proper size and cost for the country. Leaders must recognize the necessity of having high-quality information available for decision-making and they must be willing to allocate the necessary resources. It is important that data managers and policymakers enter into a dialogue that defines the essential data needs for the country. Only data necessary to meet specific information requirements should be collected and summarized. An open door to information requests allows the data-collection and data-handling resources to become overburdened. Data systems should be "demand-driven," with only amply justified data being collected. Policymakers and data managers must work together as gatekeepers in deciding on the cost-effectiveness of the number of surveys and the amount of data collected from each survey.

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B. Efficiency

Once decisions have been made concerning the data to be collected, the technical staff (data managers, statisticians, data collectors, computer technicians, and the like) must collect and publish the data in the most efficient manner possible. Selection of the appropriate survey and sample designs should be based on the type of data needed. Probability designs in which a known portion of the population is sampled should be used when inferential statements about the population are required. Probability surveys allow the calculation of sampling errors and allow survey statisticians to make scientifically valid statements of data precision. If general information is sufficient, a non-probability design may be acceptable. To achieve efficiency in surveys, the technical staff must be properly trained and correctly located. Adequate logistical support must be provided at the appropriate time and place. These requirements are difficult to achieve and often test the administrative and personnel capacities of the survey organization.

C. Timeliness

Much of the value of agricultural data depends on timing. Policymakers need access to current information to enable them to make meaningful decisions. By their nature, information on crop yields, livestock numbers, and market prices must be obtained during the season. It is impossible to determine these numbers once the crop has been harvested or the livestock sold or moved. Country leaders must be sensitive to the needs of producing timely data and support the logistical needs of the data collection units. Unless the amount of data collected is restricted to only the essential numbers, the entire process is slowed—causing losses to both efficiency and timeliness. To provide accurate data, it is essential that data collection, data summarization, and data analysis teams work in concert. The important step of analyzing the data with respect to current economic, climatic, and political conditions must also be done quickly and accurately. This is achieved by making researchers and policy analysts a part of the survey-planning team. It is only through the work of the data analysts that the compiled data become usable information.

D. Accuracy

To state that data must be accurate to be usable in decision-making seems elementary. While no policymaker would willingly accept inaccurate data as a basis for decisions, it is necessary to do just that in too many developing countries. Leaders are forced to use available data, the accuracy of which is seldom known and even less often committed to paper by data managers. Hence the data user is left with the problem of determining whether the data are accurate. This can only be done by understanding the source of the data series' sampling and non-sampling errors. Unfortunately, the data manager's judgement of accuracy is usually clouded by a lack of information.

Before commenting on a data set's accuracy, a manager must have full knowledge of how the data were collected. What were the practices employed by the field enumerators? Were mistakes or oversights made? Were the mistakes unintentional or intentional? Inaccuracies caused by these kinds of mistakes are called **non-sampling errors**. Non-sampling errors are understood and controlled by thorough survey planning followed by intensive training and supervision of staff. While it is not possible to completely eliminate non-sampling errors, a good data manager constantly works to minimize them. Minimizing non-sampling errors is possible only if data managers are able to insist upon high-quality performance from their employees. Survey leaders should strive to create an atmosphere of "expected excellence." However, to do this successfully, a manager must have the

authority to replace employees who do not display a keen interest in maintaining the highest quality standards.

A portion of a data set's accuracy can be measured by calculating the **sampling** errors. This allows a statistician to make statements of the likelihood of a population parameter falling within a certain range of the survey statistic. These calculations are valid only if the survey was designed and carried out as a **probability survey—meaning** that each sampling unit has a known probability of selection. To conduct a probability survey, it is necessary to construct a sampling frame and to follow a scientific sample design.

Accurate information is derived from data that have both low sampling errors and low non-sampling errors. As mentioned above, these errors are impossible to eliminate and difficult to minimize. Data managers should be free to discuss the various sources of errors in a data set and should publish sampling errors and data collection procedures in technical notes.

E. Types of surveys

While agricultural censuses were once believed to be the only certain way of obtaining accurate agricultural information, a wide variety of innovative methods of collecting agricultural data have been developed during the past several decades. Survey organizations have accepted the validity of smaller, more specialized probability surveys and no longer see the need to do a complete enumeration of all farming units. The proliferation of survey types has placed an added responsibility on the data manager and statisticians to choose the most effective survey designs. Careful survey selection is crucial if the four criteria listed above are to be met. For example, it is not possible to meet the need for current food security information with a national census that takes two years to plan and implement. On the other hand, a rapid rural reconnaissance survey will not suffice if detailed structural information on the number of farmers operating under various land tenure arrangements is needed. At times, these decisions may mean abandoning a time-honored survey design in favor of a more efficient, cost-effective alternative.

The most important factor in maintaining efficient surveys is to limit the use of each survey to only the most necessary information. Planners must remain vigilant in the effort to limit data collection to only necessary items. A survey overloaded with data requests slows the process, makes the data less accurate, and wastes time and money; the data provider must endure lengthy interviews and the policymaker must search through extraneous data for the information needed to reach meaningful decisions.

Table 8.1 provides additional information on the interactions and responsibilities necessary in coordinating an agricultural data system. It should be recognized that all the criteria listed have very likely been present at one time or another in the Zambian agricultural data system. The available data series show that donors and the Zambian government have supported data collection efforts rather well for over twenty years.

Table 8.1: Performance criteria for an agricultural data system

Actors	Cost-effectiveness	Efficiency	Accuracy	Timeliness
Decision-makers and policymakers	Understand importance of using current information in decision-making and willing to assist data providers in setting/maintaining data collection priorities.	Willing to provide both moral and administrative support to data systems recommended by technical managers.	Value high-quality data and insist on statements of data accuracy being made available to data users.	Insistence on timely information coupled with a willingness to support the data collection system.
Data system managers	Able to provide policymakers with realistic estimates of time and materials necessary to collect various types of information. Able to reject requests for low priority, non-essential data.	Well organized and able to make decisions on most efficient mix of programs and personnel.	Actively seek to minimize non-sampling errors and sampling errors through sound training and survey design.	Dedicated to providing high-quality information in a time frame that meets the needs of the data users.
Technical support: statisticians, computer programmers, etc.	Able to choose the most appropriate data collection methods for a variety of information needs.	Able to correctly analyze various survey options and select most appropriate data collection method.	Use "total survey design" techniques to minimize both sampling and non-sampling errors. Encourage probability surveys whenever feasible.	Able to design surveys that meet the accuracy and timeliness criteria.
Administrative support	Aware of the importance of administrative support to produce high-quality data.	Able to facilitate the required logistical support.	Acknowledge importance of administrative support in elimination of non-sampling errors.	Understand the importance of providing timely administrative support.
Data collection staff: supervisors and enumerators	Well trained in the various data collection techniques. Dedicated to the collection of high-quality data under adverse conditions.	Motivated to provide the most accurate data in the most timely manner.	Fully trained in importance of following survey plans. Must remain vigilant in the collection of high-quality data—rejecting short cuts or falsification of data.	Dedicated employees willing and able to collect high-quality data as required to meet time constraints.
Data handlers and computer programmers	Able to make realistic estimates of processing requirements and to process data quickly with minimal errors.	Knowledgeable of various computer software packages and equipped at an appropriate level.	Recognize importance of following survey plans. Maintain exacting standard of data handling. Do not hesitate to question entries, return to field for verification.	Able to input, clean, and summarize survey data within the prescribed time requirements.
Data analysts	Thoroughly understand current economic and political climates as well as available data sets; able to provide meaningful data analysis.	Well trained in various data- analysis techniques and equipped with appropriate hardware.	Knowledgeable of the biases present in various data sets. Able to explain and publish information on a data sets' accuracy.	Reviews data and prepares reports that provide requested information within prescribed time.

H. Review of Zambia's agricultural time series data

This section provides a review of the agricultural time series data available from two Zambian government statistics units: the MAFF and the CSO. This review, which focuses on the crop and land area statistics without reviewing the livestock data series, was accomplished by cataloguing the various national surveys and supplying comments on the quality of the data sets. The comments are offered with the admission that data sets are difficult to evaluate without corroborating data from other sources or accompanying notes provided by the survey managers. Unfortunately, there are few comments in MAFF or CSO publications concerning the data quality or technical notes describing survey designs. No mention of calculating sampling errors for the CSO probability surveys was found in the publication notes.

There are four sets of time series data that describe Zambia's agricultural sector: one generated by the MAFF and three compiled by the CSO, the main data gathering agency for the Zambian government. Each of these data sets is described below.

