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Coping with Household-level Food Insecurity in Drought-affected Areas of Burkina Faso

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Summary. — The paper examines strategies used by rural households in the Sahelian and Sudanian zones of Burkina Faso to ensure food security in the face of drought-induced cropping shortfalls. It finds that three-quarters of the average household income in the Sahel sample and half of the same in the Sudanian sample come from non-cropping sources. These are more diversified regionally and sectorally in the case of the Sahel. The latter's non-cropping income is less covariant with the local cereal economy than is the case in the Sudanian sample. Moreover, much greater food aid was targeted to the Sahel for geographical reasons, without taking into account the more stable and higher level of purchasing power in that zone *vis-à-vis* the Sudanian zone.

1. INTRODUCTION

The purpose of this paper is to examine the strategies used by rural households to ensure consumption security in the face of drought-induced production shortfalls. Using household-level primary data representing a poor cropping year in Sahelian and Sudanian villages of Burkina Faso, we attempt to establish two sets of points.

First, the income strategies of rural households in these zones are importantly dependent upon the generation of purchasing power in non-cropping occupations (both employment- and asset-based). To a large extent, these occupations are not oriented toward processing crop outputs or supplying inputs to cropping in the region. In part, these strategies are a means of insulating food consumption from broad swings in the local cereal sector. This is in turn linked to households' substantial reliance on purchased food to ensure consumption security, a fact that belies the conventional image of Sahelian peasants as autarkic agriculturalists. Purchases are at their summit in the hot and rainy seasons preceding harvest. Almost all households rely to a certain extent on purchases, but those with the

poorest cropping outcomes, provided they have non-cropping-based cash resources, purchase the most in proportional terms (see Reardon and Matlon, 1987).

Moreover, households spread income risk not only across occupations, but also across locations. This reduces crop-based covariation in regional incomes.

In both respects farmers in the Sahelian region of Burkina Faso — where climatic variability is highly pronounced — have developed multi-sectoral strategies to protect food consumption levels in the face of adverse weather. They appear to have done this more successfully than have farmers in the typically more humid Mossi Plateau of the Sudanian region. The importance of this is illustrated by differential levels of actual food consumption in a crisis year.

Second, despite greater self-sufficiency in crop production and higher aggregate incomes, the

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Sahel sample received much more food aid per person than the Mossi Plateau sample in the Sudanian zone. Food aid receipts are not *per se* part of a household income strategy, but do condition the strategy chosen. Targeting of food aid was guided primarily by indices of rainfall and per hectare yields. These criteria appear not to have taken directly into account that the Sahelian households compensated for lower per hectare productivity by cultivating a larger area per adult equivalent, nor that they earned more non-cropping income, which gave them more purchasing power than their Sudanian counterparts.

The paper empirically supports the important distinction between aggregate food availability and food entitlements of an individual household, as proposed by A. K. Sen in *Poverty and Famines*. Food availability from own-production on smallholder farms is clearly distinguished from food consumption security within households associated with these farms (the difference being the reliance on purchased food). Moreover, the paper demonstrates that the importance of this distinction is a function of regional characteristics.

2. DATA, STRATA, AND SAMPLE CHARACTERISTICS

Our analysis uses primary income and consumption survey panel data on household samples collected by ICRISAT and IFPRI researchers in Burkina Faso during a period which included the 1984 harvest to the immediate pre-harvest point in 1985. Although two study village samples (comprising 25–30 households per village) were chosen to represent each of the two zones, the present paper draws on data from one village only in each zone.

Rainfall during the 1984 cropping season was about 40% below long-term trends in both zones, an extremely bad outcome, even when set in the context of high inter-year variability in rainfall outcomes. Thus the behavior under scrutiny represents reaction to drought-year conditions. In addition, rainfall during the five years preceding 1984–85 was highly variable in both zones and consistently below long-term averages. As a result, cereal stocks were largely depleted coming into the study period (Reardon, Delgado, Matlon, 1987). Thus, the data well reflect farmer behavior under the type of stress conditions that household food security strategies and policy interventions are typically designed to relieve.

