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AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT (ATIP)

FOOD CONSUMPTION IN SHOSHONG AND MAKWATE

NUMBER: ATIP WP - 19

BY

DOYLE BAKER

Agricultural Technology Improvement Project
Department of Agricultural Research
Ministry of Agriculture
P / Bag 0033
Gaborone
Botswana

Telephone 352381 Ext. 260
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WORKING PAPER

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DOYLE BAKER

DEPARTMENT OF AGRIC. RESEARCH
MINISTRY OF AGRICULTURE
BOTSWANA

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P/BAG 0033 GABORONE

P. O. BOX 10 MAHALAPYE

P.O. BOX 10275 TATITOWN (FRANCISTOWN)

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PREFACE

ATIP working papers consist of methodological and empirical material which has been reviewed internally by ATIP. Working papers are prepared and circulated to make ATIP research findings easily available to GOB personnel and researchers interested in Botswana farming systems. Any interpretations or conclusions presented do not necessarily reflect the views of the Department of Agricultural Research, USAID or MIAC.

This paper gives an overview of food consumption patterns in Shoshong and Makwate between October 1984 and September 1985. The paper is based on a series of monthly visits to the ATIP cooperators in Shoshong and Makwate villages. The analysis covers the frequencies with which the major food times were consumed and the primary sources of food items. Information on consumption levels is presented for grain and meal, and milk.

The paper shows that maize replaced sorghum as the primary staple during the 1980s drought. Bread and vegetables were consumed more frequently than expected. Several differences in consumption frequencies were significantly associated with village location and cattle assets. There was substantial seasonality in consumption frequencies, and in the levels of meal and milk consumption. Home production was a minor source of food relative to purchases from general traders. Implications for future research are discussed at the end of the paper.

ACKNOWLEDGEMENTS

The analysis is based primarily on data collected through the 1984-85 Activity Survey. Chada Tibone administered the survey during the first three months. After that, the survey was administered by Reuben Serumula and Ms Tibone helped supervise the enumerator. Kelebogile Seleka entered the data.

Background information is given on the main dishes and food items consumed in Shoshong and Makwate. That information was obtained through the 1983 Crop Management Survey. The Crop Management Survey was administered by Meschack Tjirongo, Elija Modiakgotla, Davis Dira, and W. Keipeile.

David Norman and Portia Monyane helped with data processing on both surveys.

FOOD CONSUMPTION IN SHOSHONG AND MAKWATE:

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1. INTRODUCTION

Food consumption research can provide a valuable perspective for setting on-farm research priorities. Since most farm production is consumed by the producing household, consumption requirements and food preferences exert a major influence on farmers' responses to suggested innovations. Farmer welfare can be improved by targeting interventions to problems areas in the diet, even if household cash income is not increased. Data on household characteristics and consumption patterns can be used to identify target commodities for each type of household, and to see whether there is a strong connection between wealth, production practices and food consumption. Seasonal data can be used to determine whether there are particular periods when additional food production is most needed.

Detailed food consumption research, focused on measured food intake, is difficult and time consuming. This is perhaps the main reason why a food consumption perspective often has been ignored in on-farm research. There are, however, survey research methods which can provide an overview of food preferences and consumption patterns with a modest investment of research resources. Single- and monthly-visit surveys, for example, can be used to:

(a). Identify major dishes, food consumption patterns, and farmers preferences with respect to varieties and crop utilization

(b). Evaluate relationships between food consumption patterns and household characteristics

In order to develop a preliminary profile of food consumption patterns in Shoshong and Makwate, respondents to the 1983 Crop Management Survey were asked to identify and rank their main dishes and other food items. The survey was administered to 116 households in Shoshong and Makwate. The sample included the 50 ATIP cooperators, which had been selected in 1982 using stratified random sampling, and 66 randomly selected households. Findings were summarized in ATIP Research Report Number 1 and Working Paper 17.

The Crop Management Survey showed that sorghum, maize and cowpeas were the primary constituents of most dishes (see Table A.1). Most dishes also included leafy greens ("morogo"), milk or meat. Thinner porridge normally was consumed for breakfast, often with milk, while thick porridge with a relish was consumed later in the day. The relative importance of dishes was different between Shoshong and Makwate, although the same ingredients were used in both villages. The survey also showed that most farmers felt that watermelons and melons are important foods (see Table A.2). Meat and beans, such as jugo beans, were considered to be important food items aside from their role in the major dishes.

