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Nutritional Aspects of Rice Cultivation in Nyanza Province, Kenya

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SUMMARY

This is the first in a series of studies on nutrition in agricultural and rural development in Kenya. The nutritional implications of different agricultural and rural development projects for the participating populations are studied. The studies are combined with nutrition surveys of a more general nature.

The present study focused on the nutritional conditions among farming households engaged in irrigated rice cultivation in the Kano Plain, Kisumu District. It represents the existing types of participation in irrigated rice production in the area and household surveys were conducted among the following groups:

(a) tenants working and living at Ahero and West Kano Irrigation Scheme (resident tenants);
(b) tenants growing crops at the same schemes but residing outside the scheme boundaries (non-resident tenants);
(c) rice growers participating in small-scale irrigation projects (individual rice growers);
(d) farm families not cultivating rice were included for purpose of comparison (non-rice growers).

Socio-economic information and agricultural data were collected by means of structured interviews. Food consumption was assessed by two methods: a recall of all food consumed in the households during the day prior to the interview, as well as a 24-hour recall of the food consumption of individual children, aged 6-47 months. Nutritional status included the anthropometric measures commonly used in nutrition studies i.e. weight, height and mid-upperarm circumference.

The youngest children proved to have a high prevalence of diarrhoea and vomiting and showed a slow-down of height growth in the second half of the first year. The incidence of stunting among pre-school children was similar to that among Kenyan children in general. Weight-for-height, however, was low and indicated a considerable incidence of wasting at the time of the survey, early 1984. The average quantities of foods consumed by the children were rather low and did not meet caloric requirements, particularly among the 3 and 4 year old children. Protein consumption was generally sufficient.

Recommendations to improve these adverse nutritional conditions include:
- = stimulation of milk consumption, notably through the introduction of graded cattle;
- = emphasis on the quantitative food requirements of children, notably in health and nutrition education.

The general health situation, moreover, can be improved by:
- = provision of village water supply systems that are of an accessible and inexpensive nature, notably by extending the coverage of the existing shallow wells programme.

The farming households included in the study reflect varying degrees of participation in, and dependence on irrigated rice production. The non-rice growers take no part in irrigated agriculture and largely depend on traditional techniques and management practices. The resident tenants at the large irrigation schemes no longer run their farms according to their own insight and have to rely to a very large extent on the proceeds of their cash crops (rice, and in some instances sugar cane) for their daily living. The two remaining groups fall somewhere in between. The non-resident tenants have sizeable plots of land outside the schemes, and as such have a combination of the resources available to the previous groups. The individual rice growers, finally, have a similar combination of resources, although these farmers usually cultivate only small rice plots.

The observed differences in nutrition between the four groups appear to be primarily related to these variations in resource availability and are not associated with poor health conditions or unvaried "rice" diets. The group with the smallest resource base i.e. the resident tenants have the lowest food production for home consumption and the lowest average enery intake per consumption unit. This group also had the lowest food intake levels among the young children and showed a higher incidence of stunting compared to the children belonging to the other study groups. The nutritional differences among the remaining groups are much smaller but, in turn, are also related to variations in resource base. The nutritional status of the children of the non-resident tenants proved to be the most favourable. The two remaining groups, the non-rice growers and individual rice growers, take an intermediate position in respect of diversity of resources which is reflected in the nutritional conditions among these groups.

It is evident that the assumption on which the design of the schemes is based viz. that the livelihood of tenant families can be fully covered by means of cash crop cultivation, is not valid. The nutritional conditions among the resident tenants show this convincingly. However, unequivocal conclusions about the nutritional consequences of participation in irrigated rice production are not possible. It cannot be said that participation in rice cultivation in itself has detrimental effects. Both the group with the most favourable nutritional conditions (non-resident tenants) and the category which showed the least favourable results (resident tenants) are farmers at the large-scale irrigation schemes. Participation in large-scale rice production does not necessarily have negative nutritional consequences and may even contribute positively under certain conditions. However, this is not the case where the sole existence of the

farming household depends on this type of agriculture. Rice cultivation on an individual basis in the small schemes does not appear to invoke negative nutritional effects.

Since a diversified resource base is instrumental in securing satisfactory nutritional conditions it is strongly recommended:

= to assure a diversification in the agricultural resources of households in existing as well as future irrigation schemes.

With regard to the existing large-scale irrigation schemes in the Kano Plain it is stressed that:

= the group of resident tenants (farmers working and living at the schemes) should particularly be assisted to attain a more satisfactory diversification of resources.

The following concrete measures are suggested to redress the current nutritional situation at the large irrigation schemes:

= the introduction of rainfed crops in the cropping pattern either through introduction of multiple cropping of paddy and rainfed crops on existing scheme plots; or
allocation of separate rainfed plots on presently uncultivated scheme land;

= creating wider possibilities for livestock rearing at the schemes by lifting current restrictions on cattle keeping; and
the introduction of zero grazing in combination with fodder production.

Finally, it is recommended to support and promote rice cultivation on an individual basis in existing and future small-scale schemes in view of the fact that this type of rice production broadens the resource base of small farmers.

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1. INTRODUCTION

Kenya faces the problem of securing an adequate food supply for its fast increasing population (McCarthy & Mwangi,1979; Senga et al.,1981; World Bank,1983; Kliest,1985). It has been estimated that among the poorer strata of the population, which include groups such as smallholder farmers and agricultural labourers, energy intake presently reaches only 80 percent of requirements (Shah & Frohberg,1980; Greer & Thorbecke, 1984). Already pressure on arable land in Kenya is high, and future increases in agricultural production will depend on the possibilities of increasing yield levels per ha., as well as bringing unused, often marginal lands under cultivation (Mwangi,1981; Republic of Kenya, 1984).

Development strategies focusing on modernization and growth often aim to increase agricultural production, including food production, through a transition from subsistence farming to production for the market. This transition is often envisaged through large-scale agricultural development projects. A common characteristic of such strategies is their primary orientation on the national food situation and the farmers directly involved in agricultural development projects often receive little attention. It is usually assumed that improved levels of production result in increased farm incomes and higher standards of living. However, such positive effects cannot be taken for granted. In fact, concern often exists about the nutritional situation of the farm households involved in agricultural projects and there is a need for more detailed knowledge on

the nutritional effects of agricultural change (McGuire,1981; Pinstrup-Andersen,1981; Martin,1984).

One of the means to increase agricultural production is through improved water management, notably irrigation. Kenya's potential for irrigated agriculture is quite substantial (World Bank,1983). The Kenya Government attaches increasing importance to irrigated agriculture which has resulted in the initiation of several large-scale schemes and support for small schemes in different parts of the country. A substantial number of households is already dependent on irrigated agriculture, and this number is expected still to increase in the near future (Republic of Kenya,1984).

During the 1960's and 1970's, the Government initiated several large rice irrigation schemes for the cultivation of rice. The first and, until now, the largest scheme is that at Mwea in Central Province. Others were subsequently started in Nyanza Province: Ahero and West Kano (Pilot) Schemes, and in Western Province: Bunyala Irrigation Scheme (National Irrigation Board,1982). The large schemes are centrally managed and were initially organized along very similar lines. The tenants were expected to reside on the scheme, and to grow rice on the plots allocated to them. The produce was centrally purchased, and farmers were paid in cash. Each tenant was allowed to retain a certain quantity of rice for home consumption, but other foods were to be purchased from the cash returns. In addition to the large-scale schemes, a fairly large number of small irrigation schemes exists. Most of them were developed spontaneously by the farmers themselves. In contrast to the large schemes, they are largely managed by the participating farmers who have more freedom to select the types of crops to be cultivated, and to manage their farms according to their own insights. In this report, this form of irrigated rice cultivation will alternatively be referred to as small (irrigation) schemes, smallholder rice cultivation and individual rice growers in contrast to the tenants at large (irrigation) schemes managed by the National Irrigation Board (N.I.B.). Recently, the Kenya Government and development agencies have shown an increasing interest in stimulat-

ing small-scale irrigation (Republic of Kenya,1984). A number of small schemes (e.g. in Nyanza Province) are supported through the Smallholder Rice Rehabilitation Programme and the Provincial Irrigation Units of the Ministry of Agriculture and Livestock Development. There are plans to start several new schemes in the coming years.

The nutritional conditions at some of the large schemes, notably Mwea and Ahero, have on several occasions given rise to concern and have received publicity in the national press. Studies on the nutritional state of the population have been conducted at Mwea (Korte,1969; Wanjohi et al.,1978). They indicated a high prevalence of malnutrition with at least twice as many severely malnourished children compared to the national average. Several factors have been suggested to explain these negative findings. Frequently mentioned are low income levels realised by the tenants, poor health as a result of diseases associated with stagnant water, unbalanced diets as a result of mono cropping, and, finally, unbalanced spending of budgets by households not used to purchasing food.

The low income levels observed among tenants in large schemes partly result from technical problems which reduced production below expected levels. The intended (high) cropping density could not be maintained, and pests and diseases further lowered yields per ha which remained well below expectations.

Furthermore, diseases such as bilharzia and malaria pose a serious threat to the health of rice growers. The incidence of disease has consequences for the nutritional status of those affected and this applies particularly to young children. There is a danger of a vicious circle of illness giving rise to poor nutrition which, in turn, lowers the general resistance against disease.

Also, mono cropping is thought to influence nutritional conditions negatively. In the large irrigation schemes, cash crops (rice, and in some cases sugar cane) are the only crops cultivated. Other land use is

usually not permitted. Moreover, the size of the homestead plots usually does not allow for the cultivation of sufficient quantities of subsistence crops. These circumstances may easily lead to unbalanced diets. In addition, the fact that the tenants are not allowed to keep cattle at the schemes has often been critisized, since milk is an important weaning food.

Finally, the transition to commercial farming is thought to have effects of a more general nature that also negatively influence food consumption and nutrition. The shift to commercial crops profoundly influences the traditional division of responsibilities in the household. Women are no longer able to cultivate sufficient food crops to secure the food requirements of the entire family. Instead food has to be purchased from the rice proceeds, but these are usually paid to the (male) head of the household. Frequently this income is used for other purposes, and not utilised for an optimal provision of necessary foods for the family members.

In recent years, efforts have been made to reduce some of the effects of mono-cropping. In some of the schemes, such as West Kano, larger homestead plots were planned to allow cultivation of additional subsistence crops. In the Mwea scheme, tenants were allocated additional land for rainfed cultivation. In most schemes, farmers are now allowed to plant sweet potatoes, vegetables and bananas on the bunds between the rice plots as long as this does not interfere with water management. Other steps to improve nutritional conditions include the promotion of vegetable gardens within the schemes, and the appointment of nutritionists. Whether the various measures have indeed resulted in improved and more balanced diets among the tenants and their families has not yet been established.

Although the above mentioned problems and their possible adverse nutritional effects have been pointed out repeatedly, no systematic study of nutritional conditions at rice irrigation schemes has been undertaken. The present study was designed to investigate the nutritional conditions

prevailing among farming households engaged in irrigated rice cultivation in the Kano Plain, Kisumu District. The Kano Plain has a fairly homogeneous ecology, and is inhabited by a single ethnic group, the Jaluo. In this area two large rice irrigation schemes, the Ahero and West Kano (Pilot) Schemes, are situated. In addition, individual smallholders cultivate rice in a number of small irrigation schemes.

It is no simple matter to evaluate the nutritional effects of irrigated rice cultivation. For instance, one cannot resort to the (quasi-) experimental designs often used to assess the effects of nutrition intervention programmes. In addition, it is not possible to compare conditions after the introduction of irrigated rice cultivation with the nutritional situation in the area before its introduction. This is because either too much time has passed after the first introduction of this type of agricultural production and/or too many extraneous variables have been introduced. Moreover, large irrigation schemes usually involve resettlement as well as reallocation of land and this results in profound demographic and socio-economic changes among the local population. Precisely because of these changes, it is usually not possible to locate an appropriate community which can be used as a control group. One solution to these methodological problems is to compare different treatment conditions with each other.

In the case of the present study comparisons are made between groups that differ in their degree of participation in irrigated rice cultivation. Four groups were studied and compared: three groups directly involved in rice irrigation and one group not growing rice. The primary aim of the study was to gain insight into the relationship between production and consumption at the household level, taking into account different participation in irrigated rice cultivation, and to compare rice growers with farming households not growing rice. The study concentrated on food production and food consumption, nutritional status, and the social and economic characteristics of the respective groups.

2. THE LOWER KANO PLAIN

2.1 General

The Kano Plain covers an area of about 650 km² and is located in Kisumu District [1], one of the four districts of Nyanza Province. The area lies immediately south/south-east of Kisumu Town along the Winam Gulf and is bordered by steep escarpments to the south and the north. To the east, the foothills of the Tinderet Highlands form a natural boundary. The landscape consists of a wide alluvial plain through which a number of rivers reach Lake Victoria. Among these, the Nyando River which provides the Ahero irrigation scheme with water, is the most important (Maps 1-2; pp.41-42).

The climate is relatively dry with high average temperatures during the day. The rather fertile soils (Mbuga or Black Cotton soils) are difficult to drain and to cultivate, therefore decreasing the agricultural potential. The area's altitude varies from less than 1,140 m near the shore of Lake Victoria to more than 1,200 m inland. A considerable part of the plain consists of seasonal and permanent swamps. As a consequence, the higher spots which do not flood under normal circumstances, are densely settled. According to the 1979 population census, the overall population density of the Kano Plain amounts to 177 persons per km².

Although the Kano Plain has a rather homogeneous ecology, important local differences can be observed regarding the agricultural potential. Only the lower areas, i.e. those parts situated between the 1,140 and 1,180 contour lines are considered suitable for irrigated agriculture. Here, rice cultivation is a profitable, albeit sometimes risky, economic activity due to irregular flooding of the swamp zone (Jaetzold & Schmidt, 1982).

This area, the Lower Kano Plain, was selected as study area. In the following, it will also be referred to as Kano Plain in general, and it covers the following administrative areas: North-east and South-east Kano Location in Nyando Division and West Kano Location (recently subdivided into North-west and South-west Kano) in Winam Division. Some higher parts of South-east Kano (Wang'aya II and Border Sub-location) and North-east Kano (Sidho-east Sub-location), however, are not part of the area included in the study (Map 1; p.41).

2.2 Natural Potential

Generally, Nyanza Province is characterized by sufficient rainfall for agricultural production. The rains are more or less evenly spread over the year with no distinct break between the first and second rainy periods. This is caused by the humid daily westerly winds originating from Lake Victoria which converge with the south-east passat. The rising air mass produces heavy showers mainly occurring during the late afternoons (Jaetzold & Schmidt,1982).

In the Kano Plain, however, different conditions prevail. At the Winam Gulf, the shoreline of Lake Victoria reaches almost 100 km inland. Consequently, the zone of low precipitation near the Lake[(2)] curves eastward over the area (Map 3, p.43). The average annual rainfall in the Kano Plain ranges from 1,000 to 1,400 mm depending on the distance from the lake and the elevation of the terrain. With the exception of 1980, which was an unusually dry year in the whole of Kenya, annual

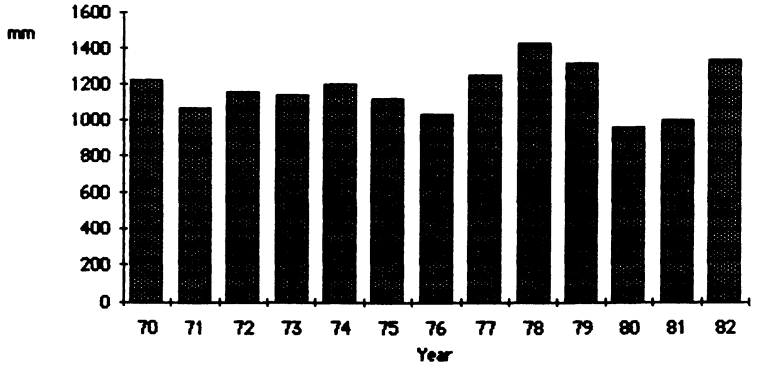
average rainfall quantities over the period 1970 - 1982 do not show important fluctuations (Figure 2.1).

