8 Seasonal Food Insecurity and Vulnerability in Drought-Affected Regions of Burkina Faso

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Strict seasonal limits to cropping in the semiarid tropics of West Africa mean that farmers must manage or supplement household cereal stocks during the extended period between annual harvests. Following a poor harvest, farmers make a series of decisions to allocate their consumption, sales, and purchases over time with the goal of satisfying calorie intake requirements through the subsequent cropping season, when labor demands again peak. Failure can have substantial effects on welfare as well as productivity. If calorie deficits are sufficiently severe and sustained, and particularly if they occur during the cropping season, households may fall into a poverty cycle not easily resolved by most market-oriented policy instruments (Behrman and Deolalikar, chapter 7 of this volume; Chambers, Longhurst, and Pacey 1981).

This chapter explores the seasonal incidence and determinants of food insecurity as experienced by farm households in two regions of Burkina Faso (Sahel savanna and Sudano-Sahel) during the recent Sahelian drought period of September 1984–December 1985. Our objectives are to (1) describe the degree and nature of household consumption deficits in a seasonal framework; (2) determine how such deficits make households vulnerable to unpredictable factors in the market and in access to relief assistance; (3) determine whether these problems affect households equally, or rather are more narrowly concentrated in certain groups with particular wealth and demographic characteristics; and (4) highlight important policy implications of these cross-sectional and intertemporal patterns.

Defining Seasonal Insecurity and Vulnerability

We define *food insecurity* in a farm household as the consumption of less than 80 percent of what the World Health Organization (WHO) considers to be an average required daily caloric intake of 2,850 kilocalories

(kcals) for a moderately active adult equivalent (FAO-WHO-UNU 1985). This then includes households that consume less than 2,280 kcals per adult equivalent (AE) per day. We define a household to have chronic food insecurity when consumption during two or more seasons is inadequate, particularly if consumption is deficient during the cropping season. Households that are chronically food-insecure constitute the highest-risk group and for policy purposes might be considered a primary target group for aid.

Households are defined as being *production-deficient* if their food stocks immediately following the 1984 harvest were below levels required to meet 80 percent of the WHO average caloric requirement until the 1985 harvest. A household can be production-deficient, and either food-secure or food-insecure in any given season, depending on (1) the resources available to buy food, (2) the receipt of transfers, (3) the intertemporal distribution of consumption that it chooses, and (4) the availability of food in the market or community.

Vulnerability denotes dependence on sources outside of domestic production to provide food for the household. These sources include the market (focusing here on purchases), transfers (external food aid and interhousehold gifts), and hunting-gathering activities which are generally done on common property lands. Under Sahelian and Sudano-Sahelian conditions, dependence on these sources can be highly precarious, for at least three reasons.

First, over time and across space, Sahelian markets exhibit wide and often unpredictable changes in prices and the availability of goods.[1] Even seasonal migrant labor markets, which can be a crucial component in the strategies of food-deficit households, are unstable.[2]

Second, because of high covariance of production, nonmarket transfers between households tend to be a positive function of the overall production sufficiency in any given year (Toulmin 1986). Thus years in which seasonal problems attain their grimmest aspect coincide with periods during which neighbor's surpluses would be least available. Dependence on external aid, where transport and soft infrastructure are poor and political winds capricious, is also a risky strategy.

Third, common property lands in many subregions are already seriously overgrazed and overhunted. While these problems restrict alternative income-generating activities, such as animal husbandry, periodic

1. A personal communication of preliminary research results from Chris Delgado.

2. For instance, during the 1985 hot season, politically inspired changes in urban rent statutes severely depressed the housing construction sector in Ouagadougou, upon which many Sahelian migrants depend for casual seasonal labor. Similar changes in regulations affecting interregional cereal trade substantially reduced cereal availability in grain-deficit areas during the 1983-84 season and widened interregional price margins.

drought and the expansion of farming have combined to decrease edible plant-gathering opportunities as well (Timberlake 1985).

Background and Methodology

Study Area

Two study villages were chosen to represent the Sahelian and Sudano-Sahelian agroclimatic zones following a review of secondary information and ground verification (ICRISAT/Burkina Faso 1981). The household sample in each village was chosen by a stratified sampling procedure, which, in an effort to obtain adequate numbers of households employing animal traction, overrepresents such households compared with the respective village populations.

Woure village, located near the regional market town of Djibo, was selected to represent the Sahel savanna. Low and variable levels of rainfall (long-term annual average of 570 millimeters [mm]) and soils that are very low in natural fertility and water retention result in farming systems with poor production potential and high risk of weather-induced crop failure. Our sample includes mainly the Rimaibe ethnic group, with some Fulani. Although both groups are sedentary agriculturalists, animal husbandry is very important to them, serving as the principal means to store wealth and as an insurance mechanism and source of liquidity.