A. MAFF agricultural data series

Prior to 1983, the MAFF published three types of Agricultural Statistical Bulletins on a consistent basis—monthly, quarterly, and annually. Both the quarterly and annual publications provided various agricultural data for multiple years. These data, published at the national and provincial levels, were obtained from parastatals such as the National Agricultural Marketing Board (NAMBoard, the primary parastatal agency vested with the legal right to purchase most crops) and the Tobacco Board of Zambia, and some private organizations and companies. As a result, only sales are reported. Farm numbers, crop production, crop areas, and yields are not available for most crops during these years. Livestock farm numbers are also not available prior to 1983.

The MAFF began its crop forecasting exercise for the entire crop subsector with the support of the Food and Agriculture Organization (FAO) and the ZATPID I Project during the 1982/83 season. The purpose of this exercise, performed by the Statistics Unit (a unit of MAFF's Planning Division) is to provide early warning information on the production of crops at the provincial and national levels. The data series contain area, yield, and production estimates for the major crops. The number of farms growing each of the crops were projected for internal use but not published. With the initiation of crop forecasting, the MAFF continued to publish its annual bulletins, which now contain more complete data series than the crop forecasts, but on an inconsistent basis. The last of these "annual" publications covered the 1988/89 and 1989/90 crop years. Thus, the only data available from the MAFF after 1989/90 are from their annual crop forecasts (table 8.2). Despite the lapses in reporting, a fairly complete data series is available on the agricultural sector from the MAFF for all crop years from 1970/71 onward.

The MAFF crop data are compiled by camp officers through their contacts with local farmers. No sampling frame or probability survey techniques are employed. The data are categorized by size groups: large (more than 20 hectares), medium or emerging (5-20 hectares), and small (less than 5

Table 8.2: Agricultural time series data available in Zambia

Crop year	MAFF agric. statistics/ crop forecasts	CSO crop forecasts	CSO annual survey (noncommercial)	CSO annual survey (commercial)
1970/71	X			n.a. ^b
1971/72	X		X	n.a.
1972/73	X		X	n.a.
1973/74	X		X	n.a.
1974/75	X		X	n.a.
1975/76	X		X	X
1976/77	X		X	X
1977/78	X		n.a.	X
1978/79	X		no survey	X
1979/80	X		no survey	X
1980/81	X		no survey	X
1981/82	X		no survey	X
1982/83	X ^c		X ⁱ	X
1983/84	X		X	X
1984/85	X		X	X
1985/86	X	X ^d	X ^f	X
1986/87	X	n.a.	n.a. ^g	X
1987/88	X	X	n.a.	X
1988/89	X	X	n.a. ^h	X
1989/90	X	X	n.a. ⁱ	X ^j
1990/91	X ^k	X	n.a. ^l	n.a.
1991/92	X ^k	n.a.	n.a. ^l	n.a.
1992/93	X ^k	X	n.a. ^l	n.a.

a. 1971/72 was the first year for this survey.

b. Data available for 1969/70.

c. MAFF crop forecasts began.

d. FAO surveys **began**.

e. CSO crop forecasts **began**.

f. BUCEN surveys **began**.

g. Disks misplaced.

h. Data entered but no expansion factors.

i. Data not entered.

j. From disks, some data missing.

k. Crop Forecast Surveys only.

l. Ag Census, data entry not complete.

hectares). Once the data are listed at the camp level, the agricultural officer forwards them to the ward supervisor.' The ward supervisor reviews the data and aggregates them to the ward level before sending them to the district agricultural officer (DAO).² Special crop-forecasting meetings are held at the district and provincial levels to review the data and to agree upon the forecasts. The data are then forwarded to the central office in Lusaka for final tabulation and review. The annual crop forecasts are published by the Early Warning Unit of the MAFF in May of each year. As an example, table 8.3 lists the MAFF time series data published for maize (Zambia/MAFF 1993).

Table 8.3: Maize time series data published by the MAFF

Maize		MAFF estimates -- All farms					
Year	Area planted	Production (90 kg bags)	Yield (bags/ha)	Sold (90 kg bags)	Percent sold	Value (kwacha)	Average value
80/81	622,550	16,500,180	27	7,832,181	47%		
81/82	456,000	8,162,000	18	5,671,613	69%	103,791,000	18.30
82/83	546,700	10,392,000	19	5,901,824	57%	144,595,000	24.50
83/84	506,500	9,686,000	19	6,347,637	66%	179,765,000	28.32
84/85	581,846	12,470,570	21	7,069,637	57%	200,212,000	28.32
85/86	588,490	13,673,265	23	10,607,414	78%	583,408,000	55.00
86/87	609,529	11,816,096	19	7,296,044	62%	569,091,000	78.00
87/88	723,087	21,591,321	30	14,989,980	69%	1,199,198,000	80.00
88/89	1,020,574	20,499,758	20	13,551,314	66%	1,463,542,000	108.00
89/90	763,277	12,140,784	16	6,678,711	55%	1,896,754,000	284.00

Year	Area (Thousands Hectares)
80/81	622.55
81/82	456.00
82/83	546.70
83/84	506.50
84/85	581.85
85/86	588.49
86/87	609.53
87/88	723.09
88/89	1020.57

Year	Total Production	Amount Sold
80/81	16.5	7.8
81/82	8.2	5.7
82/83	10.4	5.9
83/84	9.7	6.3
84/85	12.5	7.1
85/86	13.7	10.6
86/87	11.8	7.3
87/88	21.6	14.9
88/89	20.5	13.6
89/90	12.1	6.7

MAIZE-MF.WB1

² This **organizational** structure was first developed during the colonial period for purposes of providing extension services to small-scale farmers. The largest local structure **was the "block" and** within each block several "camps" were identified. **Communications** traveled from the district **agricultural** officer **through** the block supervisor to each of the relevant camps. After **independence**, the "blocks" became "wards" (with the exception of the Southern province), and the purpose of the organizational structure became primarily political.

³ The Department of Agriculture's "Crop Forecasting Questionnaire" is used to record individual farm data at the camp level. The "Crop Forecasting **Summary** Sheet" is used to **aggregate** camp-level data before it is sent to the DAO.

Theoretically, all crop farmers in the country are surveyed under this system. However, as far as can be discerned, no quality control efforts are conducted in the field during the exercise, raising doubts whether full coverage is actually attained. Some data users suspect that camp-level figures may be changed for political reasons.⁴ Finally, all tabulations of the data at the ward and DAO levels are done manually. Reports of undetected errors finding their way into final publications are common.

While the published MAFF data may be subject to considerable error, the exercise is valuable in providing timely estimates of annual crop production and early warnings of unusual production patterns. Since the summaries are subject to review and possible manipulation at several administrative levels, the potential for politically motivated self-serving adjustments should be recognized by individuals who wish to use the data as a time series.

B. Central Statistics Office agricultural data series

There are three data series emanating from the CSO. They are the commercial farms, the noncommercial farms, and the crop forecast data. The latter two data series are derived from the same sample agricultural survey. The agricultural statistics publications printed by the CSO can be found in the references.

1. Commercial farms data

Data on commercial farms are collected by the CSO annually via a questionnaire mailed to all known "commercial" farmers. During the early years of the survey the mailing list of commercial farms was based on a membership list obtained from the Commercial Farmers Union. However, this practice was discontinued when it was discovered that many union members were not farmers but had joined to obtain certain products at a preferential price. As a result, by 1969/70, the CSO had redefined a commercial farmer in terms of agricultural activity.

Definition of a commercial farmer, 1969/70

- (1) A farmer who sold maize worth K600 or more at the line of rail prices;
- (2) a farmer who grew Virginia or burley tobacco in his/her own name and was registered with the Tobacco Board;
- (3) a farmer who sold dairy products to and was registered with the Dairy Produce Board; or
- (4) a farmer who had title to land.

In the mid-1970s, the definition of a commercial farmer was expanded to include the widening variety of specialized agricultural producers. By 1975/76, when the currently available data series begins, a commercial farmer was defined as one who satisfied any of the following criteria:

Definition of a commercial farmer, 1975/76

- (1) Any farmer who sold during the previous 12 months to NAMBoard or any other cooperative union any crops the value of which was equivalent to 150 bags (90 kilograms) of maize or more at the ruling producer price;

^o For example, a ward supervisor might revise maize production estimates upward to show an increase from the previous year or to compare more favorably with an adjoining ward.

- (2) any farmer who grew tobacco in his/her own name and was registered with the National Tobacco Company of Zambia Ltd.;
- (3) any farmer who sold to the Dairy Produce Board;
- (4) **any** farmer who bred, reared, and/or fattened cattle or poultry and sold them to the Cold Storage Corporation of Zambia, Poultry Processing Company, Ltd. or to any licensed butcher or supermarket;
- (5) **any** farmer who reared and/or fattened pigs and sold them to the Zambia Pork Products or the Cold Storage Corporation of Zambia or to any licensed butcher or supermarket;
- (6) all hybrid poultry breeders; or
- (7) all state farms operated by the Agriculture Division of ZIMCO and other agencies on a commercial basis.