Because of higher rainfall and greater farming intensity, cereal yields per hectare were about 40% higher in the Sudan than in the Sahel sample

in 1984. However, due to inter-regional differences in population density, cultivated land per adult equivalent in the Sudanian sample was 42% less than the comparable figure for the Sahel sample. This difference counterbalanced the per hectare yield differentials rendering per capita crop production roughly similar between the zones.

For the purposes of this paper, sample characteristics can most usefully be analyzed in the context of the following *ex post* stratification. We define “consumption security” in a farm household as having consumed at least 80% of the level that the World Health Organization (WHO) considers to be the average required daily caloric intake for a moderately active adult equivalent: 2,850 kilocalories. This then includes households that consumed more than 2,280 kcals per adult equivalent (AE) per day on average for at least three-quarters of the survey period.

We thus define the “consumption secure” strata as including those households that experienced no more than one three-month season of consumption insecurity (in which an average day’s consumption per AE is less than or equal to 2,280 kcals) during the year under study. The “consumption insecure” are defined as those having experienced two or more seasons of consumption insecurity. Thus while the consumption secure group included undernourished people, the consumption insecure group was without exception in serious caloric deficit.

Households are defined as being “food production deficient” if their food production during the 1984 harvest was below levels required to meet 80% of the WHO average caloric requirement until the 1985 harvest.

A household can be food production deficient and either consumption secure or insecure, depending on the level of food purchases (which are in turn a function of crop, livestock and off-farm incomes, prices, and availability) and the receipt of food transfers.

Differences in the extent to which consumption security was achieved, however, were marked across the two samples. In both zones, less than 5% of the sample households were production sufficient in 1984–85. We found that in the Sahel sample: (a) 15% were both food production deficient and consumption *insecure*, and (b) another 80% were food production deficient but nevertheless consumption *secure*. By contrast, in the Sudanian sample: (a) 65% were both food production deficient and consumption *insecure*, while (b) 30% were food production deficient but nevertheless consumption *secure*. In Table 1 characteristics of strata types (a) and (b) above are described for each zone. The consump-

Table 1. Household characteristics by strata in Sahel and Mossi Plateau samples

| | Avg size* | Age HHH† | Depen. ratio‡ | Anim. trac.§ | Kcals. /AE | Live- stock/AE¶ | Land /AE** | Yield /Ha.†† | Prod. Suff.‡‡ | N |
|---|--------------|-------------|------------------|-----------------|---------------|--------------------|---------------|-----------------|------------------|----|
| A. Sahel: Prod. defic. & cons. insecure | 8 | 33 | 43% | 0 | 2,131 | 1,593 | 0.78 | 5,774 | 15% | 2 |
| B. Sahel: Prod. defic. & cons. secure | 10 | 45 | 49% | 10% | 3,054 | 51,569 | 0.99 | 9,674 | 40% | 17 |
| A. Mossi Plateau: Prod. defic. & cons. insecure | 11 | 51 | 56% | 10% | 1,848 | 10,097 | 0.57 | 20,409 | 35% | 12 |
| B. Mossi Plateau: Prod. defic. & cons. secure | 28 | 52 | 48% | 100% | 2,972 | 5,669 | 0.75 | 19,006 | 44% | 2 |

The number of households in each stratum is given in column "N". All values in table except || are measured at harvest time 1984. All averages were calculated weighting by AE and animal traction coefficients to remove the effects of these elements.

*Average size in unweighted members. Coefficients of variation (CVs) are greater than 0.5 in the Sahel and less than 0.5 in the Sudanian samples.

†Average age of household head. CVs are less than 0.33 in the Sahel and Sudanian samples.

‡Number children/household size. Children are 15 years old or less. CVs are less than 0.5 in both samples.

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

||The average kcals per day per AE consumed, of grains and pulses. The CVs are 0.35 or less for all strata.

¶The value of average livestock holding per AE. The CVs are less than 0.2 for stratum A in Sahel and B in Sudan, and greater than 0.5 in the rest.

**The total area of plots under production (thus excluding fallow), per household, deflated by household AE. The plot areas are unweighted by land quality coefficients. CV = 0.29 for Mossi Plateau, 0.39 for Sahel village sample.