Kolbila village, located near the regional marketing town of Yako, represents the Sudano-Sahel. As is typical of large portions of the densely populated Mossi plateau, rainfall is somewhat higher (with a secular average of 760 mm) and less variable than in the Sahel. Soils are heavier than in the Sahel, but shallow and with low natural fertility. The main ethnic group is the Mossi, whose central activity is farming. Livestock husbandry is relatively less important than in the Sahel, partly because of pressure on the land and partly because of ethnic tradition.

Rainfall in both zones is limited to the months of May to October, with up to 40 percent concentrated in August alone. Farm labor demands are thus highly seasonal and characterized by periods of acute labor bottlenecks. The rainfall problem was aggravated during 1984 because rainfall in the two zones' study villages was more than 40 percent below the secular average in each zone. Moreover, below-average rainfall in 1982 and 1983 had already reduced on-farm cereal stocks considerably as the 1984 harvest period was entered.

Both zones were considered to be in cereal deficit during the study period, and there is a more general concern as to the rapid deterioration of their agricultural and physical resource base because of the rising demographic pressure and recurrent poor rainfall.

Cropping systems in both zones are rain-fed and primarily subsis-

TABLE 8.1 Percentage of cultivated area sown to all crops, Sahel and Sudano-Sahel village samples, 1984

	White Sorghum	Red Sorghum	Millet	Maize	Peanuts	Other[a]	Total
Sahel	7	0	90	1	[b]	2	100
Sudano-Sahel	50	5	28	1	15	1	100

NOTES: The crops are either sole crops or principal crops in mixture. The Sahel village sample is from Woure and the Sudano-Sahel village sample is from Kolbila.

[a]The remaining crops include hungry rice in the Sahel village and rice in the Sudano-Sahel village.

[b]Less than 0.5 percent.

tence-oriented. Millet is the dominant crop and food staple in the Sahel, replaced by white sorghum as one proceeds south to the more diversified Sudano-Sahel (table 8.1). Insufficient rainfall and poor soil fertility limit maize plantings in both regions, though as an early-harvested crop maize can play an important role in meeting rainy-season food needs when carryover food stocks are low.

Livestock, along with stored crops, is among the main forms of wealth available to households to meet needs imposed by production shortfalls and periodic cash requirements. Routine sales of fowl and small ruminants are most common, with sales of cattle less frequent. Milk production, for domestic consumption, for sale, and in exchange for cereal, is of some importance during the rainy and harvest seasons in the Sahel, but not in the Sudano-Sahel.

Hunting and fishing normally provide little to meet seasonal dietary needs, although we will see that gathering activities can provide important dietary supplements for households facing the most acute seasonal consumption stress.

Seasons and Activity Patterns

To simplify our analysis, we employ four seasons defined on the basis of climatic and activity patterns, following discussions with the sample farmers. The distribution of activities across quarters can be summarized in order to highlight seasonal energy requirements in contrast to seasonal consumption patterns, which are reviewed in a later section.

1. *Harvest* (September–November): Depending on the zone's cropping profile (table 8.1), maize, red sorghum, and hungry rice are harvested in the first half of this season. These crops help deficit households meet consumption requirements until the more important white sorghum and millet harvests in the second half of the season.

2. *Cold* (December–February): Postharvest festivals and major family celebrations (e.g., funerals) begin at this time and require relatively large expenditures of crop stocks. Migration, artisanry, commerce, and husbandry are the main economic activities, and very little cropping occurs.
3. *Hot* (March–May): Activities similar to those in the cold season predominate. In 1985, the Moslem fasting period of Ramadan covered the last month of this season, shifting mealtimes for affected adults in practicing households to the evening and early morning. Land clearing is the only agricultural activity of importance. Household members engaging in seasonal migration usually return for the first planting in June.
4. *Rainy* (June–August): Farming activities are concentrated in this quarter, with labor bottlenecks in planting and weeding activities during June–July constituting a major constraint on production (Delgado and Ranade 1987). Because of available land and a generally equitable land distribution (and thus the absence of a landless labor class), labor hiring during this period is negligible. As a result, crop production is largely determined by the timing, duration, and quality of family labor, and major caloric deficits during this period can initiate the poverty cycle described earlier.

Survey Methodology and the Nature of the Data

The data used in this chapter were generated by a food intake survey administered in two International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)/Burkina Faso study villages between October 1, 1984, and December 31, 1985. The survey was directed by the International Food Policy Research Institute (IFPRI) in close collaboration with ICRISAT. The survey instrument was administered in each household approximately twice a month to obtain (1) the types, quantities, and sources (produced, purchased, received as gift, gathered) of all foods consumed during the prior day by all members; (2) the number of adults and children (both members and visitors) eating each meal or snack; and (3) the types and amounts of food sent out of the household. In this analysis, we exclude all sauce ingredients (meat, vegetables) and include only cereals and seeds, pulses, nuts, and tubers, as well as milk and leaves when used as meal base ingredients.