Because the 1983 Crop Management Survey was a single-visit survey, it was not possible to generate data on consumption levels or frequencies. This prevented a reliable assessment of the importance of the various food items at different times of the year, or an analysis of differences in consumption patterns by village location or household type. Also, no information was obtained on the relative importance of different sources of food items.

To supplement the information gained during the Crop Management Survey, one sheet (out of five) of the 1984-85 Activity Survey addressed food consumption frequencies, the sources of food items, the amount of grain and meal consumed, and the amount of milk consumed. The food consumption research in the 1984-85 season had five specific objectives:

(a).To confirm the farmers' rankings of the relative importance of food items
(b).To examine seasonality in food consumption
(c).To test for significant differences by village location, gender of household head, cattle assets and draught access
(d).To determine meal and milk consumption levels in relation to the number of consumers
(e).To identify the major sources of the most important food items

This paper presents findings from the 1984-85 Activity Survey relating to the above food consumption objectives. Section 2 describes data collection methods. Section 3 gives an overview of food consumption frequencies. Section 4 discusses differences in consumption bundles, taking into account the relative frequencies with which all food items were consumed. Sections 5 and 6 cover the levels of meal and milk consumption, respectively. Section 7 addresses the sources of food items.

2. METHODS

Participants in the Activity Survey were the ATIP cooperators in Shoshong and Makwate villages. The ATIP cooperators were selected using a two step procedure. First, a 16 question census was administered in each village in order to generate a sample frame. The census was administered in late October and early November 1982. Approximately 90 percent of households were contacted in both villages. The ATIP cooperators then were selected using stratified random sampling. Two sub-sets of cooperators were selected, one for trials and one for a resource monitoring survey. The strata for the trials sub-set were based on draught access and type of traction. The strata used for the resource monitoring sample also took into account gender of household head and cattle assets. To the extent possible, the proportion of households selected in each stratum reflected the proportion of households in that stratum in the entire population of Shoshong and Makwate villages. This was done so that weighting would not be required when aggregating results for each village.

In the Activity Survey, respondents were asked at the end of each month how often the members of their household had consumed each of 19 major food items during that month. Categorical responses were recorded, distinguishing between "not at all during the month," "one to three times during the month," "two to three times a week," "four to five times a week," and "everyday or nearly every day." In addition, respondents were asked to estimate the number of adults and children who ate at the household compound(s) during the month, the total amount of sorghum and maize meal (or grain) consumed during the month, and the average amount of milk consumed daily.

In principle, there could have been 12 responses for each household. However, it was not possible to contact every household in every month. In the end, there were 554 observations, an average of just over 46 responding households per month. Thus, the data analysis is based on "household-months." This unit of analysis takes two elements of frequency into account: the number of households and the frequency per household during different months in the year monitored.

For purposes of data analysis, households were stratified on the basis of village location, gender of household head, cattle assets and draught control. Household head was defined on the basis of the resident head. In a few cases where the recognized head was absent for the entire season, the resident head was not the same gender as the recognized head. Cattle assets

were ascertained during the 1983 Crop Management Survey and verified for the resource monitoring sub-sample during a Livestock Inventory Survey administered in 1984. Draught control was defined to include all households which used owned traction or which borrowed traction for the entire cropping season. Households which hired or obtained traction through a cooperative arrangement were defined to be draught dependent.

Most of the data analysis described in the paper relies one of two statistical tests of significance; the chi-square or the Spearman rank correlation coefficient. The chi-square statistic is used to determine whether a systematic relationship exists between two categorical variables. The chi-square statistic is calculated taking into account differences between observed cell frequencies and expected cell frequencies (based on the product of the row and column marginal frequencies). The greater the discrepancies between expected and observed frequencies, the larger the chi-square becomes.

The Spearman rank correlation coefficient is used to determine whether the rankings of food consumption frequencies were significantly correlated. This is a nonparametric correlation statistic, appropriate when analysing ordinal data. The closer the correlation coefficient is to one, the stronger is the correlation between the consumption bundles for the sub-populations being compared.