††Yield = production of coarse grains in FCFA divided by total cultivated area (excluding fallow). The CVs exceed 0.7 for both strata in the Sahel sample, and are less than 0.35 for both in the Sudan strata.

‡‡The total quantity of harvested crops right after harvest 1984, weighted by calorie coefficients, and deflated by AE*365 days*2280, to give the sufficiency of extant harvested stocks in meeting the average daily calorie requirement of the household during the ensuing year, our study period. The CVs are around one-third for all strata except B in the Sahel which exceeds two-thirds.

tion secure stratum in the Sahel and the consumption insecure stratum in the Sudan are by far the most representative of their zones. There was one food production sufficient household in the village sample in each zone. Given that this is so minor, these two households were excluded from the descriptive tables for simplicity.

The two Sahel strata in Table 1 are similar in terms of demographic structure, except that the two insecure households have younger household heads, which is reflected in their having much lower asset (livestock holding) levels. Their insecurity appears to be related to the households' situation with respect to the Chayanovian life cycle (Reardon and Matlon, 1987). The two Sudanian strata are different demographically only in that the secure are larger households. This is reflected in the high proportion of animal traction in these.

The ratios of caloric intake between similar strata are similar across zones, reflecting the stra-

tification itself. Asset holdings, represented here by livestock holdings, differ greatly across zones and between strata within given zones. The insecure stratum in the Sahel has much lower livestock holdings than the secure. This may be related to their stage in the Chayanovian life cycle, which is in turn closely related to the stage in household asset accumulation. This difference is not present in the Sudanian zone, where livestock holdings are relatively small for both insecure and secure strata. The weighted average holding of livestock is much greater in the Sahel compared to the Sudanian zone.

Livestock and stored grain are among the main forms of wealth available to households to meet needs imposed by production shortfalls and periodic cash requirements. Livestock holdings are much smaller in the Sudanian zone, in part due to cultural reasons, but primarily because population density is more than 60% higher in the Sudan zone (67 versus 41 persons per square

kilometer) which severely reduces grazing area. Although traditionally the practice of entrustment allowed Mossi farmers to enjoy the ownership benefits of cattle without incurring management costs, in recent years this system has begun to break down with increased population density and associated social change (Delgado, 1979).

A 1971 study of 40 households in the Yako region found median household livestock ownership of 3.5 tropical livestock units (TRLU) (ORSTOM, 1975). A survey conducted by Christensen (1988) in 1985 estimated that median livestock ownership levels in the ICRISAT villages in the Yako region in 1983 had already declined to less than 0.5 TRLU. This fell by an additional 25% by 1984 in response to sequential drought years.¹

Among the consumption insecure households in the Sahel sample, both lower land/AE and lower yields/hectare combine to produce very low production per capita levels which are reflected in the extremely low degree of production sufficiency. For the consumption secure households, both elements are higher, but their levels of production per capita are still well below requirements. In the Sudanian zone, the differences between strata are less marked. Most striking, however, is the fact that the level of production sufficiency per capita is very close between the secure in the Sahel and the insecure in the Sudan, the most representative strata in the two zones.

In the next section, for the purpose of simplicity and due to limited sample size, we will focus on only the most representative stratum from each zone. For the Sahel this is the consumption secure, and for the Sudanian sample this is the consumption insecure. Summarizing from Table 1, both of these strata had very similar food output per capita (livestock are very rarely eaten), very similar demographic structures, but markedly different livestock holding levels. The Sahel group was more than adequately nourished, while the Sudan group was not. It will be seen that non-cropping income or other food entitlement was crucial to secure minimum food requirements in both cases.

3. HOUSEHOLD INCOME STRATEGIES

The relative roles of cropping and agricultural wages, livestock husbandry, off-farm employment (within-zone versus outside-zone or migrant), and transfers are highlighted in Table 2 (levels) and Figure 1 (shares). Comparison of the consumption insecure stratum in the Sudanian

zone with the consumption secure in the Sahelian zone in effect compares the "bottom 90%" in the former to the "top 90%" of sample households in the latter, based on consumption across the two zones. This is done to highlight the differences in strategies emphasized by the two *ex post* groups as opposed to geographical differences *per se*. Within this context we explore the degree to which households spread income risk over sectors and geographical areas to dampen the effects of localized shocks in crop production.