Figure 2.2 shows the mean monthly rainfall at the Ahero Pilot Scheme, measured over a period of thirteen years. A distinct wet period, starting towards the end of February falls in the period March to May. Compared to the other, remaining, months in which the average rainfall amounts to some 70 to 80 mm, August and November have a higher level of precipitation. Monthly averages, however, can be misleading because of the great variation in rainfall that occurs within months. Dry spells with no rainfall at all happen almost every month, and occur even during the period of the long rains. Furthermore, the generally high temperatures leading to high rates of evapotranspiration during the short rains, prohibit the cultivation of rainfed annual crops. As a consequence, the agricultural potential of the Kano Plain is lower than that of the surrounding highlands, where a variety of crops can be cultivated all year round.

The flat Kano Plain consists of soils which developed on sediments from lacustrine mudstones and on more recent deposits in the flood plains which were formed by the various rivers crossing the area towards Lake Victoria. Soils which developed under permanent and seasonal swamp conditions are also found. Generally, the soils of the Lower Kano Plain have a relatively high fertility. However, all soil types are characterized by their poor drainage ability. Consequently, land preparation and cultivation are difficult.

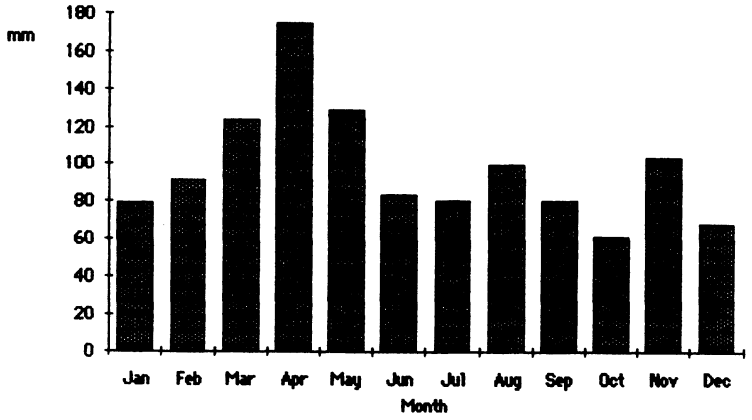
As a result of their limited capacity, the existing rivers in the area are not able to match their high discharges during the wet periods. Consequently, flooding occurs frequently. The sometimes high rainfall during heavy, local, rainstorms in combination with the heavy and impermeable soils with their poor surface drainage, causes 'ponding'. The damage to crops and, sometimes, buildings and roads is extensive.

Figure 2.1
ANNUAL RAINFALL, 1970-1982
(Ahero Station)



Source : Republic of Kenya/Nedeco, 1982; National Irrigation Board, 1983

Figure 2.2
AVERAGE MONTHLY RAINFALL, PERIOD 1970-1982
(Ahero Station)



Source : Republic of Kenya/Nedeco, 1982; National Irrigation Board, 1983

Table 2.1
Population Data for the Lower Kano Plain, 1979

Administrative Unit	Total Population	Sex Ratio (f/m)	No. of Households	Av. Household size	Area (km^2)	Density (pers/ km^2)
N.E.Kano*	31,467	1.07	6,324	5.0	155	203
S.E.Kano**	30,369	1.11	5,624	5.4	237	128
W.Kano***	32,305	1.07	5,173	6.2	141	229
Lower Kano	94,141	1.08	17,121	5.5	533	177
Kisumu District	329,684	1.06	65,153	5.1	1,823	181

* Wagaya II sublocation with an area of 19 km^2 and a population of 4,260 and Sidho East sublocation with an area of 25 km^2 and a population of 5,966 are not included;

** Border sublocation with an area of 56 km^2 and a population of 6,484 is not included

*** After 1979 several boundary changes took place e.g. West Kano location was subdivided in N.W.Kano and S.W.Kano

Source: CBS,1981

2.3 Population and Settlement

According to the 1979 census, the population of the Kano Plain, including Ahero Township, amounted to some 95,000 people. A detailed comparison of the 1969 and 1979 census data for the various administrative areas within the Kano Plain is not possible due to boundary changes of various sub-locations. Nevertheless, it is clear that the area's total population increased only moderately between the two census years, while the annual natural population growth amounted to almost 4.0 percent over that period.(3) Kisumu District as a whole also witnessed a mere 1.3 percent net annual population growth in the rural areas during the inter-censal period. This is due to an ongoing trend of outmigration to Kisumu Town and other parts of Kenya. During the past twenty years, however, the pattern of outmigration has changed substantially. The 1962 population census showed a disproportional number of adult males in relation to that of adult females, i.e. a ratio of 73 to 100 (Ominde,1963). Seventeen years later, however, the proportion of males per 100 females in the age bracket of 19 to 60 years increased to 94 (CBS,1981). This indicates a growing participation of women in the migration process. Kisumu District is rather densely populated. The average density in 1979, excluding Kisumu Municipality, amounted to 181 persons per km^2. The respective figures for 1962 and 1969 were 153 and 172 (Ominde,1963; CBS,1981). These data indicate a growing pressure on land resources. In 1979, the population density of the Kano Plain was almost identical to that of the entire Kisumu District. Densities per location vary considerably with 120 persons per km^2 in South-east Kano, but 230 per km^2 in West Kano (Table 2.1).

Table 2.2 lists the population density per km^2 of agricultural land and the availability of agricultural land per person. The relation between agricultural land and population is least favourable in West Kano Location. According to Jaetzold & Schmidt (1982), 0.5 ha of medium-potential agricultural land per person is considered the minimum requirement to maintain soil fertility under the present levels of technology. This implies that the population pressure on land resources both in

North-east and West Kano Locations is already too high. It should be noted that a considerable proportion of the inhabitants of Kisumu Municipal area also, at least partly, depend on agricultural land in the Kano Plain, thereby reducing the available land even more. Consequently, agricultural intensification becomes a necessity.

The settlement pattern in the Kano Plain is characterized by a concentration of scattered compounds or homesteads on the higher grounds. Apart from a number of small rural market centres and concentrated residential settlements in the two large-scale irrigation schemes, villages do not exist. The only settlement classified as urban is Ahero Township, with a total population of about 3,000 in 1979. The settlement pattern is, primarily, influenced by the specific physical conditions of the Kano Plain and its frequent floodings.

The compounds, which, according to Andersen (1977), were in the past protected by walls of mud and wood surrounded by a ditch, are presently enclosed by trees, a hedge of euphorbia or sisal plants. The layout of the various living quarters and other structures like kitchens, granaries and latrines was determined by tradition. Originally, the main house, i.e. the house of the first wife, was built opposite the main entrance of the compound. If other houses for additional wives (co-wives) were needed, they were placed on either side of the main house. The male head of the family had a house of his own near the cattle pen, which invariably was situated in the centre of the compound. On reaching puberty, sons would construct their own huts on both sides of the main entrance in such a way that each sons's hut would face the house of his mother. Kitchens and granaries were erected next to the house of each wife. The kitchen entrance would face the house of the wife who used to cook in that particular kitchen. Most structures were constructed from temporary materials: wattle and mud walls plastered with cow dung and thatched roofs. When the owner of a house died, the structure was left to collapse and any usable materials were removed.

The life cycle of a compound was characterized by a period of gradual expansion when the compound head became older and married additional wives. At a later stage, the sons married and built additional structures for their own families. This expansion was usually followed by a period of decline when a number of the younger compound members moved away because the homestead became too crowded, and older members died.

Although the traditional layout may still be observed in the Kano Plain, increasing population density has narrowed the possibilities of building new compounds. Nowadays, compounds are much smaller, as they are frequently sub-divided on the death of the male head. New compounds are increasingly established close to existing ones. Consequently, cultivation in the areas around each homestead becomes a problem. The houses are frequently constructed of modern building materials. Concrete blocks replace wattle and mud in wall construction and thatched roofs are gradually replaced by corrugated iron sheets.

The population census of 1979 showed the average number of persons per family to be 5.5 (Table 2.1). A recent socio-economic survey in West Kano Location indicated an average number of families per compound of 1.8 and a mean family size of 5.4 persons. This results in an average number of persons per compound of 9.7 (Republic of Kenya, National Irrigation Board/Agrar- und Hydrotechnik,1981). The Kisumu District rural housing survey observed similar numbers of inhabitants per compound in North-east Kano and South-east Kano Locations (Sterkenburg et al.,1982).

2.4 Agriculture

Agriculture is the mainstay for the majority of the working population of the Lower Kano Plain. Arable agriculture is mainly focused on production for home consumption. In addition, a number of commercial crops, e.g. sugar cane, rice and cotton are cultivated. Stockraising, also, plays an important role among the originally pastoralist Luo.

Table 2.2
Agricultural Land in the Kano Plain

Location	Total agricult. land (100 ha)	Swamps (100 ha)	Population /km² of agricultural land (1979)	Agric. land available per person (ha) (1979)
N.E.Kano	167	15	249	0.40
S.E.Kano	237	29	155	0.64
W.Kano	94	36	343	0.29
Total	498	80	201	0.49

Table 2.3
Estimates of Cropped Land in the Lower Kano Plain, 1979

Crop	Total Area (ha)		
maize	7,000		
sorghum/millet	1,600		
rice	2,080	(large schemes	: 1,940
		(individual rice growers	: 140
beans	300		
sugar cane	7,800		
cotton	3,000		
other	450		
Total	22,230		
grazing land	20,000		
Total	42,230		

Source : Based on calculations of the gross cropped area by ITAL CONSULT, 1981. Estimated rice area derived from statistics available at the pilot schemes and annual report Ministry of Agriculture.

Table 2.4
Areas under Different Crops, Kisumu District, 1979-1982 (ha)

	1979*	1980	1981	1982
maize	8,495**	11,580	13,400	13,000
sorghum,	2,654	2,805	5,030	10,000
rice***	186	263	302	400
beans	937	1,200	1,920	1,765
cassava	1,200	NA	NA	NA
sw.potatoes	1,212	1,460	1,400	1,170
gr.nuts	1,140	NA	800	931
cotton	5,633	NA	8,000	7,200
sugar cane	NA	NA	30,000	32,000

* 1979 was a drought year
** excluding local maize in Nyakach Division
*** excluding the NIB Pilot Schemes
NA = Not Available

Source : Ministry of Agriculture, 1977, 1979, 1982

The small farmers supplement their subsistence and cash income, to a varying extent, with regular and irregular off-farm economic activities. These are mainly limited to casual labour on neighbouring large-scale sugar plantations, the two large rice irrigation schemes and the farms of individual rice growers. Economic activities in Kisumu Town have further absorbed a substantial number of the working population. However, the Kano Plain and the surrounding areas offer few other possibilities for employment of the expanding population. Consequently, and as already noted, the area is characterized by a continuous out-migration.

Table 2.3 shows an estimate of the gross cropped land in the Lower Kano Plain for 1979. Maize, the local staple food, occupies about one third of the total area under cultivation. Sorghum, and, to a lesser extent, millet are also grown by almost every farming household. The former crop is considered an alternative for maize, especially during dry years. It is relatively easy to grow and does not need a high labour input. However, sorghum gives low yields under the present farm management conditions. Rice is chiefly produced for cash purposes, although it is also used by the growers to supplement their main staple food.

Cotton and sugar cane are the other important cash crops. Sugar cane can be widely cultivated in the Kano Plain. High production and transport costs, low prices and, recently, a lack of handling capacity in the sugar refineries of the Miwani-Muhoroni sugar belt north of the Kano Plain, have discouraged cane production among the small farmers. Small-scale cotton production is widespread among the farmers living in the drier parts of the Kano Plain. Problems with the poor drainage capacity of the soils and the unreliable rainfall pattern, as well as the generally low standards of crop husbandry, however, have resulted in poor yields per ha. The rest of the crops cultivated in the Kano Plain cover relatively small areas and are of limited importance. Mention must be made, however, of the area's potential for vegetable production. Unfortunately, present marketing possibilities are rather limited.

Recent information as to areas under cultivation is not available for the Kano Plain. Table 2.4 shows the hectarage for the major crops between 1977 and 1982 for Kisumu District as a whole. The data underline the overall importance of maize. Although the total area under sorghum is probably somewhat overestimated, it is clear that the farmers of Kisumu District have expanded their sorghum area. This is caused by two factors. First, maize production declined rather dramatically during the agricultural season of 1979-1980 when the long rains largely failed. Sorghum which has a higher drought tolerance, proved to be a suitable alternative. Second, the Kenyan Government has recently established fixed producer prices for sorghum which makes surplus production of this crop economically worthwhile.

No clear upward or downward trends in terms of area cultivated can be distinguished for the other food crops. Year to year variations in the area planted are mainly related to rainfall fluctuations and the incidence of pests and diseases. Rice cultivation, however, proves an exception. With an estimated total of 400 ha in 1982 (probably a serious underestimate of the real planted area), irrigated rice cropping among individual smallholders outside the large irrigation schemes increased by more than 200 percent since 1979. When travelling in the lower parts of the Kano Plain, it is clear that this type of rice cultivation on the edges of swamps and in areas with sufficient water for irrigation is rapidly on the increase.

Assuming that the trends observed in the cropping pattern for Kisumu District also apply to the Lower Kano Plain, it would appear that the area under maize has only slightly increased between 1979 and 1982. Sorghum, in contrast, has probably expanded. When asked, local farmers and Government officials tend to confirm this. The cotton area remained largely the same within the period 1979 to 1982. However, as is the case with all annual crops, future price changes, either positive or negative, may result in a sudden change in the area under cultivation. The area under sugar cane has declined in view of the relatively high production and marketing costs, as well as the limited marketing opportunities. The

amount of grazing land has remained more or less stable. This is mainly because grazing is, at present, the only alternative in those areas which are either too dry for cropping, or are frequently flooded.

2.5 Land Tenure

A complicated system of rights and obligations defined traditional tenure arrangements (Whisson,1964; Ogot,1967). The control over land and access to land rights, whether for grazing or cultivation, were based on the lineage principle. Hereby, land was held and used collectively by the 'Jokakwaro' or lineage group. Access rights to land of the individual family heads were controlled by the council of lineage leaders in each area. The traditional tenure system did not permit the sale of land, although nowadays this has become rather common.

Among the patri-lineal Luo, the land rights passed from the family head to the male decendant(s). In the case of polygamous households, the land rights were equally divided among the 'houses' or the different wives according to the so-called house principle. In turn, the rights were further subdivided among the male offspring. Although these land tenure arrangements still prevail in the Kano Plain, the system has recently shown signs of erosion. The Government, through the Land Acquisition Act, is now able to interfere in existing tenurial rights for the public benefit. Ongoing land registration and consolidation, as well as the establishment of the large-scale irrigation schemes have resulted in considerable changes in land tenure arrangements.

Traditional tenure practices have also been eroding from within during the past fifty years. After the second world war, population pressure mounted. In the Kano Plain, this process was compounded by seasonal inundations which reduced the land area suitable for cropping and livestock activities. The disastrous floods of the early 1960's, and the subsequent rise of Lake Victoria, further aggravated the situation. A considerable number of people were forced to vacate their compounds and

land, and had to resettle on the more elevated parts elsewhere in the plain. (Land rights, however, still cover swamp areas which may cause problems in the case of future land reclamation). These events led to an increased land use without proper fallow periods. Consequently, the fertility and carrying capacity of the land diminished. This, in turn, resulted in increased competition for land.

As a result, the traditional land tenure system had to be adapted and new rules were created by which the lineage leaders could solve land litigation. More important, however, was the (relative) shift of power over land from the lineage group to the compound head who acquired a much greater control over the land cultivated by himself and his immediate kin. The resulting individualization of land tenure led to considerable buying and selling of plots. Grazing rights, however, have tended to remain communal and in case of land disputes, the lineage elders are still called upon for advice, which in most cases is binding.

Excluding the large irrigation schemes with their fixed plot sizes per tenant, Sterkenburg et al. (1982) found an average holding size for the Kano Plain smallholders of 4.2 ha.[(4)]. This figure does not include communal grazing land to which, at least in theory, each farming household has access. Variations in size among the different holdings are considerable. The authors further indicated that 45 percent of a sample of 100 smallholdings in North-east and South-east Kano Locations were below 3.2 ha. Another 36 percent had a size of between 3.2 and 6.4 ha, whereas a little over 18 percent measured more than 6.4 ha.