3. FOOD CONSUMPTION FREQUENCIES

Table 1 summarizes findings on food consumption frequencies from October 1984 to September 1985.

TABLE 1: FOOD CONSUMPTION FREQUENCIES, OCTOBER 1984 TO SEPTEMBER 1985

	PER MONTH		-------PER WEEK-------			
	0	1-3	1	2-3	4-5	6-7
	(Percent of Household-Months)					
GRAIN AND MEAL:						
Sorghum Meal	22	10	6	4	4	53
Maize Meal	16	9	10	5	4	56
"Stampa"	47	35	10	6	1	0
Green Maize	91	8	<1	<1	1	<1
Bread	24	32	17	16	7	4
Rice	74	21	4	1	<1	0
Cowpeas	62	25	8	3	2	<1
OTHER CROPS:						
Lands Morogo	50	18	7	8	8	9
Other Morogo	90	3	1	2	1	3
Watermelons	83	5	3	3	3	4
Starchy Melons	91	3	2	1	2	1
Vegetables	45	21	11	12	7	5
ANIMAL PRODUCTS:						
Beef	29	37	9	9	9	8
Goat/Mutton	37	24	14	13	7	5
Chicken	67	30	2	1	0	1
Cow Milk	57	7	3	6	4	23
Goat Milk	44	2	1	2	1	49
Eggs	77	18	1	1	<1	1

The results generally confirmed farmers' rankings of the relative importance of food items. Most households relied on maize and/or sorghum meal. Many households though were unable to eat sorghum at any time. Of the crop commodities consumed, perhaps most notable is how many households were consuming bread and vegetables on a regular basis. Few households ate green maize, rice, or cowpeas.

A substantial proportion of households did not eat any meat, either beef or goat meat (mutton is rarely eaten). Milk was the major source of animal protein, although it was consumed in small quantities. Chicken meat and eggs were consumed infrequently or not at all by nearly all the households.

Information on seasonal patterns in food consumption is presented in Tables 2 and 3. Table 2 covers grains, meal and other crops. Table 3 covers animal products. Only items consumed more than once a week by at least 15 percent of the households have been included.

Seasonal differences in consumption were most pronounced for animals products (except for goat meat), lands morogo, and vegetables. Beef was least frequently consumed during the January to March period, at which time no beef was consumed in nearly half of the household-months. Except for the January to March period, beef was eaten more than once a week in nearly a third of the household-months. This is certainly high according to African standards. Goat milk consumption was concentrated between October and March. Cow milk was relatively more important later in the season.

Consumption of lands morogo was concentrated in the April to June period. Consumption was possible outside of that period because farmers often boil and then dry the morogo so it will keep for later consumption. Winter vegetables, available in October through December, were consumed more frequently by more households than were summer vegetables.

TABLE 2: GRAIN, MEAL AND VEGETABLE CONSUMPTION FREQUENCIES BY PERIOD

	SORGHUM MEAL	MAIZE MEAL	"STAMPA"/a	BREAD	LANDS MOROGO	OTHER VEGET.
	(Percent of Household-Months)					
OCTOBER TO DECEMBER 1984:						
Not at All	26	5	39	9	75	26
Once a Week or Less	15	21	47	49	17	37
More than Once a Week	58	74	14	42	8	37
JANUARY TO MARCH 1985:						
Not at All	32	8	51	23	50	65
Once a Week or Less	15	21	44	50	29	23
More than Once a Week	53	71	5	27	21	11
APRIL TO JUNE 1985:						
Not at All	19	24	56	30	21	53
Once a Week or Less	20	21	35	47	36	32
More than Once a Week	61	55	10	23	43	16
JULY TO SEPTEMBER 1985:						
Not at All	12	27	47	34	44	42
Once a Week or Less	17	17	50	50	24	35
More than Once a Week	71	57	3	16	32	23

a. Maize kernals.