This definition has continued with minor adjustments until 1990/91.⁵ The data series reviewed here (1975/76 and later) falls entirely under the "modern" definition. Data users who have occasion to use any of the pre-1975 data should be aware of the definition change. While it is reasonable to expect the estimated number of commercial farmers to be somewhat greater after the more inclusive definition was adopted, the published farm numbers are not available to make the comparisons.⁶

Commercial farm data are published at the provincial and national levels by size groups. A wide range of data are collected including: area, yield, production, and sales of major crops; inventory, production, and sales of livestock and poultry; inventory of farm implements; pesticide and fertilizer usage; production expenditures; and farm gate prices. To collect this much information requires a very long survey instrument. It is not difficult to understand why relatively few commercial farmers responded when they received such a long and complex questionnaire in the mail.

The CSO data on commercial farms forms the second longest continuous data series when compared to the other data sets—from 1975 through 1989/90.⁷ Unfortunately, the accuracy of these data is questionable for two reasons: the accuracy of the list frame used and the low response levels to the mailed questionnaires. While it was not possible to evaluate the data sets' accuracy directly, examining the response rates to the mail survey for the years in which the data were obtained along with the number of commercial farms identified to receive the mailed questionnaire indicates problems in both areas (table 8.4).⁸

The number of questionnaires sent to commercial farms increased sharply from 1,603 farms in 1975/76 to 2,595 farms in 1976/77. The number then remained around 2,000 until it dropped suddenly to 1,072 in 1982/83. It is not clear whether these variations were due to incomplete or incorrect lists or were actually correct farm numbers. However, the short time between the sizable gains and losses support the first conclusion. It would have taken a very serious economic event to suddenly halve the number of commercial farms in Zambia.

⁵ No data have been compiled after 1989/90. However, since the 1990/91 Census, the CSO has supposedly changed their emphasis from "commercial" to "large (>20 ha)" farmers. Whether this transition has actually been made is unknown.

⁶ Given the problems noted later in this paper concerning the commercial farm estimates, this change in definition may have had no effect on the published data.

Both the 1988/89 and the 1989/90 data sets have yet to be published. However, preliminary computer summaries are available.

Maize production estimates for commercial farms are available as far back as 1940. See the annex 8.2 for a complete listing of the maize data series.

Table 8.4: Commercial farms survey: numbers of questionnaires mailed and returned and estimated number of farms, by crop year, CSO, Zambia

Crop year	Number of commercial farms. ^a	Questionnaires returned	Response rate (%)	Estimated number of farms ^b
1975/76	1,603	526	33	1,527
1976/77	2,595	578	22	2,242
1977/78	2,025	523	26	2,010
1978/79	1,771	599	34	1,566
1979/80	1,920	657	34	1,894
1980/81	2,143	536	25	1,835
1981/82	2,187	583	27	1,780
1982/83	1,072	276	26	1,103
1983/84	1,231	290	24	1,314
1984/85	1,283	307	24	1,102
1985/86	912	279	31	1,972
1986/87	180	99	55	2,026
1987/88	not specified	-		2,115
1988/89	not available			2,185
1989/90	not available	-		1,444

a. Number of farmers to whom questionnaires were mailed.

b. The CSO **published** estimate of the number of commercial farms.

Source: Zambia CSO (commercial farms) series.

During the same period, response rates to mailed enquiries ranged from 22 to 34 percent. Without a sampling of the nonrespondents, the representativeness of the voluntary respondents is unknown. CSO officials recognized this problem as early as 1970 when they reported on a nonresponse survey in the "1970 Agricultural and Pastoral Production Report." The exercise found that the smaller farms on the commercial farms list had not received a questionnaire in the mail and that the list was out-of-date because of the many changes in ownership.'

Over the last three years for which surveys were published, the number of questionnaires mailed decreased significantly—down to 912 in 1986 and then to 180 in 1987. No numbers were specified for 1988. Consequently, data collected during the last five years of the time series are likely to be even less accurate than those collected during the first 10 years of the commercial farm survey.

While the exact procedures used by the CSO to arrive at the published estimates of commercial agricultural production are not explained in the publications, the most common method, **expanding**

⁹ The reporting of this nonresponse study is the only comment found which indicated an attempt to assess the quality of the commercial farm data.

the data, uses the information provided by the voluntary respondents as indicators of what all farmers are doing. Using this method, the average of the data from the mail responses is calculated and multiplied by the estimated number of commercial farms. Since the CSO commercial farm data were published by farm size within provinces, the procedure would be somewhat more complicated. The statistician would first have to estimate the number of farms in each size group in each province and then apply an appropriate average value to each.

In the 1977/78 report, the data user is warned that the estimation procedure is not totally accurate and that the "maize and other major crops would be the most accurate." This is because there is usually less variability in area, yield, and production data when nearly all the farmers are actively producing the crop. Experiences from other African countries suggest that a direct expansion of data from voluntary respondents may be flawed for a number of reasons. Some amount of overestimation or upward bias was introduced when the smaller commercial farms did not receive a questionnaire and thus were not given a chance to respond. On the other end of the scale, large farmers are notorious for either refusing to report or grossly underreporting their agricultural holdings. Since the commercial farms survey was totally voluntary with no response validation process, it is reasonable to expect that the holdings of the largest farmers are underrepresented. This would cause a downward bias in the estimates derived by expanding the data. While it is impossible to speculate on the impact of the adjustments on the crop estimates, it is fair to say that the low response rate from an unknown and possibly underrepresented portion of the population leaves serious questions about the level of estimated crop production reported. For example, the data series in table 8.4 listing the estimated number of farms shows much variability—changing radically from one year to the next, especially for the three years beginning in 1982/83 and then again in 1989/90. If it is difficult to have confidence in an estimate as basic as the number of farms, it is even more difficult to imagine how the more detailed estimates of crop area and production might be accurate.¹⁰

Another anomaly in the commercial farm survey is the timing of publications. Although the questionnaires continued to be mailed each year, the results are often not published until several years later. In the 1987/88 report (published in September 1990), the director thanks the staff for catching up with 12 years of unpublished data. Evidently the demand for detailed commercial farm data was strong enough to cause the CSO to resurrect and publish data that had not been given a high priority at the time it was collected.

2. CSO noncommercial crop surveys and crop forecasts

To complement the commercial farm data series, the CSO also collects data from the noncommercial farmers (all farmers not falling under the definition of commercial farmers). Attempts to measure the agricultural production of the noncommercial farmers is done via a series of sample surveys. At present, the CSO collects data on the noncommercial farm sector for the purpose of providing both annual crop forecasts as well as more detailed statistics. The crop forecasts focus on the number of farms growing the major crops, the area planted, and expected production. These estimates are published midway through the crop year as part of the early warning process. In contrast, the annual surveys are designed to provide more detailed information on land use, crop production, livestock numbers, and prices received for agricultural produce. Estimates are published

¹⁰ Additional remarks on estimating procedures may be found in the section titled "Setting and Publishing Agricultural Estimates" (see p. 245).

at the provincial and national levels. Table 8.5 lists the published time series data for maize production on noncommercial farms, as an example.

While the annual survey of noncommercial farmers began in 1971/72, the crop forecasting portion of the survey was first initiated with technical and equipment support being provided by the ZATPID II Project (equipment and long-term advisory support) and the US Bureau of Census (BUCEN—training and short-term technical support) in 1985/86. As can be seen in table 8.2, this effort has been less than successful in producing publishable data sets. Despite continuous collection of detailed annual survey data since 1986, only the results from that year have been published." Crop forecasts, however, have been published for the period 1986 through 1993.¹² The following is a description of the evolution of the CSO sample survey in its three iterations.

3. CSO sample surveys, 1972 to 1978

Designed as a probability survey of the entire country, the sampling frame was built by first stratifying the country into urban, peri-urban, and rural areas. The urban stratum contained all principal towns with populations of 30,000 or more; the peri-urban stratum comprised all urban centers with populations less than 30,000 plus all provincial and district administrative centers; the rural stratum comprised the remainder of the country.

Once the rural stratum was identified, a 10 percent sample of basic areas (BAs—the primary sampling unit [PSU] for the survey) was selected. A total of 134 BAs were selected in 1972 out of a total rural population of 1,145 BAs.¹³ Field enumerators listed all of the noncommercial farming households in the sample BAs, and a sample of 10 percent of the households was randomly selected for interviewing. The number of selected BAs ranged from 3 to 28 per province. Fortunately, the amount of data collected under these surveys was reasonable—especially when compared to the magnitude of the present efforts. Copies of the questionnaires used can be found in the back of each publication.

Despite the probability design of the survey which would have permitted sampling errors to be calculated, the publications do not discuss any sampling or non-sampling errors. Given the large size of the PSUs, it is difficult to say what the sampling errors might have been. Normally, a sample size of 10 percent in the second stage of sampling is more than adequate for agricultural surveys. As with most agricultural surveys, the non-sampling errors are a very important part of the estimation procedure and are largely immeasurable. If the survey managers had noted the major data collection problems and how they were handled, it would have provided future data users with some hints concerning the quality of the time series.