(a) Crop production and agricultural wage income

Given the extreme variability in cropping outcomes in the Sahelian and Sudanian portions of Burkina Faso, and the high degree of covariation in these outcomes among farm households, agriculture — either own production or farm-wage labor — is the most vulnerable source of current earnings. The Sahel sample employs strategies to insulate itself to a much higher degree than the Sudanian sample from this vulnerability by orienting its income strategy toward storable and movable assets such as livestock, and the sale of goods and services. The market for these is somewhat isolated from the condition of the local agricultural economy.

For the Sudan stratum, 17,130 FCFA/AE comes from the agricultural sector (excluding livestock but including farm wage income), or 55% of income. In the Sahel stratum, this figure is only 9,080 FCFA/AE, or 23% of income. The cropping in both zones is in its great majority dedicated to directly feeding the household. Hence, the Sudan consumption insecure stratum is, relatively speaking, twice as dependent on the agricultural sector as the Sahel consumption secure stratum, despite the fact that they have very similar figures for output per capita.

It is noteworthy that the very small group of food production deficient and consumption secure in the Sudan zone (shown in Table 1 but not in ensuing tables) had a very similar income profile to the insecure in the Sudan zone, but managed to earn twice the level of agricultural wages. This put their total income at a figure close to that of the secure in the Sahel. It is not clear whether these households had access to particular resources or contacts to gain employment that were not available to others. In any event, although they were successful at a strategy of dependence on farm-wage labor, this neither erases our argument as to its inherent precariousness nor eliminates the fact that the great majority of households either did not find it

Table 2. *Household income sources (levels) in the samples*
In Francs CFA per adult equivalent per annum. All levels rounded to nearest 10.

| Sector | Subsector | (1) Sahelian: Prod. insuff. & cons. secure | (2) Sudanian: Prod. insuff. & cons. insecurity | (2)/(1) |
|----------------------|---------------|---|---|---------|
| | | | | |
| Agriculture | Crop Prod.* | 8,500 | 9,010 | 106% |
| | Agric. Wages† | 590 | 8,120 | 1,389% |
| (Subtotal) | | (9,090) | (17,130) | |
| Livestock husbandry‡ | | 8,370 | 1,930 | 23% |
| Local Non-farm§ | Construction | 640 | 170 | |
| | Commerce | 2,510 | 70 | |
| | Artisanal | 5,420 | 1,370 | |
| | Gathering | 30 | 0 | |
| | Service | 980 | 2,640 | |
| (Subtotal) | | (9,580) | (4,250) | 44% |
| Non-local non-farm | | 8,760 | 5,200 | 59% |
| Transfers¶ | Food aid | 1,630 | 30 | |
| | Intra-village | 650 | 240 | |
| | From abroad | 740 | 2,090 | |
| (Subtotal) | | (3,020) | (2,360) | 78% |
| TOTAL | | 38,810 | 30,880 | 80% |

*Crop production: The value at producer prices of all crop production harvested after the 1984 rainy season, less the value of inputs used during that season.

†Agricultural wages: Wages received during the 1985 cropping season, working on other households' plots in the immediate region (i.e., not migratory work).

‡Livestock husbandry: Net sales plus home consumption of livestock.

§Non-agricultural income earned locally (in the zone): This is non-migratory work income earned in occupations other than cropping and livestock husbandry. Income here is net: gross income minus expenses. The activities include: construction, non-livestock commerce, artisanal (e.g., making mats, baskets, weaving), gathering (wood gathering for sale), services (prepared food sales, transport, vehicle repair).

||Non-agricultural income earned outside the zone (either within the country or in foreign countries): remittances sent to the household by its own members working abroad, or brought back by the latter after migratory work. The work could have been in the agricultural sector outside of their zone. "Non-agricultural" thus refers to lack of relation with the zone's agricultural sector.