TABLE 3: MEAT AND MILK CONSUMPTION FREQUENCIES BY PERIOD

	BEEF	GOAT MEAT	COW MILK	GOAT MILK
	(Percent of Household-Months)			
OCTOBER TO DECEMBER 1984:				
Not at All	21	36	85	24
Once a Week or Less	47	32	5	1
More than Once a Week	32	32	10	75
JANUARY TO MARCH 1985:				
Not at All	41	34	47	30
Once a Week or Less	45	47	15	4
More than Once a Week	14	20	30	66
APRIL TO JUNE 1985:				
Not at All	22	40	43	66
Once a Week or Less	47	33	11	3
More than Once a Week	31	27	46	31
JULY TO SEPTEMBER 1985:				
Not at All	29	37	49	59
Once a Week or Less	43	40	10	5
More than Once a Week	28	23	41	36

Consumption of the major cereal grains increased only slightly as the season's harvest became available. This was because maize and sorghum meal were purchased by most households (see below). There appeared to be a trade-off between maize and sorghum meal. The frequency of maize meal consumption dropped off beginning in April, just as consumption of home-produced sorghum increased.

Cross tabulation analysis was carried out to determine whether the differences noted with respect to seasonal patterns were statistically significant, and to ascertain which households were eating the different food items regularly and which were not. In order to conserve degrees of freedom and make sure there was an expected value exceeding five observations in each cell (a rule-of-thumb for obtaining reliable chi-square statistics), consumption frequencies were grouped into the three cells used in Table 2: (a) not at all during the month, (b) once a week or less, and (c) more than once a week.

A summary of the resulting chi-square statistics is presented in Table 4. Items consumed less than once a week in more than 85 percent of the household-months were not included in the analysis. Below each significant chi-square, the main deviations from the cell expected values are indicated. For example, an "S+" under village indicates that the significance of the chi-square is mainly attributable to a higher frequency of consumption for that item in Shoshong village. The symbols used are further defined in the table footnotes.

Of the nine items assessed, significant differences in seasonal consumption patterns were identified for every commodity except goat and mutton. Five of nine items (including bread, maize meal, vegetables, beef and goat milk) were consumed more frequently than average between October and December. Beef, sorghum meal and vegetables were consumed significantly less frequently during mid-summer, from January to March.

Several significant differences in consumption frequencies were associated with village and with cattle assets. For six of nine items, the frequency

of consumption was significantly greater in Shoshong. Only cow milk was more frequently consumed in Makwate. This was mainly due to the close proximity of Makwate cattle posts to the village. For all five items for which there was a significant difference in consumption frequency according to cattle assets, richer households consumed more.

TABLE 4: CHI-SQUARE STATISTICS FOR DIFFERENCES IN FOOD CONSUMPTION FREQUENCIES

	PERIOD/a	VILLAGE	SEX OF HEAD	DRAUGHT ACCESS	CATTLE ASSETS
GRAIN AND MEAL:					
Sorghum Meal	20.7	70.6	1.1	0.4	17.6
	(1-,3+)/b	(S+)			(R+)
Maize Meal	38.6	6.2	2.0	0.9	4.2
	(2-,4+)				
Bread	42.5	51.6	0.3	9.1	21.7
	(3-,4+)	(M-)			(R+)
OTHER CROPS:					
Lands Morogo	79.0	0.6	7.9	2.0	2.8
	(2+,4-)				
Vegetables	53.2	62.9	1.4	10.5	22.0
	(1-,4+)	(M-)			(R+)
ANIMAL PRODUCTS:					
Beef	23.6	54.1	8.3	9.6	20.1
	(1-,4+)	(S+)		(D+)	(R+)
Goat/Mutton	11.0	36.8	6.0	9.0	9.5
		(S+)			(R+)
Cow Milk	69.3	37.4	14.3	6.1	8.2
	(2+,4-)	(M+)	(M+)		
Goat Milk	79.5	3.8	2.7	17.4	3.2
	(1+,4+)			(C+)	

a. Period has 6 degrees of freedom while village, sex of head, draught access and cattle assets have 2 degrees of freedom. Significance levels for the Chi-Square Statistic are as follows:

Significance =	.05	.01
6 dof	12.6	16.8
2 dof	6.0	9.2

b. The symbols used are as follows:
Period: 1 = Jan.-March; 2 = April-June; 3 = July-Sept.; 4 = Oct.-Nov.
Village: S = Shoshong; M = Makwate.
Sex of Head: M = male; F = female.
Draught Access: C = control of draught; D = draught dependent.
Cattle Assets: P = 0 to 35; R = more than 35.