Jaetzold & Schmidt (1982), also point out considerable differences in farm size in the Lower Kano Plain. Their farm economic survey of 1977 among 30 farm families in North-east and West Kano Locations led to a distinction between small (1.2 ha), medium (2.2 ha) and large farms (3.7 ha).[(5)]. Differences in size of holding can be mainly attributed to local variations in ecological conditions (rainfall and soil type), as well population pressure on land resources. However, ongoing commercialization of agriculture through the introduction of cash crops, as well as land

transactions have also led to a more skewed distribution of land among the small agriculturalists in the Kano Plain.

2.6 Farm Management

As mentioned, the cropping pattern on the smallholdings in Kisumu District as a whole shows a predominance of food crop cultivation for subsistence purposes. The average smallholder farm in the district has 25 percent of its area under cash crops (Sterkenburg et al.,1982). Jaetzold & Schmidt (1982) found similar low percentages of land under cash crops among the farmers they included in their survey. In 1977, small farmers with an average total cropped land of 0.8 ha., planted about 25 percent of their land with commercial crops. Larger farms, i.e. those with an average area under cultivation ranging from 1.4 to 2.2 ha, used about 22 percent of their farm area for cash crop production (see Appendix 2). These findings are confirmed by a recent study among small rice cultivators in the Kore smallholder rice scheme, north-west of Ahero Pilot Scheme. Here, the average farmer cultivated cash crops (excluding rice) on 19 percent of his land (Small Scale Irrigation Workshop,1983).

Appendix 2 also shows two farm models based on an agro-economic survey among 53 smallholder farm families in the Upper Bwande Sublocation, West Kano Location. In contrast to the previous findings, this study reveals a much higher proportion of crop land under commercial crops[6]. Farmers cultivating sugar cane (farm type I), allocated about 49 percent of their total cropped area to cash crops in 1980. On farms without sugar cane (farm type II), however, only 27 percent of the area was reserved for the production of commercial crops, mainly cotton.

A relatively large number of smallholders in the Kano Plain do not cultivate any cash crops. For the rural areas of Kisumu District as a whole, this was one third of the interviewed farmers (Sterkenburg et al.,1982). One must consider, however, that participation in cash crop

cultivation may vary from year to year and will differ among farmers living under different ecological conditions[7].

Smallholders in the Kano Plain know three ways of land preparation: ploughing with animal traction, mechanized ploughing, and traditional tilling with the hoe. The heavy mbuga soils of the Kano Plain are difficult to cultivate and the use of the hoe is, therefore, mainly limited to the vegetable plots. Ploughing with oxen is common among the small farmers who, frequently, pool their oxen and yoke three or four teams together to plough the heavy soils. Compared to mechanized ploughing, however, the efficiency is rather low and the costs per ha of ploughing with tractors, are not much higher[8]. The latter has therefore gained importance during the past few years.

The various crops are mostly sown at random (broadcast method) or planted. Almost all smallholders practice intercropping, sometimes up to four different crops per plot. Although this technique does not lead to a high output per ha for each individual crop, it is a form of spreading risks which is well-adapted to the climatic conditions of the Kano Plain. With the exception of cotton, sugar cane and vegetables, seeds are usually taken from the previous harvest[9]. Rice growers outside the large irrigation schemes, however, frequently obtain their seeds from these schemes.

The amount of external farm inputs, i.e. fertilizer, insecticides and pesticides used on the different crops, is very low. It appears that farmers consider these inputs too costly in view of the risk of frequent crop failures in the Kano Plain. Despite the dense cattle population in the area, manure is not widely used. Manure is usually burnt in the cattle bomas in order to keep off insects (Republic of Kenya, National Irrigation Board/Agrar- und Hydrotechnik, 1981).

Weeding is usually carried out manually and requires a great proportion of the total labour input. In the case of sugar cane, about 27 percent of the total labour input per ha is used for weeding. The relevant

percentages for maize, sorghum and cotton are respectively 39, 40 and 45 (ibid.). Herbicides are used by few smallholders. Like weeding, harvesting is mostly carried out with hand tools. Sorghum and maize are harvested by picking the panicles and cobs. (The stalks are cut at a later stage and are used as fuel for cooking). Rice is harvested with the use of sickles. Sugar cane is normally harvested by labourers employed by the various sugar companies and the cost of cutting the cane is subtracted from the value of the harvested produce.

As a result of the rather poor husbandry practices described above, the difficulties of proper soil preparation and the occurence of dry spells, the yield levels of the various crops grown in the Kano Plain are low. Appendix 3 shows the average yield levels for different crops and crop mixtures and farm budgets for 53 smallholders in West Kano Location. Commercial crops such as sugar cane and cotton contribute very little to the total farm income. Food crops, cultivated for subsistence purposes, are important as 'income in kind'.

Stockraising is an important activity among the originally pastoralist Luo, and the Kano Plain is thought to be overstocked (Jaetzold & Schmidt, 1982). Approximately 63 percent of the farming households surveyed by Sterkenburg et al. (1982) had some cattle. It should be noted that smallholders in the Kano Plain do not keep improved types of cattle, and animal husbandry practices are generally poor. The cattle are usually grazed on communal land during the day, and are kept inside the compound at night. Herding asks but a small proportion of the total family labour input in agricultural activities, because the animals of different farmers are often grazed together. Milking is usually done by the owners themselves. The average number of livestock per farm family is not easy to establish due to the reluctance of the farmers to reveal their true numbers. The farm survey among the earlier mentioned 53 smallholders in West Kano Location, estimated an average number of 4 head of cattle, 2 goats and 1.5 sheep per farmer. It was calculated that income from livestock averaged Ksh 900/- per annum, i.e. over 50 percent of the yearly agricultural income.

It should be noted that the average agricultural income is low and lies below the officially recognized poverty line. However, the above calculations were based on farmgate prices for the various crops. This is not realistic in a situation in which virtually all food crops are produced for home consumption. It would be better to value the output against the prevailing retail/consumer prices, i.e. the price the farm household has to pay when a particular food item has to be purchased. Farm income on the basis of such a calculation would be considerably higher. Nevertheless, most farmers in the Kano Plain have to resort to off-farm economic activities to supplement their income.

Sterkenburg et al. (1982) have calculated the distribution of total household income among 100 farm families in North-east and South-east Kano Locations. Their findings which refer to the annual income per compound, shows that a large group of households (35 percent) earned a very low income per year (below Ksh 2,000/-). Another 17 percent earned between Ksh 2,000/- and 5,000/-, whereas about 18 percent had an annual income ranging from Ksh 5,000/- to 10,000/-. About 30 percent of the surveyed households were considered relatively well off with an annual income of more than Ksh 10,000/-.

2.7 Food Culture[10]

The main staple food of the Luo consists of cereals. Maize, which largely substituted sorghum and millet towards the end of the 19th century, is the major staple. Sorghum, although widely grown, is less important, and millet is consumed in small quantities only. Irrigated, or swamp rice is primarily cultivated for cash purposes, although it is also eaten in addition to the other cereals.

In addition, a variety of roots, tubers and starchy fruits are eaten of which cassave, sweet potatoes and bananas grown in small-sized garden plots near the compound, are the most common types. Irish potatoes are used in several dishes, but this crop is not cultivated in the Kano

Plain. Kidney beans, cow peas and green grams are used as legumes. The former two crops are often grown for their leaves only. These and the leaves of many wild plants which are gathered are used as vegetables. A number of the vegetable dishes are prepared by adding wood ashes or mineral soda in order to soften the texture of the leaves. Onions, peppers and tomatoes are frequently used as seasonings in the various dishes. Fruits such as pawpaw, pineapple, banana, citrus and mango are, generally, eaten in between meals.

The use of livestock produce such as milk, sour milk and butter milk, cream and butter is common. The various types of milk are, usually, consumed as separate drinks, but are also used as ingredients in a number of dishes. Milk is further used in the preparation of tea. Other animal products used in Luo cooking are eggs, fish and meat. Fish plays an important role in the diet and is consumed either fresh or dried. Fishing takes place in Lake Victoria, in the rivers and swamps, as well as in the many ponds scattered throughout the Kano Plain.

Cooking and eating arrangements vary from one compound to the other. Sometimes each of the married women in the compound independently prepares and cooks the food. In other cases, the women co-operate, cook together or in turns, and borrow ingredients from each other's stocks. Eating arrangements are often complex. Some of the compound members eat food from one of the kitchens only, while others share in the meals separately prepared by each of the women. Generally, the head of the compound will eat together with his sons but the eating arrangements of the younger children vary depending on the mutual relations between the women in the compound.

Three meals are cooked during the day: breakfast, lunch and supper. Women with small children may also prepare them a snack in between the major meals. Breakfast is, usually, rather light. Lunch and supper are the main meals. Appendix 7 presents the composition of the dishes which are most common among the Luo.

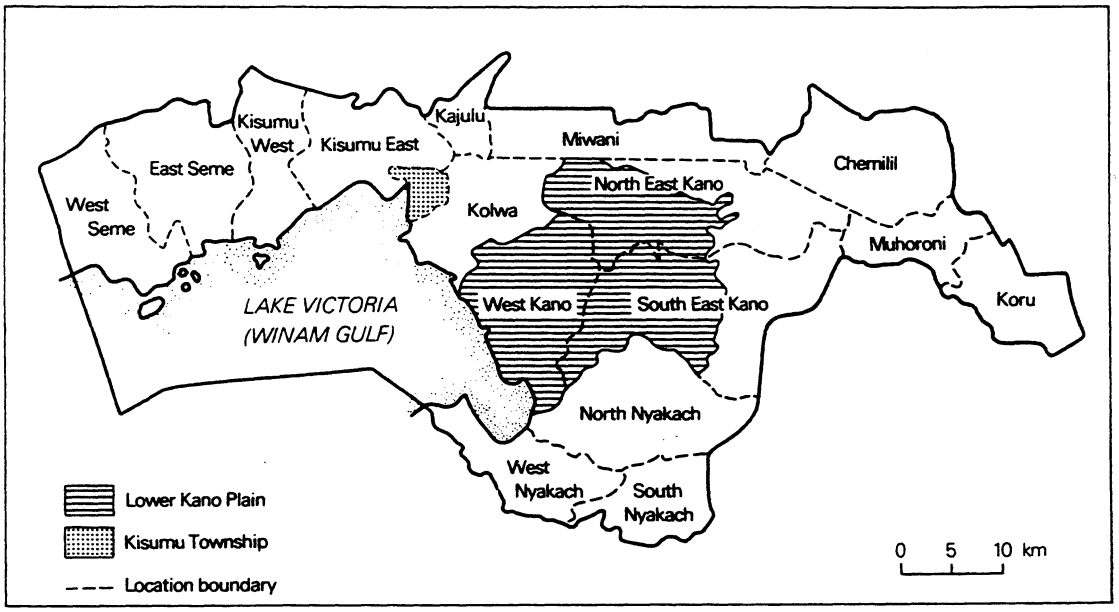
The basic dishes are kuon and nyuka. Both are normally prepared from maize flour. However, other types of flour, including rice flour are used as well. Kuon is a cereal paste with a solid consistency which is prepared by adding flour to boiling water. Kuon is always eaten in combination with a sidedish of a more liquid consistency. These side dishes are usually prepared from vegetables and fish, but sometimes contain meat, chicken, eggs or legumes.

Vegetable sidedishes are prepared in different ways. Depending on the type of vegetable, as well as individual eating preferences, cooking fat, butter, milk and various seasonings may be added. Side-dishes containing fish, meat or chicken, are invariably prepared with cooking fat or butter; milk and seasonings such as tomatoes and onions are optional. Kuon is the most common dish eaten at lunch and supper, and it is often eaten twice a day.

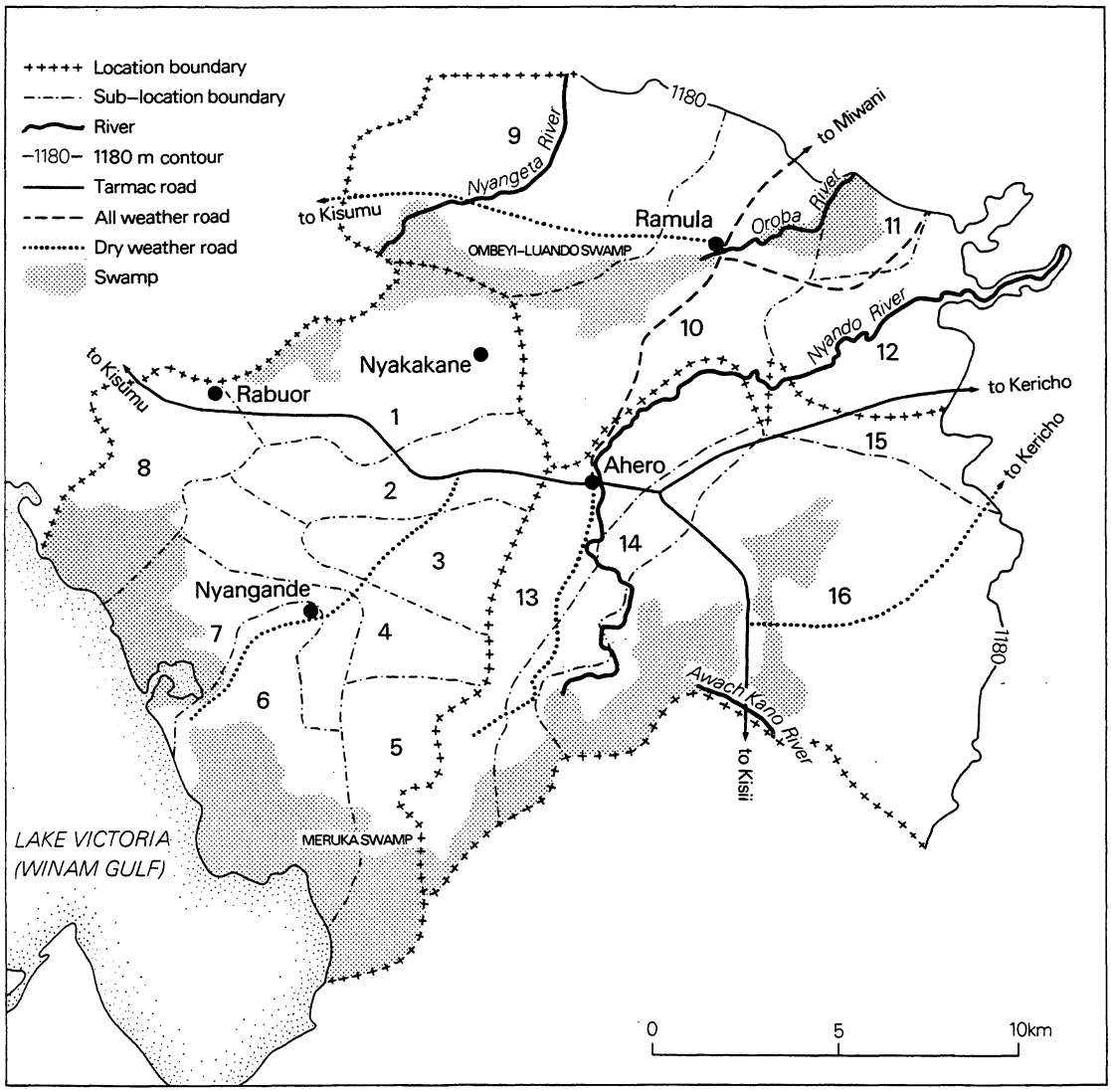
Nyuka is a thin porridge made of flour. Usually, a mixture of several types of cereal flour is used. However, cassava flour may be added as well. Milk, sour milk and sugar are optional ingredients. Nyuka is prepared for breakfast, as a snack in between meals, and sometimes as a drink during lunch or supper.

Other dishes are of a lesser importance. The most common ones are: boiled or fried roots, tubers and starchy fruits, nyoyo which is a mixture of boiled maize and beans, and rice. Each of these dishes may be consumed at either of the three meal sittings. Rice is frequently served as a sidedish.