Seasonal Food Insecurity and Vulnerability Related to Levels of Wealth and Demographics

This section examines the extent and nature of seasonal food insecurity and vulnerability among sample households and relates their incidence

to household characteristics. By juxtaposing seasonal food intake levels with time-bound farm labor demands, we also suggest how nutritional factors may undermine productivity.

Sample Stratification

For an initial stratification of sample households, we sum the value of crops and animal stocks at the beginning of our survey period and divide by household size (in AEs) to form a measure of total liquefiable wealth per AE (henceforth referred to as *wealth*). Households are ranked by the resulting ratios and grouped into terciles (poor, middle, and rich) for each village.

This procedure assumes that seasonal food insecurity and vulnerability between the 1984 and 1985 harvests were influenced by the initial wealth endowment of the households. Initial stocks can be treated as exogenous determinants of the ensuing seasonal behavior pattern. In contrast, purchase patterns, the intertemporal distribution of consumption, and income-earning strategies to augment this resource base or reduce the number of consumers (through migration) are considered endogenous variables.

Table 8.2 presents characteristics of the sample households grouped by village and wealth strata.[3] Households in the Sudano-Sahel village are somewhat larger and have a higher proportion of children. Sample farmers in that village also entered the study period with less than one-third the Sahel sample's total value of livestock per AE, though with roughly the same crop (stocks plus harvest) endowment. Moreover, livestock are much more equally distributed across strata in the Sudano-Sahel sample, albeit at a lower level. The endowment of crops is nearly equally distributed in the two samples, with ratios approaching 3:1 for the respective extreme terciles.

Seasonal migration (during the cold and hot seasons) is substantially more important in the Sahel village sample and within that village shows a strong inverse relation to wealth. This can be explained in part by the significantly larger livestock holdings among the rich, which obviates the need to migrate.

Seasonal Food Insecurity

Seasonal average daily caloric intakes per AE for each stratum in the two-village sample are presented in table 8.3, and the percentages of AEs consuming less than 80 percent of the WHO average daily caloric requirement are shown in table 8.4.

3. A household is identified from the production perspective.

TABLE 8.2 Household characteristics, Sahel and Sudano-Sahel village samples

	Poor	Middle	Rich	Total
Sahel village sample				
(a) Household size	8	11	11	10
(b) Children/total (%)	46	35	52	45
(c) Animal traction (%)	0	38	25	21
(d) Crops/AE	5,956	10,625	9,349	8,957
(e) Stocks/AE	31	1,246	8,168	3,369
(f) Livestock/AE	2,224	19,731	131,182	54,448
(g) Migration (%)	24	14	3	13
(h) Land/AE	0.76	1.22	1.04	1.04
(i) Production sufficiency (%)	23	47	70	49
(j) Yield/ha	8,175	9,051	9,275	8,902
Sudano-Sahel village sample				
(a) Household size	14	14	11	13
(b) Children/total (%)	52	50	48	50
(c) Animal traction (%)	43	29	43	38
(d) Crops/AE	5,914	9,392	13,178	9,276
(e) Stocks/AE	135	197	6,881	2,120
(f) Livestock/AE	10,837	16,770	22,922	16,484
(g) Migration (%)	10	4	7	7
(h) Land/AE	0.60	0.59	0.68	0.62
(i) Production sufficiency (%)	25	39	80	46
(j) Yield/ha	10,758	15,733	20,727	15,445

NOTES: There are 24 households in the Sahel and 21 in the Sudano-Sahel village sample. All entries are rounded to the nearest integer. Variables are defined as follows:

(a) Average household size in unweighted members.

(b) Number children as a percentage of household size. Children are 15 years old or less.

(c) The percentage of sample households employing animal traction as opposed to manual cultivation.

(d) This is an adult equivalent (AE) weighted average of the value, evaluated by an average producer market price for October–November 1984, of the total cereal, pulse, and nut production from the harvest of 1984. Currency units are CFA.

(e) The value of the same crops as in (d) in storage immediately before that harvest, all deflated by the number of AEs at harvesttime 1984.

(f) This is an AE weighted average of the value, evaluated by an average price over age and sex of animal, of the market price at harvesttime 1984 of the total livestock holdings, deflated by the number of AEs at that time.

(g) The percentage of person-days in which household members were absent on seasonal migration during the study period. This was calculated as: [number of days of migration absence by household members in cold season (here Jan.–Feb.) and hot season 1985, multiplied by AE coefficients of migrant members], divided by [total household AEs multiplied by the number of days in those seasons (60 for cold plus 90 for hot)], weighted over sample by AEs.