Whether a household was male or female headed or controlled draught resources did not, in most cases, have a significant relationship with consumption frequencies. To the extent there were any trends, male-headed households tended to consume most items more frequently. This was likely due to the fact that male-headed households were also relatively more rich.

4. DIFFERENCES IN CONSUMPTION BUNDLES

The analysis of consumption frequencies has thus far dealt with food items on an individual basis. An important additional issue is whether the relative frequency of consumption of different food items is similar or different by period, by village or by household type. This issue relates to the nature of the food consumption "bundle" taken as a whole.

To assess relative patterns in food consumption bundles, Spearman rank correlation coefficients were calculated. The rank correlation coefficients were based the means of the disaggregated categorical values for each item. Results are summarized in Table 5.

TABLE 5: SPEARMAN RANK CORRELATION COEFFICIENTS FOR CONSUMPTION FREQUENCIES

BY VILLAGE	.81/a	BY PERIOD:	
BY HH TYPE:		Months 1-3 v. 4-6	.72
Gender of Head	.94	Months 4-6 v. 7-9	.56
Draught Access	.90	Months 7-9 v. 10-12	.63
Cattle Assets	.79	Months 10-12 v. 1-3	.82

a. There are 16 degrees of freedom. Significance levels for the Spearman rank correlation coefficient for 16 dof are as follows: .43 = .95 significance; .60 = .99 significance.

Significant rank correlation coefficients were obtained for all paired groupings, but there was substantial variation in the coefficients. Overall, consumption bundles were most similar when comparing on the basis of gender of household head and draught access. Somewhat greater differences were found by village and cattle assets. The lowest correlations were found when comparing periods of the year. The correlation between the months at the end of the cropping season (April to June) and winter months was only .56, barely a significant correlation at the .05 confidence level.

5. SORGHUM AND MAIZE MEAL CONSUMPTION LEVELS

During the 1985 survey, respondents were asked to estimate how many kilograms of sorghum and maize meal were eaten each month by all the adults and children who ate with the household on a daily basis. The numbers of adults and children eating daily were also recorded. Results are summarized in Table 6.

Seasonal patterns were identified for the kilograms consumed and the number of consuming adults. Average sorghum and maize meal consumption reached almost 60 kgs per month per household between October and December, and was 45 to 50 kgs per month during the rest of the year. The number of consuming adults peaked in January and February, decreased each month until the end of winter and then started increasing again. There was little seasonal variation in the number of consuming children, although there was a slight increase during winter when the adults move back to the village to join their school age children.

TABLE 6: KILOGRAMS OF SORGHUM AND MAIZE MEAL EATEN MONTHLY AND NUMBER OF CONSUMERS

	KILO-GRAMS/a	ADULTS	CHILDREN	KGS. PER CONSUMER/a
PERIOD:				
Oct.-Dec.	59.6	5.9	2.2	7.5
Jan.-March	45.8	6.1	1.9	5.8
Apr.-June	47.6	3.9	2.9	7.3
July-Sept.	49.1	2.5	3.3	8.9
VILLAGE:				
Shoshong	52.7	4.5	2.6	7.6
Makwate	47.7	4.7	2.7	6.6
GENDER OF HEAD:				
Male	52.9	4.8	2.5	7.5
Female	46.9	4.1	2.8	7.0
DRAUGHT ACCESS:				
Control	54.3	4.8	2.7	7.5
Dependent	45.1	4.1	2.4	7.2
CATTLE ASSETS:				
0-35	49.0	4.3	2.7	7.3
> 35	54.1	4.9	2.4	7.6
ALL	50.9	4.5	2.6	7.4

a. Consumer units have been derived by weighting children at .919 of an adult. This number is the ratio of the adult and children coefficients in a regression of the kgs consumed on the number of adults and children.

Shoshong, male-headed, draught-controlling, and cattle-rich households all consumed greater amounts of meal, both in total and per consumer. Approximately 7.5 kgs of meal were eaten per consumer each month, or about one-quarter kg per day.