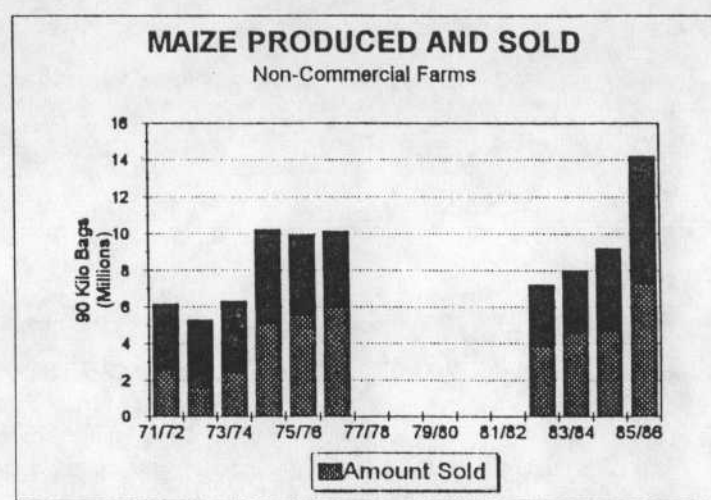
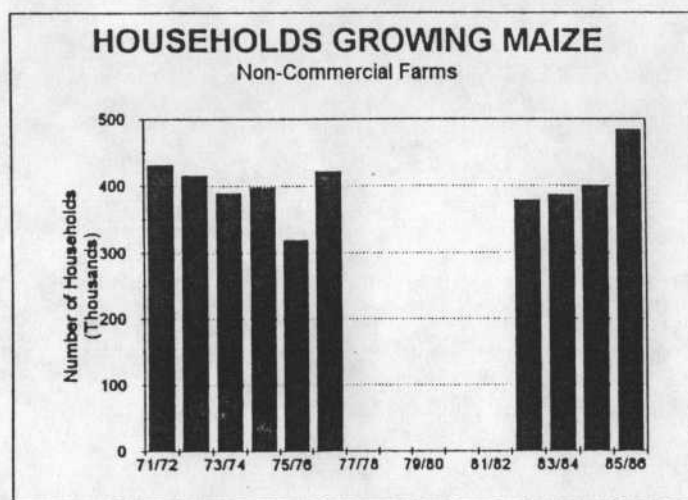
¹¹ Summary tables for both the 1986/87 and 1987/88 surveys have been completed but not published. (Disks containing the 1986/87 summary data have been misplaced.) The 1988/89 raw data have been entered on the computer but have not been summarized because the expansion factors (weights) needed for summarization have not been entered.

¹² Although these data have been published, a complete data set is not available. Some data were able to be recreated from disk backups.

¹³ The size of these BAs must have been huge. If all Zambia was divided into 1,145 BAs, the average size of a BA would have been approximately 65 square kilometers. At present, 9,682 rural survey enumeration areas (SEAs) are used as PSUs. The average size of a SEA is approximately 8 square kilometers.

Table 83: Maize time series data published by the CSO, noncommercial farms

MAIZE		ZAMBIA				NON-COMMERCIAL FARMS				
YEAR	HHS GROWING	AREA PLANTED (ha.)	AREA HARV'D (ha.)	AVE. AREA PER HH (ha.)	PRODUCTION (90 Kilo Bags)	YIELD (Bags ma.)	SOLD (90 Kilo Bags)	PERCENT SOLD	VALUE (Kwacha)	AVERAGE VALUE
71/72	431,700				6,164,600		2,618,900	42%	9,123,800	3.48
72/73	415,400				5,272,000		1,581,700	30%	6,372,500	4.03
73/74	389,200				6,302,800		2,466,200	39%	10,813,800	4.38
74/75	397,100				10,262,800		5,066,600	49%	25,274,500	4.99
75/76	319,300				9,911,200		5,614,100	57%	35,095,900	6.25
76/77	421,500				10,127,400		5,968,500	59%	37,837,300	6.34
77/78										
78/79										
79/80										
80/81										
81/82										
82/83	378,300		358,510	0.95	7,190,000	20	3,857,000	54%	68,666,000	17.80
83/84	386,560		397,020	1.03	7,998,000	20	4,543,000	57%	102,280,000	22.51
84/85	400,210		400,810	1.00	9,229,000	23	4,735,000	51%	126,692,000	26.76
85/86	483,865	660,334	522,157	1.08	14,231,905	27	7,316,004	51%	276,345,000	37.77



4. CSO sample surveys, 1982 to 1985

Following a hiatus in surveys from 1979 to 1982, **annual** surveys were conducted between 1982 and 1985 with assistance from the FAO. In 1981/82, a pilot census of agriculture was carried out in preparation for the census of agriculture that was scheduled to be conducted during the 1982/83 crop season. The actual census was never conducted, and, as a result, the FAO and the CSO agreed to do a sample survey of agriculture on a rotating basis. The four major agricultural provinces—Central, Eastern, Southern, and Lusaka—were actually surveyed in 1982/83. Recall data were collected during the following year to complete the 1982/83 survey in the remaining provinces.

It is not entirely clear how the 1984/85 data were collected. While the authors of the survey publication state that a two-stage sample was used with survey enumeration areas (SEAs) serving as the primary sampling units, they do not provide information on sample size at either the primary or secondary levels. Again, no estimates of sampling errors were calculated or published for the data.

5. CSO sample surveys, 1986 to 1993

Since 1986, the CSO has conducted annual surveys of crop forecasting on the noncommercial sector, initially with technical assistance provided from BUCEN and independently since 1990. Results have been less than spectacular, at least with respect to the publication of the annual surveys. The results of only the 1986 survey have been published. According to CSO officials, crop forecasting data are regarded as confidential until the Minister of Agriculture certifies them acceptable. Publication of such data has been the prerogative of that ministry because the final announcement was a blend of two forecasts collected separately, one by the CSO, and the other by the Ministry of Agriculture. The CSO is thus unable to publish the data themselves without upstaging or contradicting the minister's role.

For these surveys, a new sample design was used which comprised a three-stage sampling system. The sample is used for both the crop forecasting exercise and the annual survey with the goal of publishing data at the district, provincial, and national levels. The first stage of sampling is done from the census supervisory areas (CSAs). Within each CSA, SEAs have been identified based on readily identifiable boundaries. From one to four SEAs are located in each CSA. Sample CSAs are first selected with probability proportional to the number of households located in each based on the 1990 census (1980 census in earlier data-gathering efforts). Once a CSA is selected, a sample SEA is then selected, again based on probability proportional to the number of households. During the earlier years of the survey, 800 SEAs were selected, however the number has been reduced to 400 for recent surveys. Households in each sample SEA are listed and farm households identified.

Following the listing process, farm households are stratified based on area planted to crops. Three strata are identified: small (less than 5 hectares), medium or emerging (5-20 hectares), and large (greater than 20 hectares). Fifteen sample households are systematically selected from each of the small and medium groups. Normally, only a few households are identified as medium-sized farmers in any given sample SEA. If fewer than 15 households qualify as medium-sized, all of these households are selected and the remainder of the intended 15 sample households are reassigned to the small-farm stratum. For example, if a sample SEA contained 100 small farmers and 3 medium farmers, the final sample would include the 3 medium farmers plus 27 of the small farmers. Only if the total number of farmers—small and medium—were less than 30 would the sample size be less than 30. This results in a sample size that nearly always approaches the maximum of 30 per SEA or a total

of 12,000 from 400 sample SEAs. Usually, no large-farm households are identified. If they are identified, data are collected from these households via the commercial farm survey.

After the sample farmers are identified, each is visited three times. During the first visit, which is conducted in January/February, the listing process is completed, sample farmers are identified, and preliminary crop forecast data are collected. During the second visit, which is conducted in March/April, data are collected for the final crop forecast. During the third visit, which is conducted in October/November, a post-harvest survey is completed. This last data set forms the basis for the annual agricultural survey report.