(h) The total area of cultivated plots (thus excluding fallow) per household, deflated by household AE. The plot areas are unweighted by land quality coefficients. Households are weighted by AE. Coefficient of variation = 0.29 for Sudano-Sahel, 0.39 for Sahel village sample.

(i) The total quantity of harvested and stored crops (as in [e]), weighted by calorie coefficients, and deflated by AE times 365 days times 2,280 calories, to give the sufficiency of

TABLE 8.3 Average daily intake per adult equivalent by season and stratum, Sahel village sample (kilocalories)

	Harvest 1984	Cold 1985	Hot 1985	Rainy 1985	Harvest 1985	CV	Total
Sahel village sample							
Poor	2,595	2,335	2,269	2,380	2,604	0.25	2,506
Middle	3,926	3,165	2,793	2,912	3,049	0.28	3,234
Rich	3,163	2,903	2,542	2,864	3,242	0.22	2,990
Sudano-Sahel village sample							
Poor	2,036	2,203	2,251	2,137	2,875	0.37	2,312
Middle	2,069	1,985	1,972	1,860	2,260	0.36	2,038
Rich	2,631	2,548	2,802	2,395	3,100	0.34	2,704

NOTES: 75 percent of the Sahel coefficients of variation (CVs) of the seasons' average kilocalories per adult equivalent (kcal/AE) are at or below 25 percent; the rest are at or below 40 percent. 93 percent of the Sudano-Sahel CVs are at or below 40 percent; the rest are at or below 45 percent.

We used multiple comparison significance tests, Duncan procedure, at the 5 percent level, to test (1) over strata per season, and (2) over seasons per stratum, for average kcals/AE.

For the Sahel sample, for (1), all averages were significantly different, *except:* poor vs. rich in hot season, and middle vs. rich in rainy; the former is partly due to a very small number of observations for the poor in the hot season (because of migration). For (2), all were significantly different, *except:* (a) for poor, harv/84 vs. harv/85, and cold, hot, and rainy vs. each other (the latter is partly due to a small number of observations in the hot season); (b) for middle, cold and rainy vs. harv/85, and hot vs. rainy; (c) for rich, harv/84 vs. harv/85, and cold vs. rainy.

In the Sudano-Sahel, for (1), all averages were significantly different, *except:* poor vs. middle in harv/84. For (2), all were significantly different, *except:* (a) for poor, rainy vs. harv/84, cold, and hot, and cold vs. hot; (b) for middle, harv/84 vs. cold and hot, and cold vs. hot; (c) for rich, harv/84 vs. cold.

The CVs were computed without detrending data because of the short period.

Figures below the WHO average daily requirement for a moderately active AE of 2,850 are underlined.

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extant stocks in meeting 80 percent of the average daily calorie requirement during the ensuing year, our study period.

(j) The value of crops produced per hectare of land cultivated. Average weighted over sample by AEs.

We used multiple comparison significance tests, Duncan procedure, at the 5 percent level, to test over strata per village for variables (d) through (j).

For the Sahel sample, all averages were significantly different except for variables (d) middle vs. rich; (e) poor vs. middle; (j) no two strata were significantly different.

For the Sudan sample, all averages were significantly different except for variables (e) poor vs. middle; (g) poor vs. rich; (h) poor vs. middle.

TABLE 8.4 Percentage of food-insecure adult equivalents per stratum per season, Sahel and Sudano-Sahel village samples

	Harvest 1984	Cold 1985	Hot 1985	Rainy 1985	Harvest 1985
Sahel village sample					
Poor	34	54	34	57	21
Middle	0	0	27	0	0
Rich	0	0	18	18	0
Sudano-Sahel village sample					
Poor	75	54	52	63	20
Middle	71	62	90	84	65
Rich	31	29	20	49	0

NOTE: These figures indicate the percentage of AEs per stratum whose average seasonal consumption fell below 80 percent of the WHO average daily required calorie intake of 2,850 calories.

Several features of these caloric intake patterns are important. First, consumption levels are substantially lower and more equally distributed among households in the Sudano-Sahel village sample. Nearly all strata are below the WHO average adequacy standard in most seasons, corresponding to a pattern of shared chronic insecurity. The Sahel case provides a striking contrast, because consumption inadequacy is largely concentrated among poor households.

Second, the degree of cross-seasonal variation of consumption (represented by the coefficient of variation [CV]) is also substantially greater in the Sudano-Sahel sample than in the Sahel case. This reflects the greater capacity of the Sahelian farmers to avoid large seasonal reductions in consumption by supplementing crop stocks through cereal purchases.