6. MILK CONSUMPTION LEVELS

At the end of each month, survey respondents were asked to estimate how many cups of milk had been consumed per day during the month. Three categories of milk consumption were specified:

(a). Cups consumed by household members regardless of source
(b). Cups consumed by household members that were from household goats and cows
(c). Cups taken from household animals whether or not consumed by household members

Results were analysed by period, village, cattle assets and gender of household head. Findings are summarized in Table 7. The first two columns show the average number of cups consumed daily by household members from any source and from household animals, respectively. The third column shows how many cups were taken from household animals each day, whether or not the milk was consumed by household members. The fourth column shows what

percent of household consumption was obtained from household animals. The final column shows what percent of the milk taken from household animals was consumed by household members.

TABLE 7: MILK CONSUMPTION LEVELS: CUPS PER DAY

	HH CONSUMPTION ANY SOURCE	HH ANIMALS	ALL MILK FROM HH ANIMALS	PCT HH CONS. FROM HH ANIMALS	PCT HH ANIM. MILK CONS. BY HH
PERIOD:					
Oct.-Dec.	3.8	3.1	3.6	82	88
Jan.-March	7.1	6.4	7.5	89	84
Apr.-June	5.9	4.9	5.3	82	93
July-Sept.	2.7	1.8	2.0	66	94
VILLAGE:					
Shoshong	3.9	3.2	3.5	82	91
Makwate	6.6	5.5	6.4	83	86
GENDER OF HEAD:					
Male	6.1	5.4	6.2	88	88
Female	2.3	1.2	1.2	51	96
CATTLE ASSETS:					
0	2.2	0.8	0.8	35	95
1-15	2.6	1.4	1.6	55	88
16-35	5.3	5.0	5.6	93	89
36-70	6.1	5.1	5.8	84	89
71+	8.2	7.7	8.9	93	87
ALL	4.9	4.0	4.5	83	88

Each household consumed an average of just under five cups of milk a day. Based on the number of consumers shown in Table 5, this would mean each consumer consumed approximately two-thirds of a cup per day. Four cups, or an average of 83 percent, of the milk consumed came from household animals. Throughout the year, most of the milk obtained from household animals was consumed by household members.

Table 7 shows that there was significant seasonal variation in the amount of milk consumed. Milk consumption was greatest during mid-summer, in the months of December through March. Milk consumption dropped off in late summer and was lowest during the winter. Milk consumption during winter was only 38 percent of mid-summer milk consumption. During the peak milk consumption period (January to March), 89 percent of the milk consumed came from household animals. In contrast, only 66 percent of milk came from household animals during summer.

There also were significant differences in milk consumption by village and household type. As with grain consumption levels, members of male-headed households consumed significantly more milk. As would be expected, milk consumption levels were directly related to the number of cattle owned. Unlike grain consumption, however, members of Makwate households consumed more milk than did members of Shoshong households.

In general, households which consumed less milk obtained a smaller percentage of their milk from household animals. This can be seen in Table 6 with reference to female-headed households and households which did not own any cattle.

The amount of milk consumed was affected by which type of animals were being milked. In general, when cows were milked, two to three times as much milk was obtained and consumed as compared to when goat milk was consumed. This was determined by examining average consumption levels for various frequencies of cow versus goat milk consumption.

In 38 percent of the household-months, only goat milk was consumed. During nearly all of those household-months, goat milk was consumed on a daily basis. The average amount consumed was 3.1 cups. Only cow milk was consumed in 30 percent of the household-months. Average daily milk consumption in those months was 6.1 cups. Among households which consumed cow milk on a daily basis, the average was 9.1 cups a day even if no goat milk was consumed. In 54 household-months, both cow and goat milk were consumed on a daily basis. The average amount of milk consumed during those household-months was 15.4 cups, of which 86 percent came from household animals.

7. SOURCES OF FOOD ITEMS

In the Activity Survey, respondents also were asked to indicate which of the following was the primary source of each food item during that month: relative, another farmer, local trader, trader in another village, Government feeding programmes, or household production. Results for the major food items are presented in Table 8. Government feeding programmes have not been included in the table since only three items were received to any notable degree through the programmes.