MAP 1 THE LOCATION OF THE LOWER KANO PLAIN IN KISUMU DISTRICT



MAP 2 ADMINISTRATIVE BOUNDARIES AND PHYSICAL FEATURES OF THE LOWER KANO PLAIN

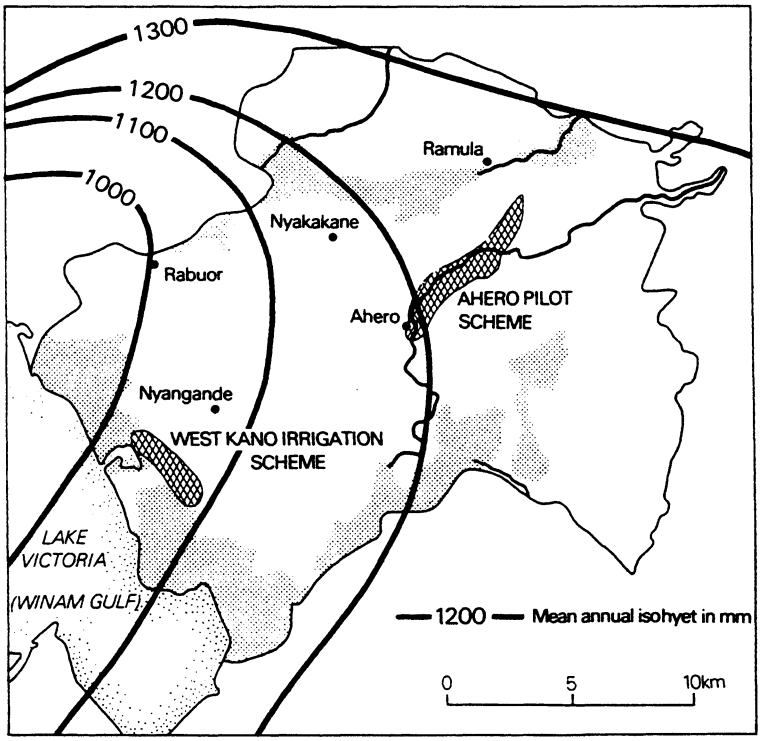


WEST KANO LOCATION
1 Kochieng
2 Kombura
3 Katho
4 Upper–Bwande
5 Lower–Bwande
6 Kadhiambo
7 Kawino
8 Nyamware

NORTH EAST KANO LOCATION
9 Sidho West
10 Kamagaga
11 Kabar
12 Wagaya I

SOUTH EAST KANO LOCATION
13 Kakola
14 Kochogo
15 Wawidhi A
16 Wawidhi B

MAP 3 GENERAL RAINFALL PATTERN IN THE LOWER KANO PLAIN



Source: Republic of Kenya/Nedeco

3. IRRIGATED RICE CULTIVATION

3.1 General

Smallholder farmers in the lowlands along the shores of Lake Victoria spontaneously started irrigated rice cultivation in the 1930's and 1940's. Rice cultivation suffered a serious decline in the 1960's. Severe floods and the subsequent rise of Lake Victoria destroyed a substantial amount of paddy land, both on the shores of the lake and on the edges of the seasonal and permanent swamps.

In the mid 1960's and 1970's, however, irrigated rice cultivation picked up again. The Government, through the National Irrigation Board, initiated two large-irrigation schemes, i.e. Ahero Pilot Scheme and West Kano Pilot Scheme. The two schemes are situated at a distance of 15 km from each other, respectively north and south of the Kisumu-Ahero road (Maps 2-3; pp.42-43). The apparent demonstration effects of both schemes, and stimulation on the part of the Government have encouraged individual smallholder farmers to engage in irrigated rice production and recently, small-scale rice cultivation on an individual basis has gained considerable importance.

A description of the characteristics of the two large schemes follows below. The information presented is largely based on an agro-economic survey carried out among 30 farmers in Ahero, and an equal number in

West Kano during the 1980 cropping season, as well as the schemes' annual reports (Houtman,1981; National Irrigation Board,1982;1983).

3.2 Large Irrigation Schemes.

Ahero Pilot Irrigation Scheme.

The establishment of this scheme, the first of the two, took some three years, and rice production started in 1969. The scheme covers a total area of 1,540 ha of which 840 ha is presently under cultivation. This area is divided among 519 farm households, which cultivate 1.6 ha each. The rice plots have to be farmed according to strict rules and regulations. The farmers are supplied with the necessary inputs and services. The scheme management takes care of land preparation, and supplies fixed quantities of inputs (seed, fertilizer and insecticides). After the farmer has harvested the paddy, the scheme management handles the marketing of the crop. The costs of inputs, land preparation and marketing are subtracted from the farmer's income. Each tenant can retain 10 percent of his total paddy production (i.e. the quantity delivered to the scheme) for home consumption.

Besides cultivating the paddy plots, some 90 percent of all the tenants grow crops on non-scheme land, a small area around the house or larger plots outside the scheme's boundary. The scheme's bunds are also used for growing crops like kale, sweet potatoes and bananas. Initially, the tenants were obliged to live in villages situated within the schemes, with houses laid out in rows on one quarter-acre plots. At a later stage, the scheme's management allowed farmers to take up residence outside the scheme if they preferred so, yet retain their plot in the scheme. Some of the tenants had access to land elsewhere before they were selected as tenants, while others have gained access to land after they settled in the scheme. According to Houtman, the average available land outside the scheme per farmer amounted to 0.7 ha, of which in 1980 (an exceptional dry year) only 50 percent appeared to be cultivated. Large dif-

ferences in availability of non-scheme land, however, exist among the tenants. These differences are primarily related to whether a tenant resides inside or outside the scheme and, in effect, there exist two groups of tenants: resident tenants living and working in the schemes, and non-resident tenants who live outside the schemes.

In the period between 1969 and the end of the 1982/83 cropping season, a total of 30 rice crops were grown. The scheme's management originally aimed at two rice crops per year, i.e. a cropping intensity of 200 percent. However, due to technical problems such as the lack of tractors and the bogging down of heavy machinery, as well as the incidence of pests and diseases caused by continuous cropping, the planned cropping intensity decreased to about 160 percent. The cropping intensity during the 1982/83 season amounted to only 130 percent.

As a result of these problems, the actual incomes of the tenants have stayed behind those initially envisaged. In view of the disadvantages of double cropping, and as a result of the satisfactory yields obtained by single cropping in other N.I.B. irrigation schemes (e.g. Bunyala), there are now plans to introduce a single cropping system in Ahero, whereby the tenants will be allowed to grow other crops on their rice plots, once the paddy is harvested. This measure will hopefully increase the total marketable surplus and may have a positive impact on the household's food consumption.

The average household in Ahero scheme numbers 6.9 residents, with 2.6 adults available for full-time agricultural labour. Households with a higher labour availability usually realize the highest yields (i.e. the category II and III farmers, see note 11). Some 90 percent of the total labour input in agriculture (including hired labour and relatives) is invested in paddy cultivation. The remaining 10 percent is used for the production of other crops on non-scheme land, and for livestock activities.

Labour peaks occur in April, May and July, when transplanting, weeding and harvesting of rice coincide to a large extent with other cropping activities. It is not surprising that the use of external labour (hired labour and relatives) peaks during these periods. On an annual basis, some 40 percent of the total labour input in rice production comes from hired labour, mainly women. Households with a shortage of adult labour hire a considerably larger number of labourers than tenants with larger families. Hired labour is always paid in cash. Relatives assisting during peak periods, usually, receive payment in kind (a share of the harvested paddy) in addition to the food they consume while staying with the tenant. In some cases labour is offered on a reciprocal basis, i.e. the tenant will, in turn, assist his relatives or friends when requested. Regular off-farm activities occur only incidentally among the Ahero tenants. However, they engage frequently in farm labour with other farmers in and outside the scheme.

According to Houtman (1981), the average annual labour input per 1.6 ha of paddy amounts to some 3,000 hours. Large differences in labour input have been recorded for the different categories of farmers. Weeding and harvesting, constitute 26 and 23 percent of the total work respectively, followed by transplanting (18 percent) and land preparation with oxen, i.e. puddling (10 percent). The remainder of the labour input is used in clearing the canals and bunds, nursery work and burning the straw after harvest. The different labour tasks are equally divided among the adults. Women and men account for 51 and 46 percent of the work respectively; children only contribute 3 percent of the labour. However, considerable specialization exists: transplanting, weeding and threshing are mostly done by women, whereas the men take care of clearing the canals and bunds, harvesting, as well as bird scaring.

Apart from paddy, all tenants cultivate other crops as well. Farm families with little labour available, however, tend to cultivate only a small area outside the scheme. Crops grown are cotton (usually interplanted with maize and sorghum) and kale which is produced on the bunds. The latter crop is, to a large extent, used for home consumption. Food crops

are maize, sorghum, sweet potatoes, cow peas and cassava. These crops are mostly grown for subsistence and form the major part of the diet of the farmer and his family.

Livestock is owned by about half of the tenants. Cattle may, officially, not be kept at the scheme, but some farmers keep a number of cattle in sheds and graze them outside the scheme. Oxen are used for levelling the wet paddy fields (puddling) and for ploughing the crop land outside the scheme. Some farmers rent out their oxen to others. Small stock, mainly poultry is owned by virtually every household.

Except for the first year, yield levels in Ahero stayed below expectations. The average paddy yield in 1980 amounted to some 3,750 kg per ha, which was about 25 percent higher than the preceeding years. However, if one takes into account the paddy which was harvested but not delivered to the scheme (i.e. irregular retentions), the real yield level averaged approximately 4,350 kg per ha (Houtman,1981). Of the non-delivered quantity of paddy, 30 percent was used for home consumption; the remainder was sold or given away to relatives. Farmers in the lowest yield bracket tended to retain 23 percent of their paddy harvest. In contrast, the high-yielding category of rice growers retained only 8 percent of their harvest. This difference can be explained in terms of degree of indebtedness to the scheme. The tenants who still have to pay (part of) their debts naturally receive less money for the produce they hand over to the scheme, hence their inclination to sell illegally [12].

In 1980, the average annual farm income was based on 1.5 paddy crops per year and amounted to approximately Ksh 6,250/- of which 26 percent originated from agricultural activities other than rice growing. Income from off-farm activities is insignificant among the Ahero tenants, and in 1980 averaged only Ksh 340/-. These averages, however, obscure significant differences in the annual income of the various categories of farmers. The disparities mainly reflect differences in the ability to produce a high paddy yield. Details on income are presented in Appen-

dix 4. 'Category I' farmers appear to realize an extremely low profit on money invested in rice production. Their total family income, including income from other crops and livestock, as well as money obtained through off-farm activities, amounted to about Ksh 1,700/- which is well below the official poverty line.

West Kano Pilot Scheme.

In 1976, the first paddy was harvested at this scheme, followed a few years later by the first crop of sugar cane. The scheme covers a total area of 3,300 ha of which a little over 880 ha are under cultivation. Each of the 553 tenants is allocated 1.6 ha, equally divided into paddy land and an area for sugar cane production. In terms of management, the West Kano scheme is similar to the Ahero scheme. Farmers also have to adhere to strict farm management regulations, and were initially required to reside on the scheme. Apart from the difference in cropping pattern, the farm-economic situation of the West Kano tenants does not really differ from the one already described for Ahero. Besides cultivating their allocated paddy and sugar cane plots, the West Kano tenants also have non-scheme land at their disposal, 0.6 ha on average. In contrast to the situation at Ahero, each tenant residing at the scheme has a larger homestead plot on which other (food) crops may be cultivated. Like Ahero, large differences in the availability of non-scheme land exist among the different tenants and here also a disctinction can be made between resident and non-resident tenants; the latter usually owning more non-scheme land.

Between 1976 and the end of the 1981/82 cropping season, 12 rice crops were grown. The first two crops had rather high yield levels. Unfortunately, diseases connected with double cropping, such as blast, reduced the initially promising output to some 2,000 kg per ha during later years. Recently, yield levels seem to have improved (National Irrigation Board,1982).

The average West Kano household is slightly larger than the one in Ahero, and consists of 7.2 members of which 2.5 adults are available for full time agricultural labour. About 90 percent of the total labour input including non-family labour was spent on paddy cultivation, compared to a mere 3 percent on sugar cane production. The relatively low labour input for sugar cane is caused by the fact that the scheme's management provides most of the necessary labour.

Non-scheme crops are similar to the ones cultivated by the Ahero tenants and absorb about 7 percent of the labour input. Food crops are mainly grown for subsistence purposes. In 1980, little kale was cultivated since the bunds of the relatively recent West Kano scheme were not yet fully developed. Compared to their Ahero colleagues, the West Kano farmers make less use of hired labour. Of the total labour input in rice cultivation, 29 percent was contributed by hired labour, usually women. Again, households with little labour available relied most on non-family labour. The period April to June is the peak season for the West Kano rice growers. For the non-scheme crops, this period lasts from May to June. During the overlap time between the two periods the largest number of hired labourers is employed. Payment arrangements for hired labour are identical to those in Ahero.

Compared to their Ahero counterparts, the West Kano tenants have fewer cattle. Only 17 percent of the households included in the survey of Houtman (1981) owned livestock; all indicated that they owned poultry. Cattle is kept for dairy purposes and the ploughing of non-scheme land (The levelling of rice plots is carried out mechanically). The tenants at West Kano engage fairly frequently (23 percent) in off-farm employment. In addition, a large number mentioned fishing on Lake Victoria as an important activity. Only 27 percent of Houtman's respondents seemed to be exclusively engaged in farming.

The average paddy yield per ha, based on deliveries to the scheme, amounted to approximately 3,700 kg in 1980. It appeared that about 20 percent of the total harvest had another (illegal) destination. In other

words, the real yield level per ha amounted to some 4,500 kg. Half of the non-delivered quantity of paddy was used for home consumption. Farmers in the lowest yield bracket retained a much higher quantity than their high-yielding colleagues. Again the difference must be explained in terms of the indebtedness of the tenant.

The calculation of the average annual income for the West Kano farmers is complicated because of the long cropping cycle of sugar cane and the occurrence of ratooning. Appendix 5 presents an annual farm budget for the different categories of farmers cultivating 0.8 ha of paddy, and an equal amount of land under sugar cane. 'Category I and II' farmers realized a low profit on investments in rice production. Even when non-scheme agricultural activities are included, their total agricultural income remains below Ksh 2,000/-, so it is not surprising that these farmers look for alternative sources of income. Also, sugar cane does not seem to be a worthwhile source of income. 'Category III' farmers who make Ksh 4,000/- from their paddy production per annum, earn only Ksh 800/- from sugar cane over the total sugar cane crop cycle. However, if one considers the small amount of labour needed in cane production, the returns per hour are still substantial.

The National Irrigation Board has tried to improve the health of the tenants of both the Ahero and West Kano scheme. Attempts have been made to eradicate bilharzia through treatment of the water in the irrigation canals, and a special prevention programme aims to lower the incidence of malaria.

3.3 Individual Rice Growers

Recently, individual smallholders, encouraged by the Government and the relatively high and stable producer prices for paddy, have again started rice plots in the low lying areas of the Kano Plain. The crop is chiefly produced for cash purposes, but growers also use small quantities for home consumption. Table 3.1 presents an overview of the

present smallholder rice irrigation schemes in the Kano Plain. It can be seen that the area under cultivation has increased rather dramatically during recent years. At present, approximately half of the potential area suitable for paddy cultivation is developed. In contrast to the large irrigation schemes, the smallholder schemes were established by the local farmers themselves. The schemes usually have farmers' committees that control the water distribution over the various plots; other farming decisions are left to the individual farmers.