Based on a preliminary analysis of the sample size, the CSO's noncommercial survey is both too small and too large. While a thorough review of the data is necessary to determine the optimum number of samples to be selected at each stage of the survey, experience suggests that a sample size of 400 PSUs would tend to have sampling errors that are too high for data presentation at the district level. At the same time, a secondary sample size of 30 farmers is clearly larger than required at the final stage of sampling. More likely, 5 to 10 small farmers and a 100 percent sample of medium farmers selected from each sample SEA would provide the basis for acceptably accurate provincial and national estimates. This would reduce the data handling load by 75 percent which would greatly facilitate the speed of collection, summarization, and publication. While the data should probably only be published at the provincial and national levels, it may be feasible to provide district estimates for only the larger districts that exhibit reasonable sampling errors.¹⁴

A review of the "Phase 3 Final Crop Forecasting Questionnaire" shows the survey instrument to be of reasonable length. However, the post-harvest survey is extremely detailed with 33 pages. Thus, three sets of data are to be collected from 24,000 (presently 12,000) farmers each year. This means the CSO staff is faced with a total of 72,000 (or 36,000) questionnaires to be entered, edited, and summarized annually. The post-harvest survey questionnaire is far too long and is also not designed for efficient data entry. It should be reduced so only the essential data are being gathered and simplified to allow easier data entry.¹⁵

The large size of the questionnaire is also problematic during the summary phase. Conversations with CSO personnel indicate that corners are cut to speed the summarization process. For example, as far as can be discerned, no computer edits of the data are conducted. Given the pressures of trying to push large amounts of data through a summary system without adequate edit

¹⁴According to officials in the CSO, the government's policy is to encourage development planning in all sectors at least down to the district level. The CSO thus feels compelled to collect and publish data at the district level to help facilitate government planning. Rather than abandoning the current practice, the CSO instead recommends improving the quality and lowering the cost of district-level data collection.

¹⁵While the management of CSO also feels that the questionnaire is probably too long, it stresses that length alone is not a hindrance. Space is provided for capturing all the possible production activities of households, but rarely does a household have more than 4-5 activities (out of 20 in section 2) to report, leaving substantial empty space. Also, few households report information on growing fruit trees in section 3 and vegetables in section 4. Thus, the majority of the questionnaires returned to the CSO have substantial space that has been left blank. Moreover, the CSO management feels that the current data being collected are essential for monitoring purposes. Before discarding items for sake of increasing efficiency, the CSO management advises caution against loss of important information, a point of view shared by the authors.

checks, it is easy to understand why data inconsistencies are routinely seen in the data sets (Zambia/CSO, noncommercial).¹⁶

6. Summary

It is obvious that the CSO, as the premier data collection agency for Zambia, has devoted much time and effort to the continuation of agricultural data series. It is unfortunate that more effort was not spent in assuring the quality of the data. It appears the foundations of the survey organization may be sound, but the current activities are sorely in need of reevaluation and redirection.

C. Comparison of MAFF and CSO estimates

One method of assessing data accuracy is to compare several independent data series. Sometimes two data series will rise and fall in the same general pattern but have minor differences. In these cases, a close comparison may reveal that one series uses a slightly different definition or may contain a bias that accounts for the variations. However, at other times, when more serious differences exist in one or both of the series, little comparability may be present. It is difficult to compare the MAFF and the CSO data series because of differences in methodologies. While both the CSO and the MAFF call their surveys "crop forecast" surveys or exercises, the MAFF series is derived from a grassroots listing of data from all farms. The CSO uses a sample-survey approach. The intent of both is to provide early-warning information during the growing season. In contrast, the CSO's commercial and noncommercial surveys are meant to provide a more comprehensive view of agricultural production without the time constraints of the forecast surveys.

The "final" estimates of the CSO crop forecast (CSO/CF), the MAFF crop forecast (MAFF/CF), and the combined commercial and noncommercial agricultural surveys (CSO/AS) were compared. While it would have been preferable to use basic estimates such as "numbers of farms" or "total land in farms" for comparison, they were not available, so maize was chosen as the crop estimate series which was likely to be most accurate. Data for "area planted," "production," and "sales" were compared. Table 8.6 lists the data and figure 8.1 provides graphic comparisons of the data sets.

Comparisons of maize area planted shows the MAFF/CF to be generally higher than the CSO/CF. In the eight years of comparative data, only in 1984 and 1987 were the MAFF estimates lower (90 and 92 percent respectively) than the CSO. There seems to be no real connection between the CSO/AS data and the CSO/CF data. For the four years, comparisons range from 91 to 126 percent. Special note is made of the 1988-89 MAFF estimate of maize planted, which is substantially higher than any other estimate in any series. The 1,021,000 hectare figure is about 40 percent greater than the MAFF estimates for the years immediately preceding and following.

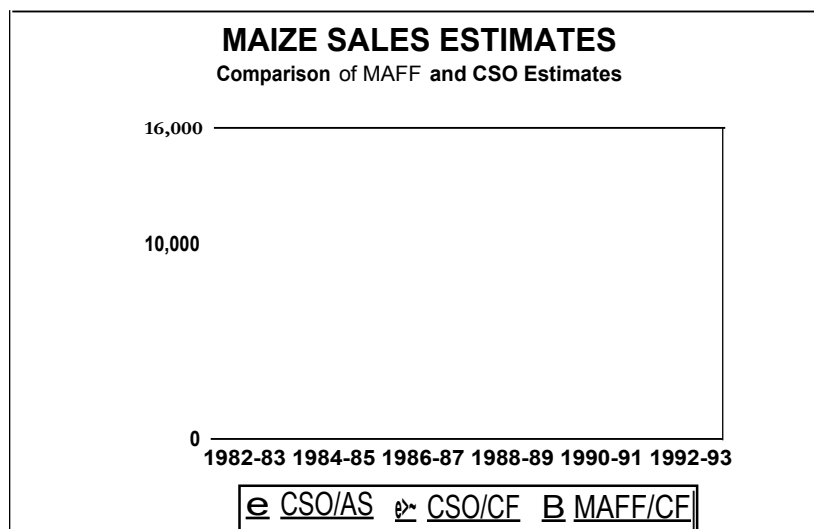
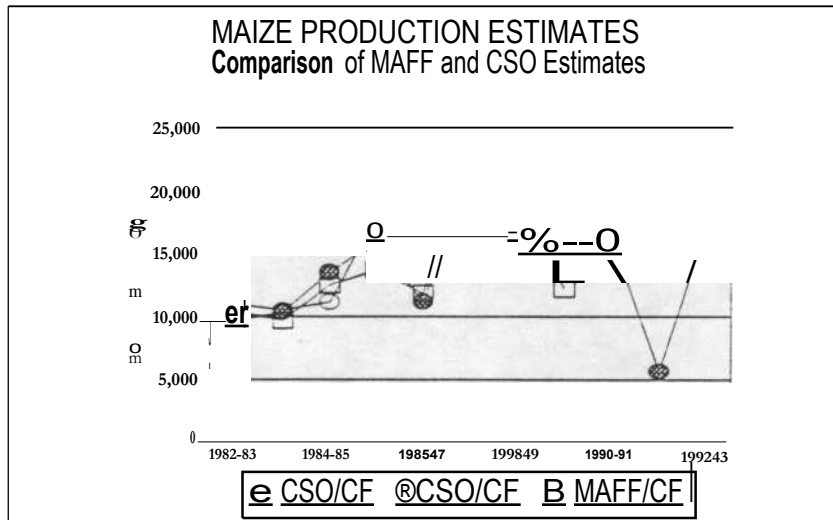
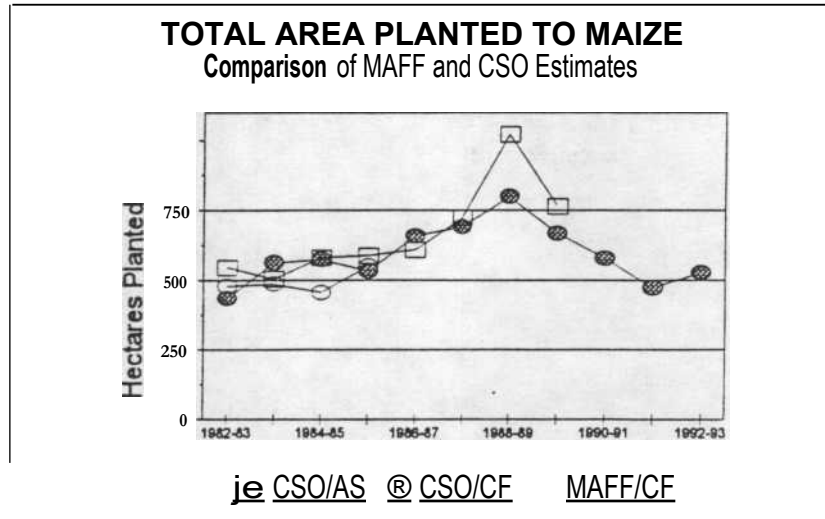
¹⁶ However, questionnaire size is not the sole or even the most important reason for these problems. According to CSO management, the problems encountered during the summary phase stem mainly from the lack of an incentive structure that encourages personnel to properly edit data before summaries are undertaken. An officer who goes to the field to collect data is eligible for an allowance in addition to salary. No such incentive is given to an officer in Lusaka who is responsible for scrutinizing data to detect and eliminate data errors. It is generally the case that data processing personnel are left alone to resolve inconsistencies without proper guidance from the statisticians—the outcome being inadequate editing and short-cut methods employed to speed the summarization process.