Third, the potential consequences of caloric deficits in the Sudano-Sahel sample are magnified by the fact that seasonal consumption and activity levels are *countercyclical*—caloric intake is lowest in each stratum during the cropping season, when demands for energy expenditure are greatest. Again, this contrasts with the Sahel case, where consumption is consistently lowest during the hot season, when labor demands are least. These comparisons suggest that the hungry-season hypothesis frequently found in the literature may hold only in situations of extreme deprivation when households are unable to ration consumption during the cold and hot seasons in a manner to meet rainy-season requirements.

Differences in the levels and distribution of wealth help to explain why the Sudano-Sahel case of "shared deprivation" contrasts with the more concentrated food insecurity observed in the Sahel village. Despite the

somewhat higher crop endowment in the Sudano-Sahel village, the livestock endowment is inadequate to generate sufficient cash to close the caloric gap through large food purchases. Low livestock holdings place a similar constraint on poor Sahelian households, with nearly identical consequences.

Dependence on the Market and Consumption of Foods from Outside the Immediate Zone

For policy purposes, it is important to distinguish between *potential* vulnerability, as measured by the percentage of calories that would have to be obtained from purchases, aid, and gathering in order to achieve minimum caloric adequacy at any given level of production, and *actual* vulnerability, as measured by the percentage of total consumption that is in fact obtained through purchases, aid, and gathering. The difference between the two measures is a function of purchasing power, prices, physical availability of food, and consumer preferences.

When we measure potential vulnerability (table 8.5), it is evident that poor harvests forced households in both regions into positions of nearly equal overall dependence on sources outside of own production to meet caloric needs. However, a comparison of actual vulnerability across sites would suggest that market dependence is considerably lower among households in the Sudano-Sahel village and more equally distributed across strata compared with patterns in the Sahel village (tables 8.6 and 8.7). This difference is caused by the relative lack of purchasing power in the Sudano-Sahel sample and by the near-absence of food aid directed to farmers in that village.

TABLE 8.5 Average daily intake per adult equivalent by source, Sahel and Sudano-Sahel village samples, five-season period (kilocalories)

	Poor	Middle	Rich	Total
Sahel village sample				
Produced	1,278	1,617	1,884	1,670
	(45)	(57)	(66)	(59)
Purchased	802	1,358	837	1,014
Food aid, gift	401	259	269	298
Sudano-Sahel village sample				
Produced	1,410	1,264	2,163	1,528
	(49)	(44)	(76)	(54)
Purchased	879	754	514	741
Food aid, gift	46	20	27	23

NOTE: Numbers in parentheses indicate the amount produced expressed as a percentage of the WHO average requirement for a moderately active adult equivalent.

TABLE 8.6 Breakdown by food item and source of caloric intake per season, Sahel village sample (percent)

	Harvest 1984	Cold 1985	Hot 1985	Rainy 1985	Harvest 1985	Total
Poor						
White sorghum	12	16	41	12	20	16
Millet	62	21	5	13	46	39
Red sorghum	2	40	14	34	9	16
Maize	16	23	40	18	15	18
Wheat	0	0	0	18	2	5
Leaves	7	0	0	2	4	4
Produced	72	37	46	10	66	51
Purchased	25	17	54	69	14	32
Food aid/gift	1	45	0	21	20	16
Middle						
White sorghum	2	8	18	5	6	6
Millet	82	19	15	11	58	42
Red sorghum	2	19	28	58	17	25
Maize	8	54	38	10	15	20
Wheat	0	0	0	4	1	1
Produced	82	27	22	25	66	49
Purchased	16	50	78	70	21	42
Food aid/gift	2	23	0	4	13	8
Rich						
White sorghum	2	12	8	7	15	9
Millet	77	42	42	52	55	54
Red sorghum	4	15	12	27	12	14
Maize	7	27	36	9	11	17
Wheat	0	0	0	4	1	1
Milk	8	3	1	[a]	4	3
Produced	86	47	43	59	73	63
Purchased	10	33	57	34	19	28
Food aid/gift	4	20	0	6	9	9

NOTES: Items such as leaves may be included for one group but excluded for others when the numbers are inconsequential. Percentages are averages weighted by AEs.

[a]Less than 0.5 percent.