Despite the fact that the Kano Plain is quite suitable for paddy cultivation, there are a number of constraints that hamper the full utilization of potential rice areas. The incidental flooding of the swamp areas causes delay in cropping activities, often destroys rice crops and occasionally the plots as well. Also, seasonal lack of water in some of the rice areas (mostly those situated along the rivers and drains of the large-scale schemes) equally lowers the potential for rice growing. Crop husbandry

Table 3.1
Smallholder Rice Schemes in the Lower Kano Plain

Name	Location	Potential Area (ha)	Actual Area Planted (ha) 1980	1981	1982	1983
Kore*	N.E.Kano	100	40	64	69	66
Alungo**	N.E.Kano	30	5	8	22	22
Aol	N.E.Kano	20	-	8	9	8
Wanjare	N.E.Kano	40	10	18	25	20
Wiswa	N.E.Kano	30	5	8	9	12
Masune/Nyaidho	S.E.Kano	60	20	16	40	40
Awach	S.E.Kano	100	10	20	28	50
Obange	W.Kano	100	40	20	50	54
Nyakakane	W.Kano	80	2	12	40	32
Nyatini	W.Kano	50	2	4	6	16
Bacho	W.Kano	80	1	6	10	14
Total		690	135	184	308	334

* Including Kore 1A, 1B and II
** Cropped area for 1983 not available, assumed to be identical to 1982

Source: Ministry of Agriculture/District Rice Officer, 1981,1982,1983a.

methods seem to be quite adequate. However, external farm inputs, fertilizer and spraying materials, are sparsely used. Under the present conditions, yield levels obtained by the individual rice cultivators average approximately 3,500 kg per ha, and compare rather favourably to the ones realized at the large irrigation schemes where farmers enjoy high levels of input. Average yield estimates of 4,250 kg paddy per ha, based on crop sampling in the Alungo and Kore schemes in 1982, demonstrate the ability of the small individual rice grower to compete with the tenants at the large schemes.

In view of the importance of rice production both for the individual growers in the Kano Plain, and for the national food supply, the Ministry of Agriculture and Livestock Development provides support for the individual rice growers. The Smallholder Rice Rehabilitation Programme (SRRP), financed by the European Economic Community, aims at improving and extending the existing smallholder schemes. In the Lower Kano Plain, the Kore and Awach schemes, respectively in North-east and South-east Kano Location, are presently included in SRRP. Assistance includes the improvement of water supply and water management, the construction of rural access roads and the provision of inputs and marketing facilities.

Little is known about the socio-economic characteristics of the individual rice growers. Information from a socio-economic survey among a limited number of smallholders participating in the Kore scheme, however, does not suggest that these farmers differ much from their counterparts elsewhere in the Kano Plains (Ministry of Agriculture, Provincial Irrigation Unit,1983).

3.4. Conclusion

Irrigated rice production has become an important agricultural activity involving a large number of rural households in the Lower Kano plain. The population is involved in rice cultivation in different ways. A con-

siderable number of households produce rice at the large irrigation schemes, either as resident-tenants or as tenants living outside the schemes. In both schemes many tenants have access to non-irrigated land elsewhere in the Kano plain, although substantial differences exist among tenants in this respect. Some dispose of relatively large plots; others have to rely on their irrigated land within the scheme only. A number of the former group had access to land prior to their selection as tenants. In addition, several tenants managed to acquire outside land after they settled at the schemes. The number of tenants that live outside the schemes can be estimated at 30-50 percent of all tenants. Sterkenburg at al. (1982) provide an estimate of about 30 percent of non-resident tenants in Ahero Irrigation Scheme. Similar estimates for West Kano could not be found in the literature, but during the sampling for the present survey it was found that about 50 percent of the selected tenants were non-residents (see, however, section 4, note 13).

A smaller number of farm families cultivate irrigated plots independently in several small irrigation schemes, scattered throughout the plain. Most of these schemes, were established by the local farmers, who produce rice for the market in addition to rainfed cultivation of maize and sorghum and livestock activities. Irrigated rice cultivation by individual smallholders increased rather dramatically during the late 1970's and early 1980's. Relatively high producer prices for paddy, stimulation on the part of the Government, and demonstration effects from the large irrigation schemes have contributed to this development.

4. METHODOLOGY

4.1 Design: Sample Selection and Composition

The study was designed to represent the three types of existing participation in irrigated rice cultivation. Two study conditions consist of tenants at large irrigation schemes: (a) tenants living in the scheme villages (resident tenants), and (b) tenants living outside the scheme (non-resident tenants). The third category (c) includes individual rice growers involved in small irrigation schemes. For purposes of comparison, a fourth group of (d) farmers not connected with rice production in any of the above ways was also included.

Except for the villages situated inside the large schemes, communities elsewhere in the Kano Plain are usually quite heterogeneous as regards the involvement of the population in rice cultivation. In other words, individual rice growers, households that do not grow rice, and (non-resident) tenants at large schemes may live in the same sub-location. Households were sampled from five geographical locations. Ahero and West Kano Schemes and the three following sub-locations: Kochieng, Kamagaga and Kombura. Kochieng and Kombura are situated in the centre of the Kano Plain, near Nyakakana, and border on each other, Kamagaga is situated on the ridge immediately north of Ahero Scheme (Maps 2-3; pp.42-43).

In the villages in Ahero and West Kano all households were by definition tenants at the respective schemes. In Kochieng a fairly large number of households was involved in rice production at the nearby smallholder scheme. This scheme was established some years ago without significant outside assistance, and is situated on the edge of a swamp. It includes farmers having a single rice plot, as well as others with access to several plots. In Kamagaga sub-location there is a fairly large number of compounds not cultivating rice but there is also quite a number of households with access to the rice plots at Ahero i.e., non-resident tenants at this large scheme. Kombura, finally, is situated at considerable distance from the nearest swamps and the vast majority of the local farmers have no access to land that is suitable for rice production (Table 4.1).

Because of the pronounced tendency of families in the same compound to share economic resources and to have mutual cooking arrangements, the compound was defined as the main sampling unit. In Kochieng, Kombura and Kamagaga, sampling took place on a community basis. Starting at a certain point within a selected geographical area, all adjacent compounds were consecutively included until the desired number was reached. Sample sizes varied slightly depending on local circumstances and statistical considerations. In Kochieng 75 compounds were included and in Kamagaga 96 compounds. In Kombura, a relatively homogeneous community without rice growers, a sample of 50 compounds was considered sufficient.

In Ahero and West Kano, households were selected by means of cluster sampling. In different villages within the scheme, clusters of homesteads were selected. Since each homestead corresponds with one particular rice plot, the clusters included resident as well as non-resident tenants. In West Kano about half the tenants selected in this way proved not to live on the homestead plot. These non-resident tenants were traced with the help of the scheme staff (all were actually located), and resident as well as non-resident tenants were interviewed. In Ahero, only the resident tenants were interviewed and no attempt was made to trace the non-resi-

dent tenants (in this case, a smaller proportion)[13]. A sufficient number of farmers of the latter category had already been sampled in Kamagaga sub-location.

Table 4.1. gives details on the number of compounds sampled in each location, and lists the number of compounds resorting under the four study conditions i.e. the different categories of participation in rice cultivation. A total of 335 compounds was included in the survey. The number of farmers with access to rice plots in the two large irrigation schemes is 147. Of this number, 83 were resident-tenants, and 64 belonged to the category of non-resident tenants. The number of individual rice farmers with one or more plots in small schemes was 54. Finally, 134 households had no access to rice plots and were not directly involved in rice cultivation.

The information collected in respect of the compounds and the compound members is described in section 4.2. The following definition of a compound resident was used: a person who takes one or more meals in the compound on a daily basis. This definition closely follows local usage, and does not necessarily imply that a compound resident also sleeps in his/her compound. Lack of suitable accommodation in combination with traditional rules prescribing that certain persons do not sleep under a common roof, may result in one or more 'residents' regularly or permanently spending the night in a neighbouring compound.

The compounds numbered a total of 995 children, of whom 41 were below 6 months of age. The total child population between the ages of 6 months and 11 years numbered 954, of whom 39 children were absent from the compound during the first visit by the survey team and who were also not present during subsequent re-visits. In the case of 16 children there was serious doubt about the exact age of the child: they were excluded from the analysis. In all, this amounts to 55 missing cases (6 percent). Table 4.2 presents the age distribution of the children between 6 and 47 months; table 4.3 gives the distribution of children in

Table 4.1
Design : Number of Compounds by Study Condition and Location

Location	Survey Period	Non-Rice Growers	Individual Rice Growers	Non-Resident Tenants	Resident Tenants	Total
Ahero	24-30/4	--	--	33*	56	89
West Kano	18-24/3	--	--	31	27	58
Kochieng	30/3-7/4	38	37	--	--	75
Kamagaga	2-17;27/3	52	11	(33)*	--	63 (96)
Kombura	13-18/4	44	6	--	--	50
Total		134	54	64	83	335

* The 33 non-resident tenants at Ahero were all selected from Kamagega location and are listed under Ahero (see text)

Table 4.2
Age Distribution Children under Four Years by Study Condition

	Non-Rice Growers (N=124)	Individual Rice Growers (N=64)	Non-Resident Tenants (N=90)	Resident Tenants (N=76)	Total (N=354)
6-11 months	14%	22%	16%	13%	16%
12-23 months	41%	23%	39%	37%	36%
24-35 months	19%	31%	21%	28%	23%
36-47 months	27%	23%	24%	22%	25%
	100%	100%	100%	100%	100%

Table 4.3
Age Distribution Children Aged Four to Eleven by Study Condition

	Non-Rice Growers (N=226)	Individual Rice Growers (N=102)	Non-Resident Tenants (N=132)	Resident Tenants (N=124)	Total (N=584)
48- 59 months	12%	11%	14%	20%	14%
60- 71 months	11%	12%	15%	15%	13%
72- 83 months	19%	21%	11%	17%	17%
84- 95 months	17%	9%	19%	10%	15%
96-107 months	12%	13%	12%	14%	12%
108-119 months	15%	17%	15%	15%	15%
120-131 months	14%	19%	13%	10%	14%
	100%	100%	100%	100%	100%

the 4-11 years age-bracket. There appear to exist no systematic differences in age composition between the respective study conditions.

All children were in the care of their natural mother with the exception of 29 children who were looked after by either a co-wife or grandmother. In 7 of these cases the mother of the child had died; in the remaining cases the mother was living elsewhere, either because she was staying with her husband, or because of divorce, in which case Luo custom prescribes that the child remains with the father.

4.2 Data Schedule

The focus of the study was on food production, food consumption and nutritional status. General information on the social and economic characteristics of the compounds was also collected. A copy of the questionnaire/record form is attached in Appendix 1.

The major topics in the data schedule covered the following:

- demographic characteristics of compound members, and births and deaths over the period of 24 months prior to the survey;
- housing circumstances and living conditions, including water source and sanitation;
- farm characteristics: acreage, food and cash crop production, livestock and farm equipment;
- the participation in farming activities and off-farm employment of compound members;
- anthropometry and health characteristics of mothers and children;
- nutritional preferences and food consumption.

Agricultural production was assessed by means of interviews on the acreage planted and quantities harvested of various cash crops (rice, sugar cane and cotton) and food crops (cereals, pulses and roots and tubers) during the long and short rain seasons of 1983/1984. In practice very few farmers did plant food crops during the short rains and the quantities harvested were negligible. Information was also collected on

the acreage planted at the time of the survey, i.e. the long rains of 1984.

Food consumption was assessed by two recall methods: (a) a recall of all food prepared in the compound during the day prior to the interview, and (b) a 24-hour recall of the quantities of food consumed by individual children, aged 6-47 months, also for the previous day. The recall of food preparation was collected for each kitchen in the compound. The women concerned were questioned about all the foods and drinks they had prepared in the course of the previous day. Starting with the first dish of the day, all subsequent dishes (drinks and snacks) were covered. The women were further asked to demonstrate the cooking procedures, and to indicate the volumes of the different ingredients used, as well as the total volume of the dish as finally prepared.

For measuring purposes, three measuring containers were provided: a nine litre bucket with marks per litre, and two smaller jars: one of 1,000 cc with 50 cc marks, and another of 500 cc with 50 cc marks. The volume of each ingredient (raw) in each dish was estimated with the help of the actual utensils used during preparation (spoons, containers, pots and pans) and then measured with the standard containers. If available, the ingredient itself was used during this exercise. Otherwise flour, dry maize or rice (in the case of solid ingredients) or water (in the case of liquid ingredients) were used to estimate the various volumes. To calculate the actual amounts consumed, all volumes of dishes were converted into corresponding weights with the help of a conversion table (Appendix 6A). For certain food items, that are served piecemeal, such as cassava, bread, meat, fish and fruits, respondents estimated the respective sizes of the pieces consumed and these, in turn, were converted in standard weights (see Appendix 6B). These conversion tables had been prepared by the nutritionist on the basis of observations made before the start of the survey. In case of left-overs from meals, the volume of food that had not been eaten was separately estimated and subtracted. For each ingredient it was further noted whether it was home produced or not.

For each of the dishes it was recorded who had shared in its consumption.

Individual dietary recalls were collected for all young children, aged 6-47 months. The information was provided by the person who had supervised the feeding of the child, usually the mother. She was asked about the foods and drinks consumed by the child in the course of the previous day and night, including the number of times the child was breastfed. She was requested to demonstrate the portions consumed with the help of the cup or plate which had been used by the child. The volumes of the different dishes were estimated with procedures similar to those used for the food preparation and these volumes subsequently converted into the corresponding weights (The conversion factors, volumes-weights, are given in Appendix 7A). Next, the weight of each ingredient was estimated with the help of standard recipes. The standard recipes used for this purpose had been collected before the survey, and were later checked against the recalls of food preparation collected for the compounds. These recipes are listed in Appendix 7B. For food-items served piecemeal the weight conversion factors already listed in Appendix 6B were used.

Anthropometry was recorded by the senior research staff and included the measurements commonly used in nutrition studies: weight, height and mid-upper arm circumference. These measurements were collected for all children aged between 6 months and 11 years, as well as the mothers of these children[14].

The children under the age of two years were weighed using a SALTER 235 scale (max. 25 kg with an accuracy of 100 grs). The weighing of these children was done with a pair of 'trousers' with a harness for support. The weights of older children and adult women were measured with a TERRAILLON digital scale (max 135 kg with an accuracy of 200 grs). All persons were weighed without footwear. To compensate for the (light) clothing usually worn, the weights of the children under 5 years were corrected by subtracting 150 grs; those of children over 5 years

by 350 grs; and those of adult women by 550 grs. The accuracy of the weighing scales was regularly checked against standard weights.

The height of children under two years was measured with a portable length board with a fixed headrest and a moveable footrest. The children were measured in supine position. Older children and adult women were measured standing straight with their backs against a portable pole with a sliding headrest.

Mid-upper arm circumference of children and women was measured with an ordinary household measuring tape of reinforced cotton.

For the older children and adult women age was calculated in years. For the children under four years, ages were calculated in months and for these children the reported birthdates, whenever possible, were checked against birth certificates or other personal records.

The present study did not collect comprehensive health information, but was limited to a few selected health aspects. Mothers were requested to report the number of days the child had been ill during the two-week period prior to the interview. Major symptoms as well as the type and the result of treatment were also registered. The incidence of diarrhoea and vomiting during the day before the interview were separately recorded. It must be emphasized that, strictly speaking, these data do not present actual morbidity but rather the incidence of disease among children as perceived by the mothers.

4.3 Survey Procedures

Preparations for the fieldwork started in November 1983. The study was introduced to the various local authorities, the five research locations were selected, and general background information on the region was collected (Kliest,1984). A list of Dholuo food names was compiled, and

general information on dietary practices was also collected (Veenstra, 1985).

Enumerators were selected with the help of the Kisumu Office of the Central Bureau of Statistics. All enumerators eventually selected were young women between the ages of 18 and 25 years, who had completed at least 4 years of secondary education ('O' level). Training of enumerators took place from the end of January till late February 1984 and covered the necessary aspects of interviewing, recording and coding. Special attention was given to the recording of food preparation and the two quantitative recalls.

Trial interviews and training were conducted at Ahero Health Centre and Ahero Family Life Training Centre as well as at the homes of the trainees. The final interview schedule was developed concurrently with the training of enumerators. During the training period, recipes of all common dishes were collected (Appendix 7). Once the survey had started repeated observations on food preparation were made in a number of selected households in Kamagaga and West Kano.