Table 8.6: Comparison of the CSO and MAFF maize estimates

Year	CSO/AS°	CSO/CF	Columns	MAFF/CF	Columns	Columns
	(a)	(b)	(b/a)	(c)	(c/b)	(c/a)
	(000 ha)	(000 ha)	(%)	(000 ha)	(%)	(%)
Maize area estimates						
1980-81				623		
1981-82				456		
1982-83	479	434	91%	547	126%	114%
1983-84	488	564	116 %	507	90 %	104 %
1984-85	455	575	126 %	582	101 %	128 %
1985-86	552	532	97 %	588	111 %	107 %
1986-87		659		610	92%	
1987-88		692		723	105 %	
1988-89		797		1,021	128 %	
1989-90		668		763	114%	
1990-91		579				
1991-92		472				
1992-93		527				
Maize production estimates						
1980-81				16,500		
1981-82	10,976	9,628	88%	8,162	108%	95%
1982-83	10,486	10,330	99%	10,392	94%	92%
1983-84	11,146	13,492	121%	9,686	92%	112%
1984-85	17,732	15,855	89%	12,471	86%	77%
1985-86		11,146		13,673	106%	
1986-87		20,378		11,816	106%	
1987-88		22,188		21,591	92%	
1988-89		16,267		20,500	75%	
1989-90		16,087		12,141		
1990-91		5,628				
1991-92		17,229				
1992-93						
Maize sales estimates						
1980-81				7,832		
1981-82	7,513	4,944	66 %	5,672	119 %	79 %
1982-83	6,685	6,749	101%	5,902	94 %	95 %
1983-84	6,593	7,227	110 %	6,348	98 %	107 %
1984-85	10,729	9,794	91 %	7,070	108%	99 %
1985-86		6,886		10,607	106 %	
1986-87		12,947		7,296	116 %	
1987-88		15,115		14,990	90 %	
1988-89		9,921		13,551	67 %	
1989-90		9,000		6,679		
1990-91		3,229				
1991-92		9,326				
1992-93						

a. Total of CSO commercial and noncommercial estimates.

Figure 8.1: Comparison of the CSO and MAFF maize estimates



It is difficult to recognize any discernable patterns between the maize production data series. Comparisons between the MAFF and the CSO data range from 75 to 108 percent. Comparisons between the two CSO series vary from 88 to 121 percent. The MAFF estimates for maize production in 1989 and 1990 are substantially greater than preceding or following years.

As with maize production, comparisons between the series show little similarity for the maize sold estimates. It appears that the MAFF series of maize sales and the CSO series listed in its "1992/1993 Final Crop Forecast" are the official estimates of sales.

Beginning with the 1993/94 agricultural season, the separate crop forecasting surveys of the CSO and MAFF were merged. The survey method is that used by the CSO as outlined in the previous section.

D. Publishing agricultural estimates

Statistical organizations have a choice of either publishing data as collected or using them as indicators in an estimation process. Governmental organizations rely on survey data as indicators for setting their published estimates of agricultural production. This method allows the survey statisticians to adjust for anomalies in the survey data. The result is a smoother set of survey estimates which show reasonable (believable) changes over time. If the organization publishes "raw" survey data (or data with little review) the users are forced to make their own interpretation of how questionable data are to be used. For instance, most agriculturalists would find it difficult to imagine a set of circumstances that would result in the numbers of commercial farms (or the average area planted to maize) fluctuating as much as is indicated by the CSO data. The graphs in the appendix illustrate the dramatic amount of variation in the commercial farms data series. Normally averages for a group of farms change slowly over time unless there are severe political, economic, or climatic events.

Agricultural statisticians agonize over how much they should adjust survey data. On one hand, they do not want to be accused of "manipulating" data, but they are also reluctant to publish data series that show inconsistencies. The CSO has had difficulty in choosing just how much intervention they wish to impose in reporting their survey results. It appears they should have been more willing to control for the variability caused by both sampling and non-sampling errors in the commercial farms surveys. If the CSO statisticians had written technical notes about problems and the procedures they followed in correcting them, it would have provided both a consistent data series for the many users who just "need a number" and a basis for further study for the in-depth analysts. However, simply expending more time writing technical notes will prove ineffective in correcting the problem without a commensurate improvement in salary structures that provide office staff sufficient incentive to scrutinize data and make necessary corrections.

After reviewing data series such as those published by the CSO and the MAFF, external reviewers often face the dilemma of deciding whether to state that the data series are too fraught with errors to be usable or to be more understanding and merely warn data users that the series contain many unexplained inconsistencies. The first alternative is seldom taken because data are so badly needed and are deemed to be "the best there are." Fortunately, an understanding of statistical organization and training exists in Zambia that can be used as a basis for reviving the system if the government decides to move toward fewer, more accurate statistics.

III. Suggestions and recommendations

As mentioned at the outset, Zambia has a large data system which has received support from various donors over the years. Unfortunately, donor support has been spasmodic and not sustained. The system has not been held to high standards of cost-effectiveness, efficiency, accuracy, or timeliness. The following are some suggestions of how to improve performance in these areas.

A. Improving cost-effectiveness

The overriding need in the Zambian agricultural data system is to work toward a more cohesive, organized data system that emphasizes collecting **only** data that has been substantially justified. Currently, too many resources are flowing into a system that produces many, but not necessarily usable, results." It appears the system has been allowed to accept more and more requests for data without a thorough review of necessity. Publications are often delayed due to the inability to summarize the unwieldy quantity of data.

It is not uncommon for large national surveys to become vehicles for collecting increasing amounts of data. The CSO's survey questionnaires have become laden with many interesting but inappropriate questions. To rectify the situation, every survey instrument used in Zambia should be forced to pass a rigorous evaluation process that would allow only the most essential items to remain on the questionnaires.¹⁸ Eliminating questions that have been on questionnaires for a number of years will be difficult, but it is an essential step in making the surveys more accurate sources of information. Even when troubles are well known, problems of institutional rigidity, lack of resources, lack of skills, or complacency lead to inaction. Scott mentions a CSO "user-producer seminar on government statistics" scheduled for May 1990 (Scott 1990). According to CSO management, that seminar was held, but no changes were made to the surveys by way of follow-through.

Data collection should be trimmed to an absolute minimum. The specific data to be collected should be determined at a series of data user conferences where the realities of data collection and publication are discussed. Organizations requesting data must be convinced that less-extensive, higher-quality data sets are of more value than the more detailed, but questionable, statistics currently being collected. Data users who want to maintain current levels of data collection should be asked for specific examples of where published data are used. Only those data sets which have a proven current use should be allowed to continue. It is difficult to believe that the detailed structural/size group data collected by both the MAFF and the CSO are necessary every year. Usually collection of these data every three to five years is sufficient. Following thorough review, data from other sources, such as parastatals and marketing boards, should continue to be published by the CSO. These data provide the only comparisons to the survey data published in Zambia.

¹⁷ Based on requests it has received from users, CSO officials believe that most of the data collected is usable. Rather, it is the long **lag** between data collection and publication that diminishes the data's usefulness.

¹⁸ The CSO's comprehensive agricultural survey described by Scott (1990) was not reviewed as a part of this study. Given the extreme amount of data collected by the survey, the exercise sounds like an ill-conceived use of resources. The level of detail collected by the survey is normally restricted to specialized research studies and is seldom deemed cost-effective at the national level.

A sampling frame should be developed which allows for the collection of data at various administrative, ecological, and geographical levels. This would facilitate the initiation of smaller, more cost-effective survey designs to collect detailed data for specific needs.

With a accurate sampling frame in place, most future surveys should be based on probability designs. Probability surveys allow the statistician to make statements about the estimates' precision. These statements in turn allow the data users to calculate a band of confidence in using the data. Decision-makers would gain confidence in both the MAFF and the CSO if the organizations moved to more probability surveys and concentrated on collecting and summarizing fewer, higher-quality data sets.

Scott suggests that some movement has begun within the CSO to combine the noncommercial and commercial surveys. This is an excellent idea. When combined, the resulting survey should be much more cost-effective and efficient than the existing separate surveys. However, as of April 1994, separate questionnaires were still being administered to the two categories of farms. One small improvement has been made. Instead of sending and receiving commercial questionnaires by post, the forms are now being delivered by enumerators and later collected by them.

B. Improving efficiency

Survey efficiency is gained through the proper management of resources. All survey managers should be well trained and should be vested with the authority to respond quickly to unexpected field conditions—adjusting logistics and personnel accordingly. Extra salary incentives that encourage fieldwork over central office work are detrimental to both the efficiency and the accuracy of the surveys. The extra time spent in the field not only lessens the amount of time spent in cleaning and summarizing the data, it allows more data to be collected, thus adding even more to the burden of work to be done in the central office. Staff working on the agricultural data have not yet systematically collected, entered, analyzed, and published data as one continuous and coherent process. The emphasis on data collection has pulled resources away from analysis—the outcome being piles of unprocessed data. Reducing data collection to the essentials will go a long way toward solving the central office staffing problems, but incentive structures need to be modified to encourage office work in Lusaka on analysis and publication.