¶Transfers: inter-household gifts at the regional level, food aid receipts, and transfers from persons not from the household, outside the region (e.g., family members living permanently in Côte d'Ivoire).

an adequate strategy or were not able to pursue it successfully. The latter is due to the limits, especially in a poor year, of the local demand for hired agricultural labor.

The agricultural labor market is very limited in both zones. The Sahel's is more limited than the Sudanian's because seasonality is more pronounced and cultivation practices differ (e.g., there is no clearing, and very little pre-season cultivation).

Average aggregate income per AE is approximately 25% greater in the Sahel stratum. The major difference between strata incomes is due to differences in non-cropping, non-transfer income (livestock income and earnings from local and non-local non-farm occupations). For the Sahel, 26,710 FCFA/AE or 69% of income comes from non-cropping, non-transfer income. For the Mossi Plateau, this figure is only 11,380 FCFA/AE or 37%.

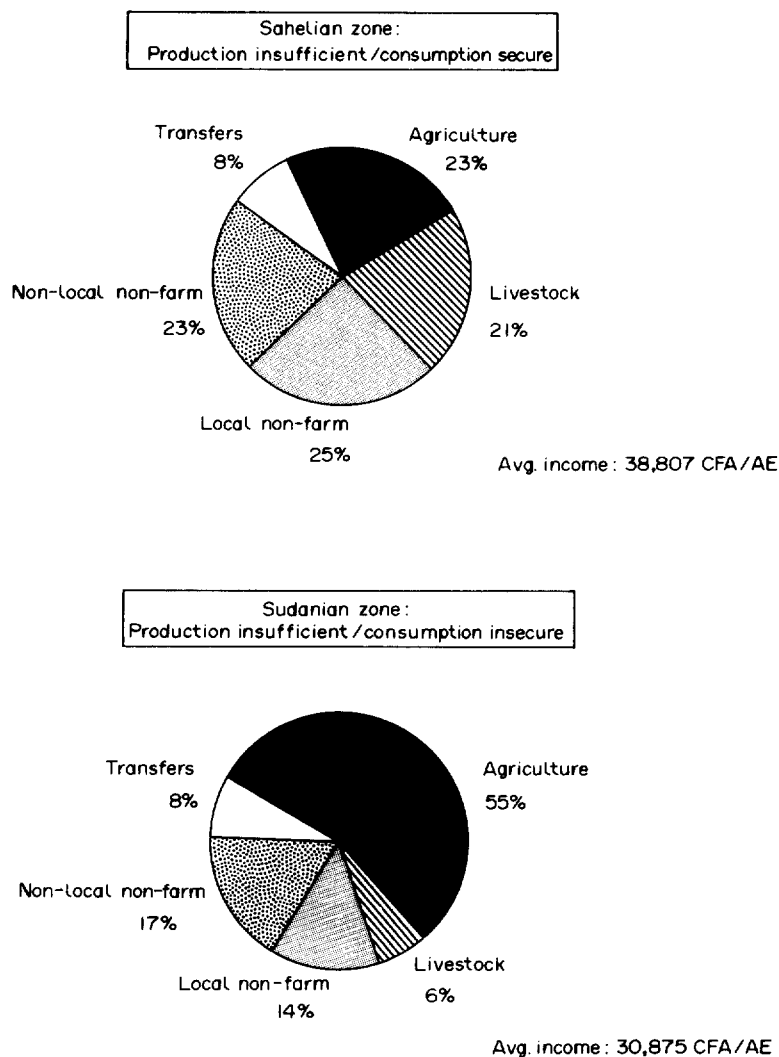


Figure 1. *Income shares for Sahelian and Sudanian samples.*

(b) *Livestock husbandry*

Livestock is a store of wealth that serves as an important insurance mechanism in the sense that these assets are saleable in poor years to provide purchasing power for grain consumption. This latter assumes that drought does not persist so long that either holding levels are too much reduced, or the price of cattle relative to grain prices is too much reduced. For reasons already described, livestock incomes are more than four times greater in the Sahel than in the Sudanian sample — 8,370 FCFA/AE vs. 1,930 FCFA/AE. The relative lack of saleable assets among Sudanian households means that households in that

region have to rely principally on current income flows to generate purchasing power.