The actual survey covered the period March and April 1984, i.e. the season of the long rains. This is, usually, the time when food stocks are at their lowest level, and when nutrition problems are most manifest. It should be noted that food intakes at this time of the year most likely represent an underestimate of usual intake levels. Between the survey period and the previous harvest a period of 8-9 months had elapsed. With respect to rainfed crops, the last (long rain) harvest had been a near failure and a large number of farmers (40 percent) reported zero harvests. As a result, food stocks may have been abnormally depressed. Since irrigated agriculture is less dependent on rainfall, the farming households with access to irrigated plots were in a different situation. Moreover, in many cases they had harvested their rice crop only three to four months before the date of the survey.

To make appointments for the interviews, compounds were visited the day before the planned home-visit. All interviews were conducted in Dholuo. Completed interview schedules were checked on location by senior staff. In order to complete missing data, compounds were revisited. Upon completion of the interview, a tin of cooking fat or a package of maize flour was given to the respondent.

4.4 Data Analysis and Presentation

Chapter 5 presents the information on the social-economic characteristics of the surveyed population. Chapter 6 contains information on food consumption, and nutritional status and health are discussed in chapter 7. The findings are usually presented for each of the four study conditions. Whenever relevant, data are aggregated for the total population surveyed.

The results of the food preparation recall and the dietary recall for the children aged 6-47 months, are presented in two ways. Absolute figures are reported for: energy, protein, calcium, iron, thiamine (vitamin B1), riboflavine (vitaming B2), and absorbic acid (vitamin C). The food table by Platt (1962) was used to calculate the energy and nutrient content of the foods. In addition to these figures, the intake levels of young children are also presented as intake per kilogram bodyweight and compared with the levels recommended by the FAO/WHO (1974).

For children still on the breast the number of times that the child had been breastfed was also recorded. The actual amounts of breastmilk consumded, however, were not measured. Instead these quantities were estimated, using figures for Kamba children reported by Van Steenbergen et al. (1984).

Estimates of energy and protein intake per compound are expressed as intakes per consumption unit. The number of consumption units in a compound equals the number of adults increased with the number of

children converted into adult equivalents, using conversion factors based on the FAO/WHO (1974) recommended energy intakes for different age groups.[15] For instance, the number of consumption units for a compound comprising one adult and two children under five years, is 2.0 (1.0 + 0.5 + 0.5). The total energy and protein content of all the food consumed in the compound was subsequently divided by the number of consumption units, resulting in the average intake per consumption unit. This procedure is similar to the one described by Onchere (1984).[16]

The anthropometric measurements were expressed in terms of the standard values of a reference population. Height is expressed as height-for-age: the percentage of the corresponding median height of children in the same age category in the reference population. Height-for-age values of 90 percent or less are generally regarded as evidence of severe stunting, indicating that the child has failed to grow satisfactorily during lengthy periods in the past. Therefore height-for-age is commonly regarded as an indicator of nutritional history.

Weight-for-height expresses the weight of a child as a percentage of the median weight of children of similar height in the reference population. Weight-for-height values below 80 percent are generally regarded as evidence of severe wasting, indicating acute malnutrition. A percentage between 80 and 90 is often regarded as marginal wasting. Weight-for-height is commonly taken as an indicator of present nutritional condition.

The weight of the child can also be expressed in terms of weight-for-age. This indicator is often used as a 'shortcut measure' because it reflects both previous growth and present nutritional conditions, and is used for a broad classification of malnutrition. Children with less than 60 percent of the standard weight for their age are generally considered to be severely malnourished, those with weight-for-age between 60 and 80 percent are generally regarded as malnourished.

The figure for mid-upper arm circumference (mac) is usually expressed in mac-for-age. This measure reflects the degree of wasting and is used in the present study as a check on the weight-for-height data.

For the calculation of the respective height-for-age, weight-for-height and weight-for-age indices the WHO reference population was used (WHO, 1983). For mac-for-age, the tables by Jelliffe (1966) were used.

5. SOCIO-ECONOMIC CONDITIONS

5.1 Compound Characteristics

Table 5.1 presents the average number of residents and houses per compound, as well as the mean number of occupants per house for the different study conditions. The average number of residents per compound amounts to 8.3. The resident tenants at the large irrigation schemes, on average, have a much smaller number of residents per compound compared to the other groups. This indicates that there are relatively many small nuclear families in this particular group.

The average number of houses per compound does not show major differences among the various study conditions, except for the resident tenants at the large schemes. The relatively low number of houses per compound among this group can be explained by the limited possibilities of constructing residential structures in addition to the main house originally provided by the scheme management. The number of houses in a compound is generally closely related to the life cycle of the family and reflects family composition as well as economic conditions. Compounds with polygamous or extended families, for example, require more houses and the N.I.B. tenants residing outside the schemes have much greater freedom in this respect.

Table 5.1
Compound Characteristics

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Average number of :					
Residents/compound	7.9	8.8	10.3	7.3	8.3
Houses/compound	2.8	2.9	3.1	1.8	2.6
Occupants/house	2.8	3.0	3.3	4.1	3.2

Table 5.2
Age Distribution of Resident Population

	Non-Rice Growers (N=1057)	Individual Rice Growers (N=477)	Non-Resident Tenants (N=660)	Resident Tenants (N=602)	Total (N=2796)
Children (0-47months)	14%	15%	16%	15%	15%
Children (4-10yrs)	22%	23%	21%	22%	22%
Children (11-16yrs)	18%	19%	17%	15%	17%
Adults (17yrs and over)	46%	43%	47%	47%	46%
	100%	100%	100%	100%	100%

Table 5.3.
Average Number of Absent Compound Members

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Schooling	0.7	0.7	0.7	0.3	0.6
Employed	0.8	0.8	0.6	0.1	0.6
Total	1.5	1.5	1.3	0.4	1.2

The age distribution of the compound residents is rather uniform. On average, about 46 percent of the resident population consists of adults, i.e. persons of 17 years and older. The child population is also uniformly distributed over the various age categories: 15 percent in the 0-47 months category; 22 percent in the age bracket 4-10 years old; 17 percent aged between 11 and 16 years (Table 5.2).

Compound membership entails more than mere residence in a particular compound. In general a man who has not yet started his own household elsewhere, or a woman who has not yet married, are considered members of the compound they are related to by birth. This is invariably the compound of the father, as kinship among the Luo follows patrilineal reckoning, and people usually maintain close social and economic links with the paternal household. There are two categories of non-residents. The first are the school-age children who are enrolled at boarding schools or live with relatives closer to school. These children usually return home during the school holidays and depend on the compound for their livelihood. The second group consists mainly of persons who are employed elsewhere, but who contribute to the compound economy, and either frequently or infrequently return for shorter or longer periods (Table 5.3). The number of absent compound members averages 1.2 for the entire survey population, of which about half are employed.

5.2 Housing and Living Conditions

In the Kano Plain, the traditional round houses with thatched roofs are gradually being replaced by 'modern' types of housing. Nowadays, new houses are rectangular and have corrugated roofs. All compounds have one residential structure which is regarded as the main house. In smaller compounds, this may be the only residential structure. In larger compounds the main house is the residence of the first wife of the head of the compound, and it is usually the largest building present. The type and quality of the building materials of the main house are an important indicator of material wealth.

Table 5.4
Housing Characteristics

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Percentage of main houses with :					
Roof : metal sheet	48%	28%	69%	86%	58%
Walls : cement/blocks	6%	4%	11%	24%	11%
Floors : cement	8%	6%	13%	8%	9%

Table 5.5
Living Conditions

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Average number of:					
== Rooms/house	1.9	1.8	2.0	2.3	2.0
== Occupants/room	1.5	1.7	1.7	1.8	1.6
Percentage of compounds with :					
-- Latrine	72%	54%	94%	92%	78%
== Improved kitchen	6%	2%	3%	5%	4%

Table 5.6
Drinking Water
(Percentage Households with Improved Source* of Drinking Water)

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Dry Season	38%	39%	53%	35%	40%
Wet Season	32%	26%	52%	41%	37%

* Improved Water Source : tank; piped water; borehole; or well with protection against contamination

In nearly 60 percent of the compounds surveyed, the main house had a corrugated iron roof. Walls plastered with cement, or constructed of concrete blocks, and concrete floors were less common (Table 5.4). The quality of the houses in the large irrigation schemes compares favourably to that in the other study conditions because the scheme management provides standard houses with a metal roof. In Ahero, all houses initially provided for the tenants were constructed of cement blocks with a corrugated iron roof. The quality of housing outside the N.I.B. schemes depends on the amount of money the owners are able and willing to spend, and it should be noted that the houses of individual rice growers are seldom constructed with improved building materials. Most probably this is because this group resides in the vicinity of the swamps and these areas are regularly flooded - hence an understandable reluctance to invest money in improved housing.

Besides the quality of the building materials, housing conditions are also determined by the number of rooms per house, the average number of occupants per room and sanitation facilities (Table 5.5). Generally, the houses are small: an average of two rooms with a mean occupancy rate of 1.6 persons[17]. No major differences were observed between the study groups in this respect except for a larger number of rooms per house in the large schemes, which reflects the standard number of four rooms in the houses provided in West Kano. Nearly all the houses of N.I.B.-tenants have a latrine and there is no difference in this respect between tenants who reside at the schemes and those living elsewhere. A smaller proportion of the households in the two remaining groups have a latrine, and this is especially so at the compounds of individual rice growers.

Only 40 percent of all compounds surveyed had access to improved sources of drinking water: a (partly) protected well, borehole, communal tap, or roof catchment with storage tank. It should be noted, however, that the source of drinking water may differ with the seasons (Table 5.6). This is because some water sources run dry at certain times of the year (e.g. the individual storage tanks at West Kano) and because, on the other hand, unimproved water sources that can be used at no cost

Table 5.7
Cash Crops
(Average area planted with the respective crops (acres))

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Cotton*	0.1	<0.1	0.1	<0.1	0.1
Sugar Cane**	0.5	0.2	0.5	0.7	0.5
Rice***	--	0.8	3.4	3.3	--

* Planted during long and short rains of 1983 (acreages combined)
** Acreage under sugar cane at the time of the survey
*** Acreage harvested during past 12 months (In case of more than one harvest, acreages combined)

Table 5.8
Rainfed Crops

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Average area under cereals and legumes (acres):					
1983 : Long Rains	2.2	2.5	1.9	1.1	1.9
1984 : Long Rains	2.1	2.2	1.9	1.1	1.8
Average quantity harvested after Long Rains, 1983 (bags):					
Maize	1.9	1.8	1.4	0.7	1.5
Sorghum	2.3	1.7	1.5	0.8	1.7
Average duration of stocks after Long Rains Harvest, 1983 (days)					
Maize	59	51	63	34	52
Sorghum	61	53	75	37	57

are not available all year either. Overall, the N.I.B. tenants residing outside the schemes more often have improved water sources at their disposal. It may further be noted that among the individual rice growers and the non-rice growers the use of improved water sources decreases during the wet season.

5.3. Resource Base

The main resources of smallholders in the Kano Plain are: crop cultivation, livestock rearing and income from migrant labour. Indicators for these different aspects are listed in tables 5.3, 5.7, 5.8 & 5.9.

The average area under various cash crops per compound is shown in Table 5.7. The area planted with cotton is generally small, this crop is mainly cultivated in the higher parts of the Kano Plain. Suger cane is much more prominent especially among the farming households that do not grow rice. The N.I.B tenants in West Kano also grow this cash crop. As described earlier the tenants at the N.I.B. schemes each have 4-acre rice plots (Ahero Scheme) or 2-acre rice plots (West Kano Scheme). Among the individual rice growers the area under rice was less than one acre.

Table 5.8. shows the average acreage under rainfed cereals and legumes, the main staple crops. The areas planted during the 1984 long rains (the time of the survey), do not differ from the areas reported for the preceeding year. It should be noted that on both occasions the rains largely failed. Generally, the area planted with the rainfed staple crops is rather small. This applies in particular to the resident tenants at the large schemes and is related to a scarcity of farm-land outside the schemes available to these farmers. For the three remaining study groups the average area per compound under cereals and legumes is roughly the same 2-2.5 acres, although the individual rice growers tend to have slightly more land under rainfed crops.

Table 5.9
Animal Husbandry

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Percentage of compounds with:					
== Cattle Pen	38%	41%	31%	8%	30%
== Goat Shed	24%	28%	25%	12%	22%
== Ox-Plough	21%	35%	17%	4%	18%
sometimes selling:					
== Milk	13%	17%	8%	0%	9%
== Chicken	50%	63%	50%	49%	52%

Table 5.10
Paddy Production (1983/1984)
(bags)

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Quantity harvested*	--	12.4	62.5	63.9	--
Yields/acre*	--	15.5	18.4	19.4	--
Paddy retained for home consumption	--	3.1	6.3	3.0	--

* Quantity harvested during past 12 months (In case of more than one harvest, harvests and acreages were summed)

Table 5.11
Estimates of Cereal Availability (Home Production)
(Expressed in number of consumption days/consumption unit)

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Maize & Sorghum	80	58	42	32	57
Rice	--	41	69	46	31
Total	80	98	111	78	88

Livestock and livestock produce still play an important role in the economy of farming families in the Kano Plain. As noted in section 2.6., Jaetzold & Schmidt (1982) estimated that income from livestock averaged about 50 percent of the yearly agricultural income. Since it is rather difficult to obtain accurate data on the exact number of livestock - in particular the number of cattle - during a single visit survey, only a cursory assessment of animal husbandry was included in the schedule. For this purpose information was collected regarding the presence of a cattlepen or goat shed, the presence of an ox-plough and the reported sale of milk or chickens. Table 5.9 summarizes this information. It appears that livestock activities are more important among the individual rice growers than among the other study groups. The resident tenants at the large schemes are least involved in livestock keeping which is as expected because these farmers are not allowed to keep cattle within the scheme premises.

Finally, many compounds draw an income from migrant labour. The average number of migrant workers per compound, as mentioned, amounted to 0.6. This figure, however, conceals an important difference between the category of resident tenants and the other groups. The number of employed migrant workers among the former group is very low, and this will have important consequences for the inflow of remittances (Table 5.3).

In sum, there are major differences with respect to the resource base of the four groups. Particularly, the resident tenants appear to have access to few economic resources other than the production of rice (and sugar cane in the case of West Kano). The three other groups, in particular the individual rice growers and the non-resident tenants have access to more diversified resources.

5.4. Agricultural Production & Food Availability

Table 5.10 lists the number of bags of paddy that were reportedly harvested. The number of bags harvested by the individual rice growers averaged 12 per compound. This shows the limited importance that rice cultivation has for these farmers compared to the tenants in Ahero and West Kano who harvested an average of 64 bags.[18] Among the individual growers rice production serves as an important source of cash income, and three quarters of the amount harvested is marketed and the remainder used for home-consumption. The tenants at the large schemes delivered 70 percent (non-resident) and 86 percent (resident tenants) of their harvest to the scheme management, but this does not mean that all of the remainder is used for home consumption. Usually, part of the remainder is paid out in kind in return for agricultural labour and part of it is sold privately in the local markets. On the basis of Houtman's (1981) findings it was assumed that one-third of the quantity of paddy retained was ultimately used for home-consumption. Table 5.10 lists the resulting estimates of the amounts of paddy retained for home consumption.

Table 5.8 lists the number of bags of maize and sorghum harvested in 1983. As can be expected the resident, but also the non-resident, tenants at the large schemes, harvested smaller quantities of food crops than the two other groups. Because of the disappointing harvest of 1983, very little maize and sorghum was marketed by farmers. Those farmers who did sell maize or sorghum, reportedly sold only very small quantities, mainly to cover immediate cash needs.

Respondents were also requested to indicate the period of time the maize and sorghum stocks of the 1983 harvest had lasted. The data indicated very low stock levels which were barely sufficient to cover a period of two months after harvest time. Maize and sorghum stocks were depleted particularly early among the resident tenants at the large schemes, indicating a greater dependence on rice and on cash among these farmers. The non-resident living outside the schemes appear to be in

- relatively- more favourable circumstances (Table 5.8).