C. Improving timeliness

The inability to publish timely reports has been most obvious in the CSO commercial farm surveys. Many of the reports are published well after the year in which the data were collected. One reason for delay is the imbalance between field and central office staff discussed earlier. Reorganization may be necessary to assure that each survey unit has a data entry and computing staff capable of handling the current data collection activities. The speed with which data are handled can be greatly enhanced with proper data entry/computer editing programs. Modern microcomputer processing is available to overcome many of the time and accuracy problems of out-of-date systems. Data summary and analyses can also be made more timely through the proper addition of computer techniques.

Late reports are also often the result of ill-defined priorities. If the data managers do not have a clear sense of priorities, it is easy to allow outside requests for data to overcome what should be ongoing data series. To maintain proper focus on the priorities, a clear mandate must be agreed upon

and realistic budgets and human resource support must be provided. Without the insistence of top government officials on timely publications, the timing will inevitably slip. Data managers must see their mission as providing **high-quality** information that is available for current decisions.

D. Improving accuracy

It is difficult to judge the accuracy of the **agricultural** estimates because there are few alternative measures for comparison. The data series reviewed show variations that may have been caused by either natural variations in agricultural production or data collection errors. However, the magnitude and rapidity of fluctuations suggest significant collection errors. Unless a thorough review of a survey's accuracy is completed during the survey period, much of the information that would reveal the true accuracy of the data is lost.

For example, it is not difficult to understand why errors exist in the CSO data series when surveys take several years to be published. It is difficult to accurately track data for the three-year waiting period now occurring between data collection and data entry. Data have to be tracked at every point in the data entry/editing process—upon receipt, during data entry, and at each point in the computer editing process. Steps need to be taken to ensure that manual edits performed in the field and after receipt at the central office are performed correctly. This requires both training and good manuals which define the editing required.

In the future, it is hoped that both the MAFF and the CSO survey units will publish technical notes that attempt to explain data fluctuations. A mature and confident survey unit displays an open interest in eliminating survey shortcomings. All surveys, even in experienced hands, have points of difficulty. For the Zambian units to ignore or minimize them is not helpful to the data user. When the survey managers begin publishing comments on the possible biases in the survey, the data users will gain confidence in both the data and the survey unit. Again, this type of information can be easily lost in the delay between collection and analysis/publication.

The survey units should make every effort to employ improved statistical techniques designed to minimize sampling and non-sampling errors. Employing "total survey design" techniques would be a helpful approach. This methodology allows the survey designers to identify the various error-causing components of a survey and to minimize both sampling and non-sampling errors.

Training is often a key component in minimizing survey errors.¹⁹ All survey personnel should be provided with comprehensive training so they fully understand and appreciate the impact their actions have on data quality. For example, field personnel are often expected to spend long days following intricate procedures in search of data that have little meaning to them. This situation often leads to fabrication of the data by the field enumerators. However, when the staff is given information about the survey sample design and insights into the purpose of the survey, the quality of their performance is higher.

¹⁹ The CSO is presently engaging its statisticians in on-the-job training of manual editing using 1992/93 post-harvest data. The statisticians, after the program, are then expected to supervise junior officers in future surveys. Based on early feedback, the statisticians are gaining a lot of experience with common data errors generated by enumerators in the field and data entry personnel in Lusaka (CSO, personal communications).

IV. Summary

In spite of substantial effort in agricultural data collection, review of the available summaries and reports suggest significant problems with quality. As stated earlier, it is difficult to review data series after a period of time has elapsed unless there are technical notes that document the survey procedures including problems that may have affected the **quality** of data collected. Unfortunately, few such notes exist in either the MAFF or the CSO publications. However, the quality of Zambia's agricultural data may be improved in the future in a number of ways. The most important steps are to ensure the elimination of all unnecessary questions from the two main CSO and MAFF surveys and then to concentrate on the development and maintenance of solid data collection techniques. This will not be an easy task. It will take the courage of policymakers and survey managers alike to make commitments to data quality rather than data quantity.

The most expeditious way of beginning to change the Zambian data system is to employ a team of outside evaluators to review the system in detail. Once the evaluation is complete, and a plan of work is agreed upon by the appropriate governmental units, the government should request the aid of donors in mounting a sustained program of survey evaluation and improvement. Following are four alternative levels of technical support donors should consider providing to the Zambian agricultural data system. Each alternative offers unique benefits. Assisting Zambia with a combination of these inputs would be most effective.

- (1) Short-term trip(s) with the specific task of designing and organizing surveys to collect data for LTC research projects might be considered as a minimal level of support. Working on specific LTC research questions, short-term technical assistance (STTA) would collaborate with CSO statisticians in designing appropriate samples. STTA would explore the use of CSO sampling frame to facilitate probability samples. Areas of possible data-collection collaboration could be considered with the MAFF and/or the CSO field personnel. Any collaboration would be accompanied by in-country training provided by the STTA. The number of trips provided in this category would be totally dependent on LTC research needs.

Benefits: Professionally designed surveys resulting in high-quality research data. Collaboration and a small amount of training provided for the MAFF and the CSO staff.

- (2) One or two short-term trips to search for existing data that would be helpful to the LTC researchers would probably produce information that was previously overlooked. Data series or administrative records very likely exist which have potentially valuable information for researchers. These may include information from governmental or parastatal units (e.g., mortgage listings, title registrations, and the like), or listings currently being compiled for the CSO sampling frames. The search for these information sources would take some time and would depend on STTA's ability to convince government officials of the value of cooperating in the effort.

Benefits: Possible discovery of information that could be made available to the project and others at a relatively low cost.

- (3) STTA would develop an ongoing relationship with CSO and MAFF to assist in providing incremental improvements to the agricultural data system. Following a system review, the STTA would work to encourage changes that appear to be most effective in improving data

quality. Training of staff (both in-country and in the US) would be encouraged as the most certain method of assuring long-term improvements. STTA would expect to spend no less than two months in Zambia each year. Additional time would be spent in the US designing specialized training programs as needed.

Benefits: Improved data and improved working relationship between the project staff and the data collection officials. This kind of technical input could be particularly beneficial if the STTA is allowed to work closely with the CSO and/or the MAFF staff to gain their confidence and cooperation. As travel and training opportunities are realized, interaction between UW and Zambia professionals would be strengthened, offering possibilities for future collaboration.

- (4) Long-term TA (LTTA) to work with the CSO in completely rethinking the data system. There is evidence that the system needs major structural changes if it is to satisfy the needs of future data users. While new technologies such as GIS, remote sensing, and area frames may offer efficiencies and improved accuracy, there are many areas in which incremental changes would be beneficial to the organization. A resident LTTA would be able to influence major changes in design and methods that a STTA may not have the clout to accomplish. However, STTAs would be important for specialized training and statistical design needs.

Benefits: With sufficient funding, the CSO and the MAFF could collaborate in building an agricultural data system that uses cost-effective and efficient surveys to provide timely and accurate data.

Any project delivering STTA and LTTA should emphasize transfer of knowledge to local personnel. As obvious as this sounds, according to CSO officials, some TA personnel have perpetuated their employment by doing the work themselves. Some have failed to produce technical notes about survey methods despite remaining in Zambian organizations for years. Despite these reservations, the CSO nevertheless welcomes STTA and LTTA. From the perspective of the authors, such problems of confidence and transfer of knowledge are best encountered through projects emphasizing long-term institutional collaboration and commitment (e.g., options (3) and (4) above).

Improvement of staff performance is key to raising the quality of agricultural data in Zambia. By offering training opportunities to the staff, both productivity and accuracy will rise as they learn new procedures and experience higher morale. Some of the statistical training programs available are summarized below:

ISPC, Bureau of Census offers focused training in several areas of statistics, survey management, and computer analysis. Courses are usually 12 months in length. ISPC training is expensive, but courses impart valuable practical training on what is needed to manage an agricultural data system.

OICD/USDA contracts with governmental agencies and universities to provide specialty training of 2 to 8 weeks in length. Each year OICD offers several 2- to 6-week courses in agricultural statistics and computer usage. The impression is that the courses are somewhat limited in scope and the contractors have fairly rigid programs with limited latitude for adapting materials to specific country needs.