TABLE 8: PRIMARY SOURCES OF FOOD

	RELATIVE	OTHER FARMER	LOCAL TRADER	DISTANT TRADER	HOME PRODUCT
	(Percent of Household-Months)				
GRAIN AND MEAL:					
Sorghum Meal	2	1	65	0	31
Maize Meal/a	1	0	92	0	1
"Stampa"	1	1	96	<1	2
Green Maize	6	30	17	11	36
Bread	1	1	97	0	<1
Rice	0	0	99	1	0
Cowpeas/b	2	4	46	0	35
OTHER CROPS:					
Watermelons	3	31	6	1	59
Starchy Melons	4	6	2	0	88
Vegetables/c	<1	5	79	2	<1
ANIMAL PRODUCTS:					
Beef	6	49	33	1	11
Goat/Mutton	4	65	4	0	27
Chicken	1	2	2	1	95
Cow Milk	5	30	22	0	43
Goat Milk	10	11	<1	0	79
Eggs	1	2	13	0	85

a. Government programmes were the primary source in 6% of household-months.
b. Government programmes were the primary source for 13%.
c. Government programmes were the primary source for 14%.

Table 8 shows that local traders were the primary source of most of the grain and meal consumed. In more than 90 percent of the household-months, traders were the primary source for maize meal, bread and rice. Green maize was obtained primarily from other farmers. Despite the dominance of sorghum in farm production, household production was the primary source of sorghum in only 31 percent of the household-months. This of course reflected the influence of the drought.

With reference to other crops, melons and watermelons were obtained almost exclusively through home production or from other farmers. Most vegetables, on the other hand, were purchased from traders.

Animal products generally were obtained from home production or from other farmers. In most cases, farmers sell some beef or goat meat when they slaughter animals. Across a village, a few individuals might slaughter animals on any given day. In this way, many people can eat small quantities of meat. Farmers also often sell each other small quantities of milk. Since milk is consumed in small quantities, there are often small surpluses to sell when more than a few cows are lactating at the same time. Chicken and eggs were obtained almost exclusively from home production.

Cross tabulation analysis was carried out to determine whether there were significant differences in the sources of the main food items associated with period of the year, village or household type. For this analysis, relatives and other farmers were grouped into a farmers category, and all traders were grouped. Only six items were analysed since the others were either consumed on an infrequent basis or were nearly always obtained from a single source. The resulting chi-square statistics are presented in Table 9. The main deviations from the cell expected values are indicated for groupings having significant chi-square statistics.

A number of significant differences were identified, by period, village and household type. Overall, Makwate households tended to rely on home production or other farmers more than did Shoshong households. Female-headed households relied less on home production for most commodities, relative to male-headed households, as did draught-dependent household relative to draught-controlling households and cattle rich-households relative to cattle-poor households.

TABLE 9: CHI-SQUARE STATISTICS FOR DIFFERENCES IN SOURCES OF MAIN FOOD ITEMS

	PERIOD/a	VILLAGE	SEX OF HEAD	DRAUGHT ACCESS	CATTLE ASSETS
GRAIN AND MEAL:					
Sorghum Meal	29.7 (1:t+,h-) (2:h+)	78.0 (M:h+) (M:t-)	30.0 (F:h-) (F:f+)	20.0 (D:h-)	3.9
Cowpeas	30.1 (1:f+) (2:h+)	27.3 (M:h+) (S:t+)	14.8 (F:t+) (F:h-)	11.7 (D:t+)	2.6
ANIMAL PRODUCTS:					
Beef	11.1	63.4 (S:t+) (M:f+)	13.3 (M:h+) (F:t-)	10.5 (D:t+) (D:h-)	16.3 (R:h+) (R:f-)
Goat/Mutton	13.9	12.3 (M:h-)	16.5 (F:h-) (F:t+)	8.8	18.1 (R:h+) (P:f+)
Cow Milk	114.9 (3:t+) (4:h+)	62.1 (S:t+) (M:f+)	42.7 (F:h-) (F:f+)	29.4 (D:h-) (D:t+)	42.3 (R:h+) (P:f+)
Goat Milk	35.4 (3:h+)	1.5	10.9 (M:h+)	18.4 (C:h+)	2.8

a. Period has 6 degrees of freedom while village, sex of head, draught access and cattle assets have 2 degrees of freedom. Significance levels for the Chi-Square Statistic are as follows:

Significance =	.05	.01
6 dof	12.6	16.8
2 dof	6.0	9.2

b. The symbols in parentheses indicate the main deviations from the cell expected values for grouping of which the Chi-Square is significant at a .99 confidence level. A plus represents a larger proportion than the expected value, while a minus represents a smaller proportion. The symbols used are as follows:

Period: 1 = Jan.-March; 2 = April-June; 3 = July-Sept.; 4 = Oct.-Nov.
Village: S = Shoshong; M = Makwate.
Gender of Head: M = male; F = female.
Draught Access: C = control of draught; D = draught dependent.
Cattle Assets: P = 0 to 35; R = more than 35.
Sources: f = other farmer; t = trader; h = own household.