Our results also show consistent variation across strata within each region, which has potentially important equity effects. Households with smaller endowments of crops and livestock consume a higher percentage of purchased and donated foods and thus tend to be more vulnerable to market fluctuations and uncertainties in flows of relief assistance. Moreover, vulnerability for the poor is especially critical in the rainy season, when

TABLE 8.7 Breakdown by food item and source of caloric intake per season, Sudano-Sahel village sample (percent)

	Harvest 1984	Cold 1985	Hot 1985	Rainy 1985	Harvest 1985	Total
Poor						
White sorghum	77	49	61	97	52	68
Millet	10	23	7	0	28	14
Red sorghum	3	8	2	2	0	3
Maize	3	19	29	1	8	11
Peanuts	5	1	1	1	11	4
Produced	69	76	25	40	89	61
Purchased	29	23	74	58	10	38
Food aid/gift	2	1	1	2	1	2
Middle						
White sorghum	50	30	48	84	26	47
Millet	28	35	0	0	44	23
Red sorghum	13	12	21	0	4	9
Maize	0	17	29	13	11	14
Peanuts	7	3	1	2	10	5
Produced	86	72	38	24	88	62
Purchased	13	27	61	72	11	37
Food aid/gift	1	1	1	3	1	1
Rich						
White sorghum	48	68	81	89	50	67
Millet	37	18	2	0	32	18
Red sorghum	7	1	1	0	1	2
Maize	3	8	13	7	4	7
Peanuts	3	4	2	4	11	5
Produced	83	91	77	53	95	80
Purchased	17	10	22	43	4	19
Food aid/gift	1	0	1	4	1	1

their dependence on the market is highest, and when the negative effects on real income of preharvest price increases can be devastating in terms of both welfare and labor productivity. Between 60 and 70 percent of all calories consumed by poor and middle-strata households during the rainy season were in fact purchased.

These conclusions are reinforced by our finding that the diet of the poor households in the Sahel village sample is strongly skewed toward crops produced principally outside of the region. Although white sorghum accounts for only 4 percent of the cropping area, it provides roughly 25 percent of the calories consumed outside of the harvest seasons for poor

households. The majority of this was transferred from surplus-producing areas of Burkina Faso. Even more striking is the consumption of red sorghum and maize, which account for only about 1 percent of the cultivated area but provide up to 60 percent of the diet of the poor during nonharvest seasons. Nearly all supplies of both commodities were provided through food relief.

Households in the Sudano-Sahel sample were also highly dependent on interregional food transfers and imports. More than half of all sorghum consumed during the cropping season was purchased, with the greatest volume derived from surplus-producing regions in Burkina Faso. Maize, though not significantly produced in the zone, was also an important item of purchase. Relatively cheap surpluses from the southwest of Burkina Faso and imports from Ghana served as the main sources. Some maize was also available as food aid in the 1985 rainy season and appears in the consumption patterns, albeit weakly.

Dependence on Food Aid

During the cold, rainy, and early-harvest seasons of 1985, donors poured food aid into the Sahel region, and important amounts were received by our sample households. In the cold season this included mainly red sorghum; in the rainy season this shifted toward wheat and in the early harvest period toward maize. The changing composition of the aid flow was clearly reflected in the diets of the poorest households, for whom aid served as a crucial source of calories. Dependence on aid peaked in the cold season, when almost *half* of the poor's diet was from aid, and held at about 20 percent of calories consumed during the rainy and harvest periods. These shares are roughly double those observed for households in the middle and rich strata, and reflect relatively efficient de facto targeting of aid among households.

Interregional targeting of relief assistance was far less efficient, if judged on the basis of need. While own production met 59 percent of the average daily caloric requirements in the Sahel village, where relief was widely available, own production met only 54 percent of requirements on average in the Sudano-Sahel village, where such transfers were negligible (table 8.5). In fact, food received per AE as relief assistance was more than 10 times larger in the Sahel village sample than in the Sudano-Sahel village sample (298 versus 23 kcals/AE). This reflected the perception by policymakers that punctual food relief was most needed where rainfall, yields, and market access were poorest. However, since it ignored interregional differences in purchasing power (compare absolute purchases between regions in table 8.5), the calculation of need was incomplete and ultimately in error.

Dependence on Common Property Resources

Caloric dependence on common property resources is represented here mainly by the consumption of gathered leaves and milk. Respondent farmers often asserted that gathered leaves and fruit were important as a dietary backup for the poor. While it is difficult to capture this kind of information in a survey (particularly with regard to foods eaten in the field while working), the seasonal importance of these foods to the poor is apparent in table 8.6. Although the leaf consumption shown relates only to leaves used as base products (not as sauce ingredients), that figure reaches 7 percent of the poor's total intake in the Sahel sample during the 1984 harvest. The percentages are substantially lower for the other groups (not shown).

The role of leaves is probably even more important than this figure suggests. Farmers claimed that the poor often use leaves to increase the bulk of a dish, thereby filling their stomachs while using a smaller amount of grain. Thus leaves appear to be linked to a strategy of rationing, in addition to their role as a source of energy and variety.

In sum, the quality of the common property resources and their usefulness as a source of gathered plants are marginal but nevertheless important seasonal factors for the poor in the Sahel. In this respect, famine food strategies of poorer households, despite their low livestock holdings, are increasingly vulnerable to the ongoing degradation and destruction of the tree and bush stands in the greater Sahel region.