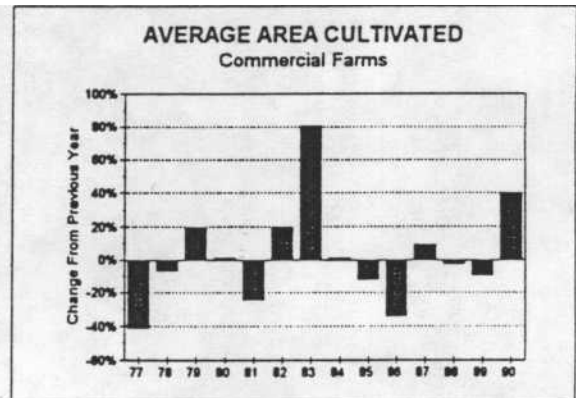
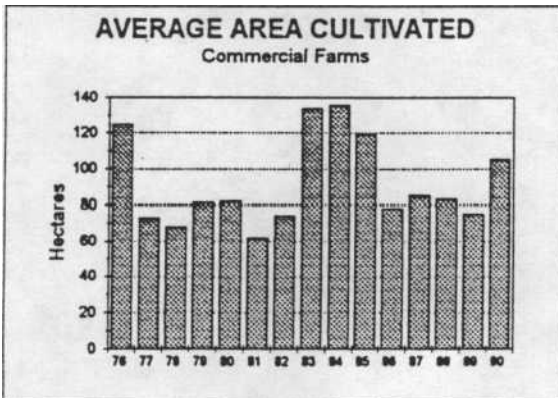
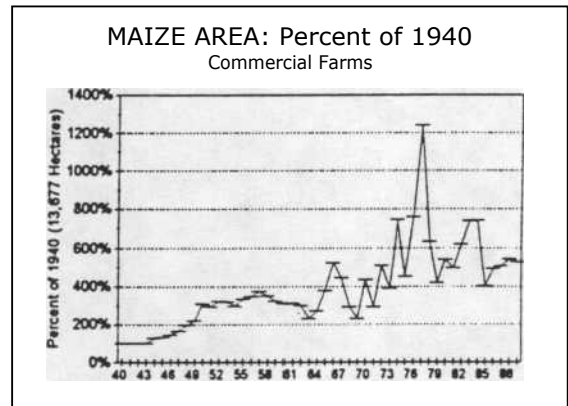
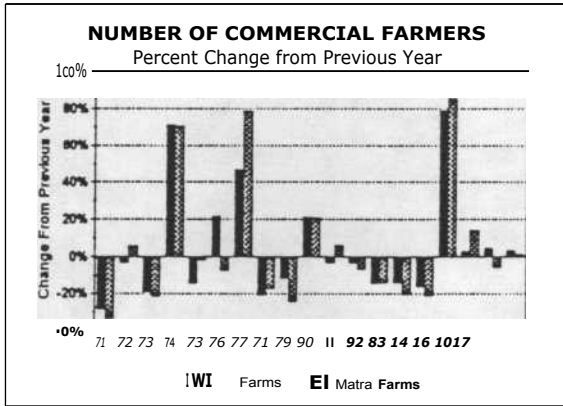
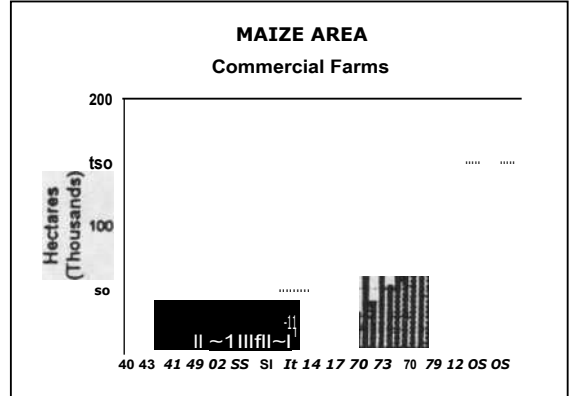
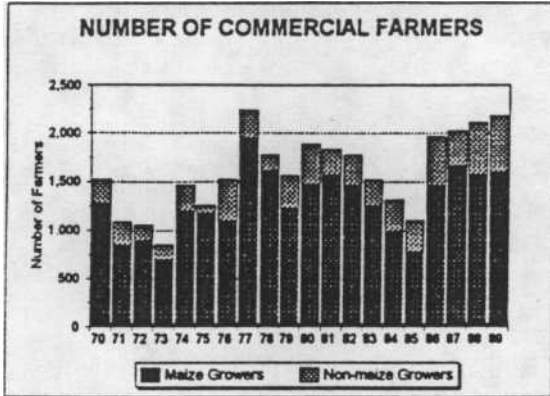
University of Wisconsin-Madison offers training opportunities either on-campus or in-country. Courses range from formal university graduate-level courses to 2- to 4-week workshops. Courses can be geared to the needs of the students. For example, courses can be adapted as refreshers for experienced staff or as beginning courses designed to get new employees started. Instructors will travel to Zambia to conduct short courses and/or assist Zambians in training local staff.

If employed as STTA to interface with the CSO and the MAFF (item 3 above), the instructor will spend up to two months per year in Zambia working on data problems. Coordination of STTA visits and training plans would increase effectiveness.

The University of Wisconsin offers additional courses in monitoring and evaluation, research methods, rapid rural appraisal methods and land tenure issues periodically at various African sites (e.g., Senegal, Madagascar, Uganda, and The Gambia).

The CSO prefers locally-organized courses as they afford opportunities for a larger number of officers to attend. However, this by no means precludes training abroad in specialized areas. Further, as it is difficult to identify with perfect knowledge all training needs in advance, the CSO strongly advises maintaining flexibility in choice of training programs during the course of project design.

Annex 8.1: Graphs illustrating variation in commercial farm estimates



Annex 8.2: Maize time series data published by the CSO, commercial farms

Year	Households growing	Area planted (ha)	Ave. area per HH (ha)	Production (90 kg bags)	Yield (bags/ha)	Sold (90 kg bags)	Percent sold	Value (kwacha)	Average value
1940		13,677		261,000					
1941		13,729		173,000					
1942		13,666		203,000					
1943		13,574		202,000					
1944		17,472		289,000					
1945		17,982		348,000					
1946		19,797		395,000					
1947		22,627		204,000					
1948		26,658		446,000					
1949		29,976		369,000					
1950		42,510		572,000					
1951		39,783		467,000					
1952		44,254		443,000					
1953		43,842		637,000					
1954		40,578		715,000					
1955		45,462		651,000					
1956		47,383		956,000					
1957		51,203		1,257,000					
1958		47,798		661,000					
1959		44,211		1,120,000					
1960		42,190		1,075,000					
1961		42,700		1,427,000					
1962		40,838		1,490,000					
1963		31,522		946,000					
1964		37,311		1,459,000					
1965		51,657		2,452,000					
1966		71,689		3,413,868					
1967		60,850		2,933,000					
1968		39,879		1,834,400					
1969		31,603		1,462,100					

Annex 8.2, Maize time series data, cont.)

Year	Households growing	Area planted (ha)	Ave. area per HH (ha)	Production (90 kg bags)	Yield (bags/ha)	Sold (90 kg bags)	Percent sold	Value (kwacha)	Average value
1970	1,277	59,530	47	2,318,590	39				
1971	849	39,940	47	2,020,400	51	3158600	97%	12,469,000	3.95
1972	898	69,970	78	3,264,600	47	2213070	97%	9,391,810	4.24
1973	705	53,028	75	2,291,008	4	4,982,220	95%	21,261,440	4.27
1974	1,203	102,030	85	5,247,430	51	2,923,500	95%	14,475,360	4.95
1975	1,181	62,130	53	3,077,000	50	4,376,490	94%	27,282,290	6.23
1976	1,096	103,650	95	4,647,840	45	4,765,160	95%	29,788,890	6.25
1977	1,959	169,860	87	5,014,830	30	3,273,806	91%	22,385,618	6.84
1978	1,620	86,684	54	3,601,018	4	1,972,530	95%	18,749,520	9.51
1979	1,224	57,070	47	2,086,880	37	2,307,704	87%	26,395,249	11.44
1980	1,478	74,233	50	2,656,850	36	2,870,635	94%	39,476,683	13.75
1981	1,569	67,860	43	3,044,772	45	2,471,264	96%	38,599,593	15.62
1982	1,463	84,701	58	2,572,991	30	3,656,297	97%	67,797,895	18.54
1983	1,259	100,859	80	3,786,320	38	2,141,583	86%	51,319,040	23.96
1984	1,000	101,286	101	2,487,687	25	1,858,407	97%	53,518,671	28.80
1985	789	54,922	70	1,917,150	35	3,412,687	98%	185,893,448	54.47
1986	1,463	67,739	46	3,500,140	52	3,398,491	97%	266,587,369	78.44
1987	1,670	69,477	42	3,504,521	50	3,031,477	94%	257,466,415	84.93
1988	1,577	74,763	47	3,231,122	43	3,314,679	94%	403,922,001	121.86
1989	1,595	72,090	45	3,533,213	49				

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