(c) *Local non-farm income*

In the Sudanian Mossi Plateau, a substantial portion of non-farm employment is closely interlinked with the local cereal economy, on both the input and output sides, as well as with local effective demand. Table 2 shows that local non-farm income is derived almost entirely from artisanal manufacture of mats, baskets, and tools, and services (primarily sorghum beer-making). These activities are relatively dependent, on either the

input or output side depending on the activity, on the local agricultural economy. The total income from these occupations is 4,250 FCFA/AE, or only 14% of income.

In the Sahel insufficient/secure stratum, by contrast, 9,580 FCFA/AE or 25% of income is earned locally in non-farm occupations. This is composed primarily of commerce in cola nuts (not grown in zone), and artisanal manufacture of non-food consumption goods. The balance is composed of relatively small amounts of construction earnings (the bulk of this sort of activity is carried on as part of migration activities included under non-local income) and services (very little of which includes food preparation).

While the majority of local non-farm income in the Sudan sample is sorghum beer-brewing (which is closely related to the local cereal economy), the majority of the same type of income in the Sahel sample is in commerce, unrelated to local crop supply, and artisanal manufactures. The effective demand for the latter is rooted in overall income which is derived in its great majority from sources unrelated or only indirectly linked to the local cereal economy.

(d) *Non-local off-farm income*

5,200 CFA/AE or 17% of income is earned by Sudanian insufficient/insecure households outside the zone (in either cropping or non-cropping-related activities performed during the period spent as migrant). In the Sahel insufficient/secure stratum, on the other hand, 8,760 FCFA/AE or 23% of income is derived primarily from this type of employment. These occupations include both non-agricultural (mining, well-digging, etc.) and agricultural (plantation labor, etc.). The latter took place almost exclusively in coastal countries much less affected by the drought than those under study here.

(e) *Transfers*

We reiterate here that food aid conditions the income strategy of the household. Other transfers, such as those from family working in other regions, can become part of the long-term survival strategy of the household.

The relative magnitude of transfers income is similar between the strata; in the Sahel stratum, 3,020 FCFA/AE was received, relative to 2,360 FCFA/AE in the Sudanian stratum. However, the composition of the transfers in the zones differs greatly. In the Sahel, 22% of transfers represented gifts from households in the village; 21%

were transfers from family abroad; and fully 57% were from donor food aid. This can be contrasted with the following figures for the Sudan sample: 10% from within-village transfers, 89% as remittances from non-household members working abroad (mainly in Côte d'Ivoire), and only 1% from donor food aid.

The latter reflects the fact that policymakers targeted food aid not on the basis of purchasing power and need, but rather on output per hectare and weather criteria. Despite higher incomes and better pre-aid consumption levels in the Sahel, food aid receipts per AE were in fact 10 times higher in the Sahel compared to the Sudanian sample.

(f) *Implications of geographical and sectoral income diversification*

Because annual rainfall patterns are perhaps the major determinant of crop yields in semi-arid rain-fed production systems, inter-annual production is subject to a high degree of intra-regional covariation. Income earning activities that depend substantially upon incomes generated through input, output, or demand linkages to local cropping are therefore not effective means of stabilizing aggregate incomes by counterbalancing poor crop yields. In the absence of stable local employment opportunities — such as salaried employment in the "formal sector" — a common strategy followed by households is for single males to find seasonal employment in other regions and in other economic sectors where income levels have relatively low covariation with local cropping incomes.

Such migration income accounts for about half of off-farm income in both the Sahel and the Sudanian samples. The migration income is higher in the Sahel, however. Both receive transfers from outside the zone, which are of nearly equal magnitude. For the Sahel this is mainly food aid; for the Plateau this is transferred from non-household family members living outside the zone. Thus, the degree of orientation toward sources of income from outside the zone is on balance moderately higher in the Sahel.