8. CONCLUSIONS

This research has shown there were significant differences in consumption patterns, both with respect to individual items and consumption bundles, by village, period of the year, and cattle assets. Few significant differences in food consumption frequencies were associated with the gender of household head or draught access. The research also revealed significant differences in the sources of food items by location, period and household type.

One on the most important policy-related finding is that rural households have substituted purchased maize meal for home grown sorghum. While this was a forced decision during drought, it shows a willingness to eat maize meal (if not a preference for maize, since sorghum meal often was available). A growing acceptance of maize reduces, at least to an extent, the incentive to produce sorghum. As farming households develop a preference for maize, they may increase the proportion of resources invested in maize production. Unfortunately, maize is an extremely risky crop in the Central Region. Some decision will have to be made whether to provide an additional incentive for sorghum production or to seek ways to grow maize that are more successful.

The relative importance of bread and vegetables in the diet also holds policy implications. If, as appears to be the case, rural households want to consume bread then Botswana could become even more dependent on food imports. Two options would be to: (a) examine consumer reaction to bread made with some sorghum meal and (b) evaluate the economics of irrigated winter wheat production. Recent assessments of the prospects for winter wheat production in Botswana have been inconclusive. The Ministry might turn to Zimbabwe for additional information on either option. More attention might also be given to evaluating the best options for winter vegetable growing and distribution. One issue is whether the Ministry should focus on practices for household vegetable gardens rather than continue its current emphasis on small-scale commercial production. This issue is related to the pattern of water availability.

Food consumption research also has pointed out the importance of home produced secondary crops. Cowpeas, morogo and melons provide variety and contribute important nutrients. While it is unlikely that varietal breeding or selection could be justified for most of the secondary crops, some attention to appropriate husbandry practices would be warranted.

TABLE A.1: FARMER RANKINGS OF MAIN DISHES, 1983

DISH/a	DESCRIPTION	SHOSHONG EAST RANK	POINTS/c	--MAKWATE-- RANK	POINTS	----ALL---- RANK	POINTS
LEFATA	Sorghum or Maize & Cowpeas or Jugo Beans	3	91	1	100	1	100
BOGOBE	Sorghum & Morogo or Meat or Milk	1	100	3	43	2	81
THOPI	Sorghum & Melons	2	93	7	8	3	61
PHALECHE	Maizemeal & Morogo or Meat or Milk	4	35	6	30	4	35
MOGODU	Cowpeas & Melons	5	19	2	46	5	32
MOKGANIYANE	Sorghum Cooked With Milk	6	5	4	42	6	21
SETAMPA	Semp & Meat or Oil or Milk	7	3	5	37	7	18

Source: 1983 Crop Management Survey; 116 farmers.

a. Dish names vary within the Mahalapye area and across the country. The most common names in Shoshong and Makwate have been used.

b. Farmers were asked to cite their four main dishes in order of importance. Points were given in reverse order, with four points for the most important dish, three points for the second dish, etc. Points were then transformed to a basis of 100 for the top ranked dish, to eliminate differences due to sample sizes.

TABLE A.2: FARMER RANKINGS OF OTHER MAIN FOODS, 1983

	SHOSHONG EAST RANK	POINTS/a	MAKWATE RANK	POINTS	ALL RANK	POINTS
WATERMELONS	1	100	4	40	1	100
MELONS	3	83	3	52	2	96
MEAT	6	56	2	78	3	94
BEANS	8	26	1	84	4	76
MILK	2	88	7	12	5	72
SWEET REED	4	63	10	0	6	46
CUCUMBER	5	58	9	3	7	44
PUMPKINS	7	39	8	5	8	32
GREEN MAIZE	9	11	5	33	9	30
BREAD	10	7	6	32	10	26

a. Points were calculated as described in Table A.2.