Higher population pressure (hence low foraging potential) in the Sudano-Sahel village has already restricted gathered leaves to a minor stopgap role as a base ingredient during the pre- and early-harvest periods. For this reason, farmers in this village generally place greater emphasis on maize to meet early-harvest consumption needs when sorghum and millet stocks are at their seasonal lows. Because of poor 1984 maize yields, however, and the lack of milking herds, early crops such as peanuts and sweet red sorghum were relatively more important during the study period but still grossly inadequate in absolute volume.

Identification of the Chronically Insecure for the Purpose of Policy Intervention

Earlier we distinguished between two categories of seasonally insecure households: those insecure only in a single season (and presumably more able to recuperate in subsequent seasons), and those chronically insecure or nutritionally deficient during several seasons in the year (and as such probably less able to recuperate from the health and productivity effects of

seasonal calorie deficits). The latter can be considered a priority target group for policy interventions to augment consumption. This section describes the salient characteristics of this risk group that could be used by policymakers to target interventions and to assess the likely impacts of various policy instruments on the seasonal and overall welfare of such households.

Table 8.8 compares a set of structural and behavioral characteristics for households that are, and are not, chronically insecure. When divided in this manner, only 17 percent of the Sahel village sample (four households) are included in the high-risk group, underlining once again the concentrated distribution of seasonal food insecurity in that village. In contrast, the majority of Sudano-Sahel sample households (13 households representing 62 percent of the sample) fall into the target group. The small size of the Sahel sample target group in particular cautions against generalizing too broadly from the inferences that follow. Furthermore, the CVs cal-

TABLE 8.8 Chronically insecure versus secure households, Sahel and Sudano-Sahel village samples, five-season period

	Sahel Village Sample		Sudano-Sahel Village Sample	
	Chronically Insecure	Secure	Chronically Insecure	Secure
Percent of sample	17	83	62	38
Household size	9	10	13	12
	(58)	(70)	(45)	(78)
Child./total	52	43	52	47
	(24)	(48)	(23)	(32)
Age of head	*35	*48	56	56
	(20)	(24)	(28)	(29)
Percent using anim. tract.	25	20	38	38
Crops/AE	*3,919	*9,870	*8,208	*11,136
	(83)	(69)	(50)	(55)
Stocks/AE	*765	*3,840	*1,023	*4,028
	(118)	(179)	(320)	(205)
Livestock/AE	43,416	56,446	*13,823	*21,117
	(113)	(125)	(48)	(52)
Land/AE	*0.91	*1.06	*0.59	*0.68
	(25)	(41)	(29)	(28)
Yield/ha	*5,502	*9,517	*14,292	*17,451
	(104)	(70)	(41)	(62)

NOTES: Numbers in parentheses indicate coefficient of variation, in percentages. Asterisk indicates significantly different at 0.05 percent level between insecure and secure groups. See note to table 8.2 for definition of variables.

culated on household characteristics are generally larger than the CVs calculated in the wealth-based stratification, which indicates that the criterion of chronic food insecurity aggregates households with diverse natures. Despite these caveats, the results do suggest several structural differences between target and nontarget groups.

Examining the Sahel village first, we observe that the average proportion of children in total household size is higher and household heads are significantly younger in the chronic-deficit group. This suggests that target households are in an earlier stage in a Chayanovian life cycle compared with those in the nontarget group. The hypothesized consequences of such life-cycle differences are reflected, though imperfectly, in the wealth and production characteristics. Households at an earlier developmental stage would be expected to have accumulated smaller livestock holdings. Our results suggest that this may be true, although the difference (30 percent) is not statistically significant. This apparently anomalous statistical result, however, is the artifact of an extremely skewed distribution of livestock within the target group. Among these four households, three owned essentially no livestock. The other possessed a herd valued at nearly 100,000 francs CFA but experienced a nearly complete crop failure.

Similarly, with a smaller proportion of workers (a consequence of the high ratio of children to total household members), a household's cultivated area per AE would also be expected to be smaller. The hypothesized sign of the relationship holds, but the magnitude of the difference is small (15 percent). Dominating the comparisons, however, is the large (73 percent) and significant difference in land productivity between target and nontarget groups. In the production environment of the Sahel village, which is characterized by relatively homogeneous technology and cropping patterns, productivity differences of this magnitude cannot be explained by life-cycle factors alone, but are more likely caused by variation in factor quality (including management) and stochastic events affecting yield variability (microclimate variation, household worker morbidity, etc.).

The simple comparison between target and nontarget households in the Sudano-Sahel village sample does not provide evidence that life-cycle relationships distinguish the two groups in that zone. However, several differences do emerge. Livestock holdings, though small, are significantly lower (53 percent) for the target group, suggesting that such farmers had less insurance to protect them from production shocks. Crop production variables are again significant. Cultivated area per AE is significantly lower for target households (15 percent), and there is a significant gap in land productivity as well (22 percent).