Extra-regional income sources may of course involve a lower degree of control (by the migrant). Moreover, such incomes are subject to the precariousness inherent in the life of the migrant, and are not only a function of economic conditions in other zones, but may also depend on the goodwill of family or on political decisions. For example, during 1985, a politically inspired moratorium on housing rents in Ouagadougou essentially eliminated new construction

and related employment. The Sahelians, whose construction-oriented migration earnings are substantially based in the Ouagadougou market, suffered relatively more from this circumstance. Nevertheless, it is safe to say that the periodic and long-run difficulties of the local agricultural economies in our study zones make strategies incorporating regionally diversified employment in the aggregate inherently less risky.

While these data strongly suggest that an overall income generation strategy — in particular sectoral and regional diversification — underpins household food security strategies, they do not provide an unambiguous answer as to why the Sahelian income is composed of relatively much more diverse components than the income strategy pursued by Sudanian households. With the qualification that we are only examining results from two villages in one bad year, it appears that this diversity is the secret of greater Sahelian food security in bad years. While cultural differences clearly exist between the two regions, it is also clear that they alone cannot provide a satisfactory explanation. Traditions presumably develop in response to specific physical, political and economic conditions.

Yet these conditions change and insufficient adjustment time can be a key constraint to the modification of income strategies. Until relatively recently, crop farmers on the Mossi Plateau had fared adequately by pursuing a production strategy based on the separation of livestock and crop management functions, whereby they could enjoy the benefits of cattle-based insurance mechanisms with low maintenance costs. Sufficient pasture away from the village and a subordinate pastoral ethnic group made this possible. Relatively rapid socio-political, demographic, resource base, and climatic changes have undermined that strategy. On the other hand, migration and the establishment of links with the regional non-agricultural economy also require investment of capital and time, and appear, at least to the present time, to have been largely neglected.

Currently, the relative dearth of assets militates against the former and the rapidity of the alteration of the situation against the latter.

Farmers in the Sahel, by contrast, have traditionally been exposed to severe production variability. The latter, combined with the cultural presence of pastoralism, led the sedentary agriculturalists to build up their asset or insurance base. At the same time they invested in links to sources of effective demand for their products and labor in the urban areas, abroad, and in other regions whose agricultural situations were not highly covariant with the Sahel. It appears

that time, need, and relatively liquid stores of wealth may have combined to make practicable the sectoral and geographical diversification of their income strategy.

3. POLICY IMPLICATIONS

The results above are based on only two village samples in two zones, in one poor crop year in the Sahel. Thus, we cannot claim that they are strongly generalizable. Nevertheless, they are presented as hypotheses to guide future research. With that caveat in mind, three main sets of policy implications are discussed below, based on the above results.

First, rural households in these zones consider opportunity costs across sectors and geographical areas when forming their income generation strategies, though the success to which such strategies are implemented vary greatly by region. Second, rural households in these zones are highly involved in the market, both to generate income as well as to purchase food. Third, the need for food aid is a function not only of crop production determinants, such as rainfall, crop yields per hectare, and land/man ratios, but also of purchasing power broadly considered. These three points have a series of important implications.

Turning to the first set of issues: in policy formulation rural households are often uniquely treated as crop producers, or at most as crop and livestock producers. The consequence of looking at them this way is that the policymaker or technology designer believes that the rural household is comparing net earning levels and variability of various options only within the farm sector. Examples would be whether or not to invest money in a draught animal, or to grow cotton as opposed to grain.

In contrast with this unisectoral view of the rural household, the typical household in our sample earned from one-half to only one-quarter of its income in a crisis period in cropping or livestock activities with the rest derived from off-farm businesses, migration remittances, and transfers. Similarly, a survey of African farm management studies found that 25 to 50% of household labor time on smallholder farms is typically spent on non-agricultural activities (Eicher and Baker, 1982). The appropriate inference is that when the household is deciding on where to invest its money or use its labor time, it evaluates earning potential across the various crop, livestock, and non-farm sectors. Our results confirm this on an income basis (as compared to a labor-use basis).

Furthermore, given extreme inter-annual variability in cropping outcomes, opportunity costs may be relatively higher in those sectors that are relatively less affected by that variability (although this is not quantified in this paper). Consequently we find that households disperse their time and money investments over a wide range of sectors and locations. The level and stability of earning appears to be perceived as greater in the non-cropping activities.