On the basis of the quantities of maize and sorghum and rice retained for home consumption separate estimates were calculated of the number of days that these cereals could feed the compound residents (Table 5.11). For these calculations it was assumed that 2600 kcal are required per consumption unit daily, and that 80 percent of the daily energy intake (i.e. 2000 kcal) are provided by cereals, as was shown by the food consumption data presented later on. Taking into account estimated processing losses, one bag of maize or sorghum would be sufficient to feed one consumption unit for 135 days and one bag of paddy would be sufficient for 99 days.

The figures point at a relatively low "food availability" i.e. 57 days on average, for maize and sorghum, the main staple foods[19]. This is especially the case among the resident tenants, with an average of only 32 days. Farmers who did not grow rice succeeded in securing the largest amount of maize and sorghum. However, their total maize and sorghum output in 1983 covered only 80 days of consumption. The quantity of rice available for home consumption is highest among the non-resident tenants covering about 70 days. Corresponding figures for the individual rice growers and resident tenants were 40 and 45 days, respectively. The average period of consumption covered by all home produced cereals (maize, sorghum and rice) appeared to be less than 3 months. However, the group of non-resident tenants were able to match their consumption needs for a period of almost 4 months. Both the resident tenants and non-rice growers on the other hand, could cover only 80 days, i.e. a period of 2.5 months.

Apart from these important differences in food availability, it is clear that all groups have to depend on purchased foods to cover their consumption needs for the larger part of the year. Thus, cash income, either from farm or off-farm activities becomes of paramount importance for the provision of food. And in this respect the resident tenants at

Table 5.12
Compound Food Consumption
(Average Intake of Protein (grs) and Energy (kcal) per Consumption Unit (CU))

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
(Average number of CU's per Compound)	*(6.9)*	*(7.7)*	*(9.0)*	*(6.3)*	*(7.3)*
Grs Protein/CU	84	95	94	84	88
Kcal/CU	2592	2767	2681	2494	2613
Contribution (%) of home-produced foods to Energy Intake	20%	19%	24%	21%	21%
Contribution (%) of rice to Energy Intake	5%	5%	6%	13%	7%

*FAO/WHO Recommendations; Energy : 2600 kcal/Consumption Unit
Protein : 41 grs/Consumption Unit

Table 5.13
Distribution of Energy Intake per Consumption Unit
(Compound Estimate)

	Non-Rice Growers (N=134)	Individual Rice Growers (N=54)	Non-Resident Tenants (N=64)	Resident Tenants (N=83)	Total (N=335)
Percentage of Recommended* Energy Intake :					
100 and over	44%	54%	52%	37%	45%
80.0-99.9	15%	11%	23%	17%	16%
60.0-79.9	21%	22%	3%	21%	18%
59.9 and below	21%	13%	23%	26%	21%

* See Table 5.12

the large schemes seem to be in a relatively disadvantageous position because of their limited resources, having no livestock and very few employed non-residents. They are followed next, by the group of farmers not involved in rice cultivation.

5.5 Food Consumption

The final section of this chapter gives an overall estimate of energy and protein intake levels per compound. These estimates are based on a recall of the total quantities of foods prepared in the compound during the previous 24 hours and they are presented as average quantities prepared per consumption unit. (More detailed information on individual food intake of young children is presented in the next chapter).

Table 5.12 shows that, in general, the average amounts of energy per consumption unit do not compare unfavourably to the figure of 2600 kcal recommended by the FAO/WHO. This is despite the fact that the data were collected during the months when food stocks in the Kano Plain are generally low, while the recent 1983 harvest, moreover, had largely failed, probably resulting in even lower food stocks than usual at this time of the year. The lowest energy and protein intake levels are realized by the resident tenants at the large irrigation schemes. The highest figures, in contrast, are reached by the individual rice growers and the non-resident tenants. The proportion of energy derived from home produced foods, i.e. all products from arable farming, livestock activities, and fishing, is very low among all groups. This proportion ranges from a mere 19 percent among the individual rice growers to 24 percent among the non-resident tenants at the schemes. Comparatively, rice contributes most to the energy consumption of the resident tenants at the N.I.B. schemes.

The above-mentioned averages, however, conceal large differences among individual compounds and Table 5.13 provides insight into the degree of variation. About half the compounds in the group of non-resident N.I.B.

tenants as well as the group of individual rice growers realized an energy level per consumption unit of less than 2600 kcal. The distribution of intake levels, moreover, is skewed. The proportion of compounds that realized less than 80 percent of the FAO/WHO norm is 26 percent among the non-resident tenants, and 35 percent among the individual rice growers. The farmers that do not grow rice and the resident-tenants at the schemes appear to be in an even less favourable position. A much smaller proportion of compounds in these groups reached the recommended energy level, while the percentage of compounds falling below 80 percent of the norm is high (more than 40 percent), in these two groups, in particular among the resident tenants at the N.I.B. schemes.

Finally, it must be pointed out that the above estimates pertain to compounds and disregard possible differences in food intake within the compound, i.e. between members of the compound. Consequently, the possibility exists that individual energy and protein intakes vary even more.

6. FOOD INTAKE OF YOUNG CHILDREN

This chapter presents data on the food intake of children between 6 months and 4 years of age. The focus is on the food intake from the period of weaning to the time children have been fully introduced to the adult diet. Sections 6.1 to 6.3 present findings for the surveyed child population as a whole. In sections 6.4 detailed findings for the different study conditions are presented.

The age period under four years is characterized by important changes in child nutrition. Infants are gradually introduced to foods other than breastmilk. Depending on the duration of breastfeeding this weaning process may extend up to the age of two years, sometimes even longer. Subsequently, a second process follows: the gradual change of weaning foods to the adult diet. The latter may imply major dietary changes or merely consist of a relative shift in the frequency of consumption of certain foods or dishes. For purposes of the present study the child population was divided into five sub-groups according to age and breast-feeding status.

The first group includes all infants aged 6 to 12 months. Nearly all these children (90 percent) are still breastfed. The next group includes all breastfed children older than 12 months (12-23 months (N=83); 24-35 months(N=14)). The remaining children had all been taken from the breast and were divided into three age groups: one-year-olds (12-23

Table 6.1
Composition of Age Groups (Children aged 6-47 months)

Group	N	Breast-feeding yes	Breast-feeding no	Age Range (months)	Average Age (months)
Infants	52	46	6	6-11	8.8
BF 12+	97	97	--	12-35	17.7
1yr	38	--	38	12-23	19.9
2yr	66	--	66	24-35	28.7
3yr	84	2	82	36-47	40.7

Table 6.2
Meal Consumption
(Percentage of children eating the respective meals)*

	Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
Breakfast	100%	100%	100%	100%	96%
Lunch	98%	99%	100%	97%	97%
Dinner	94%	95%	97%	95%	94%
Snacks**	190%	124%	100%	65%	38%

* Breastfeeding not included.
** Figures may exceed 100% because each snack was counted separately.

Table 6.3
Average Intake of Energy and Nutrients.

		Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
Energy	(kcal)	358	508	755	838	811
	(mJ)	1.51	2.14	3.17	3.52	3.41
Protein	(grs)	8.8	14.1	20.2	23.9	25.3
Calcium	(mg)	136	201	317	437	397
Iron	(mg)	1.8	3.2	5.3	5.9	6.6
Thiamine	(mg)	0.09	0.13	0.19	0.24	0.26
Riboflavine	(mg)	0.16	0.21	0.33	0.36	0.33
Ascorbic Acid	(mg)	4.2	4.0	10.6	12.3	7.9

months), two-year-olds (24-35 months), and three-year-olds (36-47 months)[20]. For details see table 6.1.

Food intake was estimated with the 24-hour recall method. This method makes no allowance for the consumption of breastmilk and, consequently, the estimated food intake of the two groups of breastfed children is incomplete. The data for these children are nevertheless presented to illustrate the development and extent of supplementary feeding.

6.1 Meals and Dishes

Generally, children eat three meals a day. A fairly large number of children eat additional snacks in between meals. Table 6.2 shows the percentage of children taking the meals and it is evident that only a small number of children did not take three meals a day. In some cases this must have been because of lack of appetite due to illness, but in other cases mothers did not have enough food to prepare three meals. In the latter cases, it was usually the evening meal that was not prepared.

The total energy and protein intake of the children in the different age groups are presented in Figures 6.1 and 6.2. The figures also show the contribution of the different meals to total intake. Energy intake, at first, increases with age but appears to remain stable among the two- and three-year-olds. Among the younger children 80 percent of energy intake is provided by the three main meals. Snacks contribute another 20 percent. Once children grow older, the contribution of snacks decreases and lunch and supper provide a larger share of daily energy intake.

Levels of protein intake are lowest among the infants and increase among the older children continuing up to the fourth year. In general, the breakfast meals supply a smaller share of protein intake than lunch and dinner. This applies especially in the case of the three-year-olds.

Table 6.1
AVERAGE ENERGY INTAKE PER MEAL

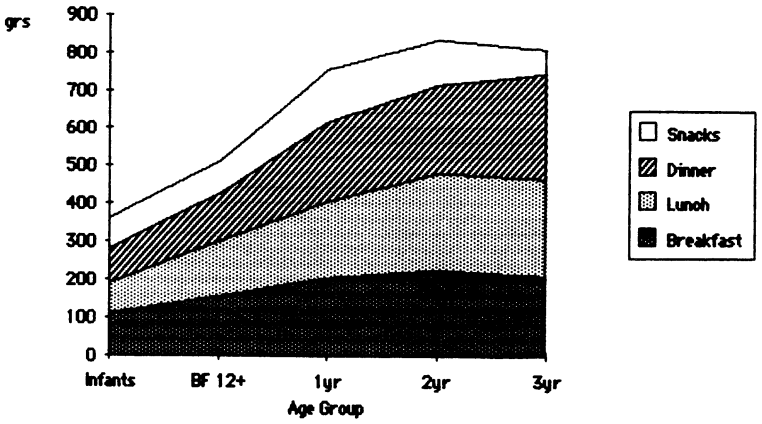


Figure 6.2
AVERAGE PROTEIN INTAKE PER MEAL

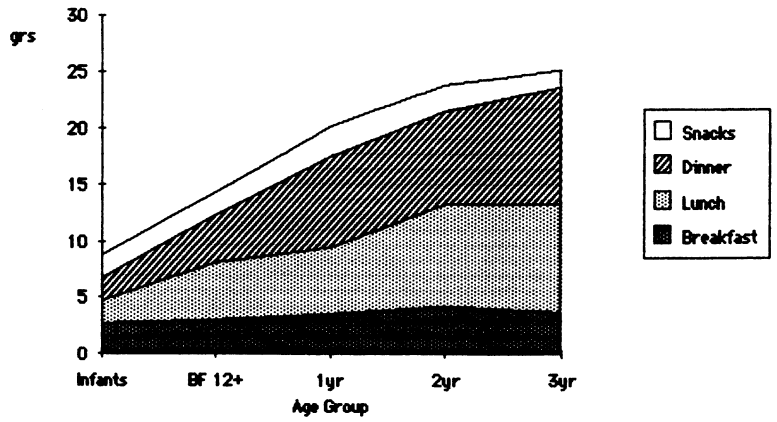
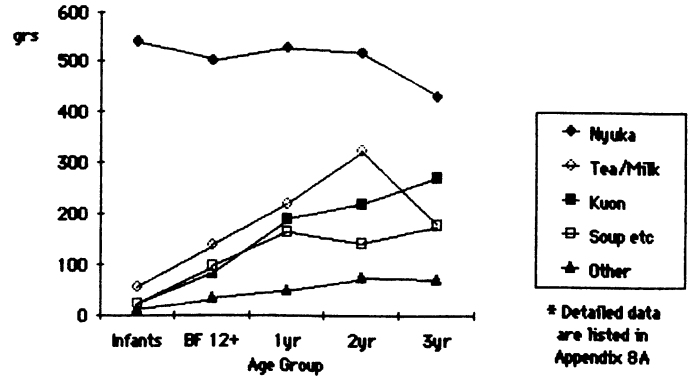


Figure 6.3
AVERAGE CONSUMPTION OF DISHES*



* Detailed data are listed in Appendix 8A

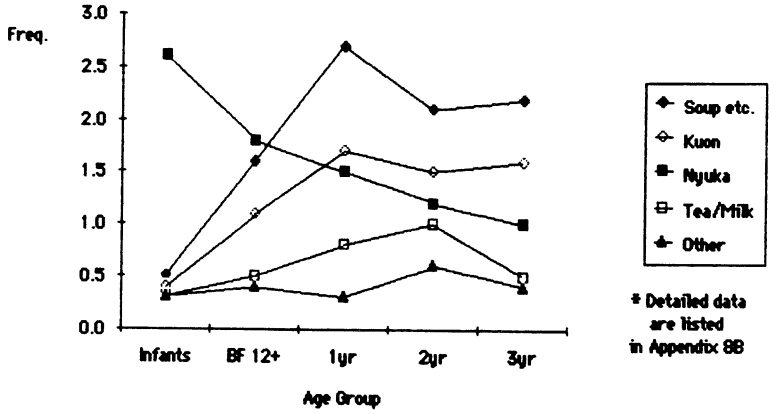
Among the older children lunch, and in particular dinner, supply a growing share of daily energy and protein intake. This is mainly the result of changes in the composition of meals. Figure 6.3 shows the average amounts of various foods and dishes consumed by children of different ages. The major changes occur with respect to nyuka and kuon.

Nyuka, a thin porridge, is an important weaning food, and is one of the first dishes given to infants. After weaning, the frequency of nyuka consumption declines (Figure 6.4), but the average quantity consumed daily decreases only slightly. With age the amounts of milk, and tea with milk, also decrease. Tea without milk, a substitute when milk is not available, is generally only given to the children over two years.

While the consumption of nyuka and milk decreases, the intake of solid dishes increases. Kuon, a cereal dish of solid consistency, is the main ingredient of the adult diet. Its consumption increases after weaning, both in terms of frequency of consumption and portion size (Figures 6.4 and 6.5). Kuon has a higher energy density than nyuka and also has a high satiety power. It is usually served together with a side-dish of vegetables or animal products and the consumption of these side-dishes also increases with age. The same, albeit to a lesser extent, can be said in respect of the rice dishes which are often used as a substitute for kuon.