Comparing regions, we note finally that the extent of chronic seasonal food insecurity was substantially greater in the Sudano-Sahel village de-

spite the fact that average land productivity was 75 percent higher than in the Sahel village. This reinforces the point that more limited land resources and lower livestock holdings in the more densely populated Sudano-Sahel village placed those farmers at greater risk when shocked by stochastic climatic reversals, and it underlines the inadequacy of employing yields or the magnitude of rainfall deficits as simple indicators of the potential impact of drought.

Conclusions and Policy Implications

These empirical results support several generalizations that have important policy implications.

First, it is essential to disaggregate by region, household wealth, demographic characteristics, and season in order to determine the magnitude, location, and consequences of food insecurity. Average measures can grossly underestimate the size of the food problem, depending upon the underlying distribution of consumption across households and seasons. When seasonal consumption patterns run countercyclical to energy demands of cropping activities, as observed among the poorest households in this study, the potential welfare and productivity consequences of a more general food shortage are greatly magnified. The use of chronic seasonal insecurity as a measure of need captures this dimension, but it is an empirically demanding criterion. The development of more cost-effective proxy measures that reflect the seasonal incidence and duration of food insecurity would be extremely valuable.

Second, following a poor harvest, dependence on the market and thus vulnerability to market inefficiencies were found to be extremely high, both across study sites and across wealth strata. A particularly important finding is the high dependence of the poorer strata in both zones on markets and the fact that the purchased share of their total consumption is largest during the preharvest seasons, when cereal prices normally peak. Improvements in market infrastructure to reduce interregional and interseasonal margins could have major benefits in efficiency and equity goals. Where purchasing power is lacking, seasonal generation of employment, such as through public works projects financed by food-for-work mechanisms, may be a highly effective complementary policy instrument.

Third, relief assistance was found to provide a crucial food supplement for a limited group of deficit producers in the Sahel sample, but relief largely bypassed the Sudano-Sahel site, where chronic food insecurity was as severe and more broadly distributed across households. This raises important policy questions about appropriate methods of targeting assistance both among and within regions.

In assessing the relative need for relief assistance among regions, gross measures such as yields or rainfall deficits reflect poorly the degree of food insecurity where there are important regional differences in the structure of production and in farm-level purchasing power. Because of regional variations in the land-to-person ratio and in livestock holdings and migration (and thus potential purchasing power), areas of greatest risk in the West Africa semiarid tropics are not necessarily in the low-rainfall Sahel, as is commonly held. This is due in part to farming systems in the Sahel having incorporated more risk-reducing strategy components. These include extensive farming systems, access to bush areas for gathering activities, large livestock holdings, and well-established seasonal employment channels in urban areas. When comparable shortfalls in precipitation occur, there may be greater risk of severe seasonal food shortages in the middle Sudano-Sahel belt. The efficiency of traditional strategies for risk reduction has been reduced over time in that region by a rising population, which limits cropped area as well as the potential for large livestock holdings and important gathering activities.

Fourth, within-region targeting of relief assistance and development interventions designed to benefit only households that are chronically short of food are difficult to achieve, since high-risk groups are not easily identifiable as structurally distinct household sets. Unfavorable household composition, low crop productivity, and small livestock holdings are major correlates of chronic food insecurity. A high ratio of children to adults occurs as a natural stage of family development and alone would not normally have permanent impoverishing effects except during consecutive poor years. Nevertheless, its association with severe seasonal deficits suggests that nutritional programs aimed at children may be an efficient means of directing seasonal food supplements to an important group of high-risk households, regardless of the subsequent distribution of intrahousehold consumption.

The number and complexity of factors causing low crop productivity in traditional cropping systems also suggest major problems in using this indicator as a targeting criterion. Rather, they underline the need to increase overall productivity (while reducing downside yield risks during drought) through the development of improved, broadly adaptable cropping techniques.

The practical as well as moral problems in evaluating land area and livestock holdings also present important obstacles to using these criteria for targeting food aid.

Finally, the sharp seasonality of food insecurity underlines the importance of timing in accurate targeting of interregional food transfers. In terms of policy, this argues for (1) the collection and broad dissemination

of timely information on prices and on-farm stocks;[4] (2) where possible, the maintenance of reserve stocks in close proximity to high-risk groups, through such approaches as village cereal banks; and (3) the development of cost-effective famine early warning systems, which are necessary to ensure a large lead time to initiate requests for foreign assistance.

4. Although price is a robust and comprehensive measure of emerging food shortages, it should be recognized that price levels alone can be misleading in subregions with low purchasing power and thus little effective demand and thin markets.