These findings are equally relevant to agricultural research and extension strategies. Given that rural households are not constrained to invest their funds and time in cropping, and appear sensitive to intersectoral relative net returns, it may be difficult to persuade rural households to intensify their cropping through greater labor, capital, or variable input use, since these same resources provide an important risk aversion function elsewhere. This is consistent with a finding elsewhere for Burkina Faso that farmers who chose not to adopt animal traction were in fact much more heavily engaged in commerce than those who did (Barrett *et al.*, 1982).

In a related argument, it can be shown that labor-saving technical change in agriculture does not translate necessarily into a reduction of labor demand or opportunity for sale of labor, in the overall rural economy. That is, an increase in farm income coming from a productivity increase could translate into an increase in demand for the output of off-farm activities. Derived labor demand from the latter could absorb the labor that had been freed from agricultural tasks. On the other hand, if cropping becomes much more profitable because of labor productivity increasing technology, then households may choose to allocate more labor to cropping and less to non-farm activities. However, if the productivity increase is insufficient or too variable to lead to a shift in household income strategy toward cropping, then households would probably choose to use the labor freed from cropping tasks in off-farm income generating activities. This would, of course, depend on the households' demand for leisure function.

We turn now to the second finding, that sample households are highly involved in market activity to generate both income and food. Conventionally, in policy discussions, rural households in Africa — especially in the semi-arid zones — are viewed as subsistence producers: at most they may have some surplus grain which is sold to urban areas. The consequence of this view is that demand-side price and marketing policies are considered to have an insignificant effect on rural households.

In contrast with this view, we have found that

from one-half to three-quarters of household income comes from interaction with the non-agricultural market. While cereal sales are a very small part of income in bad years such as the one surveyed, cereal purchases are an important part of the diet (see Reardon and Matlon, 1987). In fact, the degree of vulnerability to cropping outcomes is inversely related to dependency on the market from both the income and expenditure side.

The upshot for food policy focused on equity objectives is that real income transfers can be effected via concessional sales of cereal in rural areas. Though in some areas and years this may act as a disincentive to production, in other areas, such as the zones we have examined here, aid and concessional sales in drought years act primarily to shore up real incomes of households, the majority of which are simultaneously producers and consumers. If one assumes that the level of production is mainly a function of the rainfall level, and relatively inelastic with respect to producer prices, then the positive effect on the consumption side would outweigh the potential production loss from disincentive, and the overall effect would be a net gain.

At the very least, consumer price changes should be seen as having important welfare impacts in rural areas. Conventionally they are seen as only influencing urban welfare. "Cheap food" may be a blessing in certain rural settings as well and thus should not be reviled across the board as being contrary to the spirit of rural development.

In the final analysis, it is purchasing power that ensures food entitlement. As we have seen, this can be delinked from the local cereal economy. This leads to the third set of policy implications concerning food aid targeting.

We found elsewhere that in the Sahel strata in 1984/85, hunger was not widespread (Reardon and Matlon, 1987). Rather, hunger was found only in pockets of the population. By contrast, hunger was widespread in the Mossi Plateau. There is concern among food aid donors and recipients that aid be targeted cost-effectively to meet needs. A practical outcome of our analysis, given that manageable indicators and targeting rules are in short supply, may be the following. "Longer-run" assistance focusing on infrastructural and off-farm employment development can be oriented toward zones such as the Sahel, where the potential for agricultural development is limited and mechanisms to generate purchasing power are well established. Public grain sales in poor years can be directed toward these zones. By contrast, where there is widespread hunger in some years but an absence of income earning activities not linked to cropping outcomes, prior-

ity should be given to concessional food aid and food for work projects in bad years. The latter can be supplemented by longer-run strategies of infrastructural development to encourage the creation of off-farm businesses.

In sum, it would be most efficient to have long-run schemes for areas in which households have income bases that are higher and more diversified intersectorally, and have short-run relief schemes where the opposite is true.

NOTES

1. These results were provided by Garry Christensen based on his survey work in 1984–86 in Burkina Faso.

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