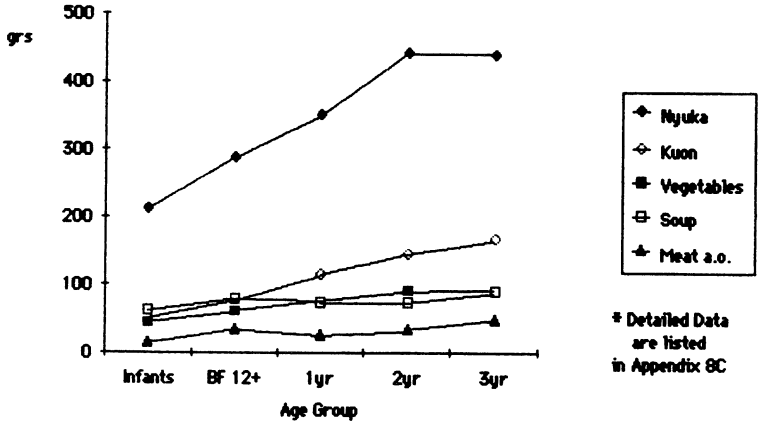
The consumption levels of the remaining dishes are relatively low and fluctuate only slightly among the different age groups. Sometimes portion sizes increase with age as in the case of miscellaneous dishes like fruits and bread, sometimes they peak at a certain age, as in the case of roots, tubers and starchy fruits. (See also appendix 8)

Figure 6.4
FREQUENCY OF CONSUMPTION OF DISHES*
(Number of times served per day per child)



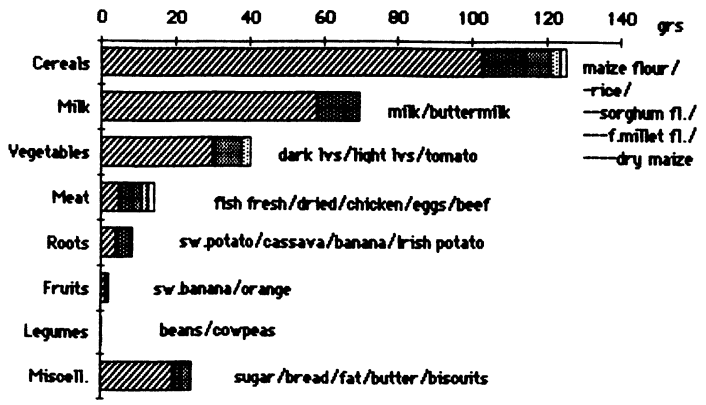
* Detailed data are listed in Appendix 8B

Figure 6.5
CONSUMPTION OF DISHES
(Average Portion Size When Consumed*)



* Detailed Data are listed in Appendix 8C

Figure 6.6
AVERAGE CONSUMPTION OF FOODGROUPS IN GRAMS
(All Age Groups, 6-47 months, N=317)



6.2 Ingredients and Food Groups

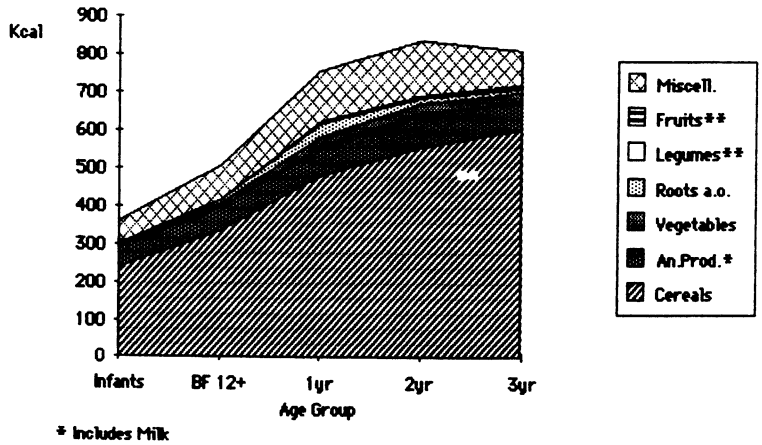
The average amounts of raw ingredients consumed by children of all age groups are graphically presented in Figure 6.6. Maize flour is the single most important ingredient (102 grs), followed by milk and buttermilk (69 grs). As a result of this the food groups with the highest consumption levels are cereals and animal products. Vegetables follow next. Surprisingly, sugar consumption (classified under miscellaneous) ranks next and is higher than, for example, the total amount of roots, tubers and starchy fruits eaten.

Figures 6.7 and 6.8 illustrate the composition of the diet and present the relative contribution of different food groups to the daily intake of energy and protein. Similar information in respect of the various nutrients is listed in Appendix 9. Cereals are the primary source of energy, protein, iron and thiamine. Among the three-year-old children the contribution of cereals to energy intake increases to almost 75 percent. Animal products are important sources of protein, calcium, thiamine, and riboflavine. The contribution of animal products to the daily nutrient intake, however, decreases with age, mainly because of lower milk consumption. This also has consequences for the thiamine and riboflavine intakes. Vegetables become a more important source of nutrients for the older children, providing most of the calcium, riboflavine, and ascorbic acid.

6.3 Energy and Nutrients

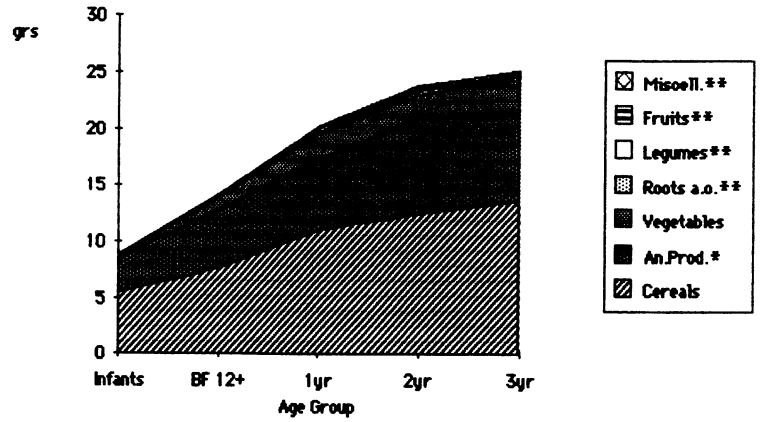
The total amounts of daily intake of energy and nutrients are separately listed in Table 6.3. Energy intake is expressed in kilocalories and megajoules, protein in grammes, and the intakes of the other nutrients are expressed in milligrammes. The table includes the respective amounts of calcium, iron, thiamine, riboflavine, and ascorbic acid. It has already been noted that energy intake showed no further increase among the three year old children while protein intake, still increases among this

Figure 6.7
AVERAGE ENERGY INTAKE BY FOOD GROUP



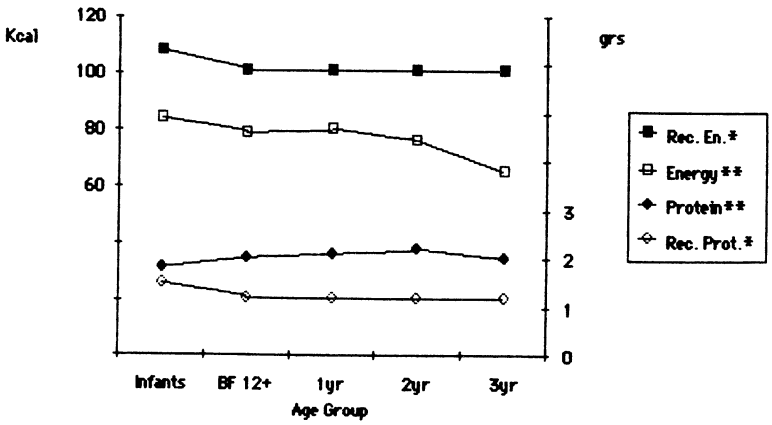
* Includes Milk
** The amounts of energy from fruits and legumes are too small to show separately in the figure

Figure 6.8
AVERAGE PROTEIN INTAKE BY FOOD GROUP



* Includes Milk
** The amounts of energy from these food groups are too small to show separately in the figure

Figure 6.9.
RECOMMENDED AND OBSERVED INTAKE
PER KG/BODY-WEIGHT (Average)



* Recommended levels
** The figures include estimates of breastmilk consumption

age group. The intake of other nutrients follows a different pattern: intakes increase during the weaning period, but after weaning levels remain more or less stable. The children who were no longer breastfed realized adequate iron intakes compared to the FAO/WHO recommendations (FAO/ WHO, 1974). The intake of calcium, however, was sufficient only among the two-year-olds. Intakes of thiamine, riboflavine, and ascorbic acid, were generally insufficient according to FAO/WHO standards.

In Figure 6.9 the intake results are expressed in relative terms, i.e. per kilogram bodyweight and compared with the FAO/WHO-recommended intake levels which are represented by the dotted lines[21]. In this case, unlike the results presented above, the intakes of the two groups of breastfed children include an estimate of breastmilk consumption. These estimates were calculated on the basis of findings for Akamba children reported by Steenbergen et al. (1984) and they were added to the reported recall amounts.

The energy intake of the two groups of breastfed children reaches only 80 percent of the recommended amounts. At later ages, the energy intake per kg bodyweight decreases to even lower levels, and the three-year-old children receive only 65 percent of the recommended levels. It must be pointed out that this low figure does not occur because of a decrease in the absolute figure for energy intake, but rather because energy intake does not proportionally increase with the weight increase of children as it should. It is clear that on the whole energy intake levels at this time of year were very low even if the FAO/WHO recommendations are somewhat on the high side, as is often suggested. Findings with respect to protein intake are different. Protein intake per kg bodyweight increases from sufficient among infants (120 percent) to an intake of 160 percent of the recommended amounts among the other groups.

The average intake levels among the children are much lower than that of the population as a whole, i.e. children and adults together. The average protein consumption of the survey population as a whole was

Table 6.4
Distribution of Energy Intake per Kg/Body-Weight
(Listed according to the percentage of the recommended intake realized)

	Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
100 and more	19%	20%	27%	22%	13%
80.0-99.9	29%	22%	11%	14%	11%
60.0-79.9	25%	25%	22%	28%	28%
59.9 and below	27%	33%	41%	37%	49%
Total	100%	100%	100%	100%	100%

Table 6.5
Average Intake of Energy and Nutrients by Study Condition
(Children 6-47 months)

		Non-Rice Growers (N=116)	Individual Rice Growers (N=57)	Non-Resident Tenants (N=80)	Resident Tenants (N=64)	Total (N=317)
Energy	(kcal)	658	684	695	552	651
	(mJ)	2.76	2.88	2.92	2.32	2.73
Protein	(grs)	18.1	20.6	20.5	15.4	18.6
Calcium	(mg)	244	408	334	252	298
Iron	(mg)	4.5	4.8	5.1	3.9	4.6
Thiamine	(mg)	0.2	0.2	0.2	0.1	0.2
Riboflavine	(mg)	0.3	0.3	0.3	0.2	0.3
Ascorbic Acid	(mg)	7.7	7.5	8.1	5.9	7.4

Table 6.6
Distribution of Energy Intake per Kg/Body-Weight
(Children 6-47 months; Listed according to the percentage of the recommended intake realized)

	Non-Rice Growers (N=116)	Individual Rice Growers (N=57)	Non-Resident Tenants (N=80)	Resident Tenants (N=64)	Total (N=317)
100 and more	22%	23%	20%	11%	19%
80.0-99.9	19%	14%	23%	13%	18%
60.0-79.9	21%	32%	24%	33%	26%
59.9 and below	39%	32%	34%	44%	37%
Total	100%	100%	100%	100%	100%

more than 2.5 times the recommended amounts but among the children, although sufficient, protein consumption averaged at about 1.5 times the requirement. The differences as regards energy intake between adults and children, however, are much more striking and alarming. In section 5.4 it was estimated that energy intake on a compound basis approximated 100 percent of the FAO/WHO recommendations (table 5.12) which compares with an average energy intake of children that reaches only 75 percent of the recommended levels. Why there would be such a discrepancy between adult and child consumption is not quite clear. This could be the result of the different recall methods (the first assessing compound preparation, the second individual child consumption) but more likely it reflects genuine differences in consumption between adults and children, because the bulky adult diet is not particularly well adapted to meet the needs of young children.

Table 6.4 presents the distribution of energy intake among the surveyed children, showing that the low energy levels are not confined to only one section of the child population. Rather, they present a general phenomenon, since only few children realize high intake levels, and the majority appear unable to satisfy their nutritional needs.

6.4 Food Consumption and Rice Cultivation

Table 6.5 to 6.7 present the results of the 24-hour recall for each of the study conditions. The average intakes of energy, protein and other nutrients are shown in Table 6.5. The children of the tenants resident at the large irrigation schemes score lower in all respects than any of the other groups. The former group also has the highest proportion of children receiving less than 60 percent of the recommended energy intake (Table 6.6). This finding is in line with the low compound consumption noted previously among the tenants living at the schemes (Section 5.4). The N.I.B. tenants resident outside the schemes, however, are in a different situation. The average energy intake of the children in this group is the most favourable compared to the other

Table 6.7
Contribution of Rice to Daily Food Intake
(Children 6-47 months)

	Non-Rice Growers (N=116)	Individual Rice Growers (N=57)	Non-Resident Tenants (N=80)	Resident Tenants (N=64)	Total (N=317)
% of Energy Intake	4%	3%	9%	6%	5%
% of Protein Intake	4%	2%	8%	5%	5%

groups. Moreover, the proportion of children in this group with intakes below 60 percent of the recommended intake is considerably lower than in the group of resident tenants. The individual rice growers and the non-rice growers take an intermediate position.

In the context of this study the consumption of rice is of special interest. Table 6.7 presents the contribution of rice to the total energy and protein intake of the children in the different study conditions. Rice contributes only 5 percent on average to the energy intakes of the children and there are no important differences between the various groups in this respect. Evidently rice consumption by children is low, although, as could be expected, it contributes comparatively more to the energy and protein intake of the children of tenants at the large irrigation schemes, and less to that of the children of individual rice growers.

6.5 Discussion

Young children living in the Kano Plain are fed a diet consisting mainly of cereals. Weaning is characterized by gradual changes, and breastfeeding generally continues up to the age of two years. Nyuka is the most important weaning food although older children also consume relatively large quantities of this dish. Solid foods, kuon in particular, are

already given at an early stage during weaning, and steadily gain importance as the child gets older.

The diet of the younger children at the time of the survey is not sufficient in terms of energy intake. Moreover, energy intake per kg bodyweight becomes lower with increases in age. Particularly, the energy intake of three-year olds was low, and averaged only 65 percent of the amount recommended by FAO/WHO. Protein intake, however, was above recommended levels in all age groups.

The diet consists mainly of nyuka and kuon. Nyuka, prepared with cereals, milk and sugar, constitutes a nutritious supplement to breastmilk, particularly during the first months of weaning. However, the food has a low energy density and in times of duress it may be diluted, resulting in an even lower energy density. Kuon, the main solid dish has, on the other hand, a high satiety power, and children are generally not able to eat large portions. This may particularly present a problem in the case of older children who eat fewer snacks in between meals.

The importance of milk and milk products as weaning food is relatively small when compared to findings of an earlier survey in Central Province (Hoorweg et al., 1984). The average consumption of 69 grs for milk and milk products in the present survey is low compared to the average milk consumption of 320 grs found in Central Province. In this respect, there seems to be room for improvement of the weaning diet, and this offers a starting point for intervention. Milk is an important source of those vitamins and minerals which are lacking in the diet of the children.

With respect to the present findings it should be noted that the 24-hour recall method only reflects food intake levels at the time of the survey. It has already been noted that food stocks were generally low as a result of the poor maize and sorghum harvest of 1983. The survey, moreover, took place during the period of the long rains, which is commonly the

time when food problems become manifest. It is very likely that this has caused the very low intake levels recorded on this occasion.

It was further noted that rice consumption plays only a minor role in the diet of young children and stays far behind maize consumption. In this respect the differences between the various study conditions are small, although the children of N.I.B. tenants derive a slightly larger proportion of their energy and protein intake from rice than the other children.

The most important differences observed between the study conditions are the lower energy intakes among the children of resident tenants at the large irrigation schemes. This finding accords with the generally low compound consumption levels estimated for this group and confirms its disadvantageous position.

Table 7.1
Summary Table on Anthropometry from Various Sources (1972-1983)*

Area	Year of Survey	Reference	Number of Children	Age Group (months)	Average H-A	Children < 90% of Standard	Average W-H	Children < 90% of Standard	Average W-A	Children < 80% of Standard	Children < 60% of Standard
Kano Plain	1972	Allen	320	0-72	n.a	n.a	n.a	18%	n.a	15%	n.a
Kano Plain	1976	Alnwick	821	0-42	93	n.a	96	32%	85	33	n.a
Kisumu District(rural)	1982	CBS	106	3-60	94.9	19.8%	103.3	20.7%	n.a	n.a	n.a
Lower Kano Plain	1984	Niemeyer	335	6-48	94.1	22.1%	92.9	38.3%	83.4	38.9%	2.4%
Lower Kano Plain	1984	Niemeyer	558	48-132	94.3	21.0%	93.7	30.0%	82.5	43.8%	3.2%
Kenya	1982	CBS	5,323	3-60	94,2	24.0%	100.7	17.5%	n.a	23.0%	0.7%

* This table was compiled from a similar table in Social Perspectives (CBS,1977) with additional data from the 1982 Nutrition Survey (CBS,1983).

7. NUTRITIONAL STATUS AND HEALTH CONDITION OF YOUNG CHILDREN

This chapter presents data on the nutritional status of children aged between 6 months and 11 years, together with information on reported infant mortality and child morbidity. First, the data for the child population as a whole are discussed, in section 7.6 results are presented for each of the study conditions.

7.1 Growth Curves

Figure 7.1 presents cross-sectional growth curves for, respectively, boys and girls aged between 6 months and 11 years. The curves closely follow the third percentile of the WHO reference population, particularly from the second year of life onwards. The Child Nutrition Survey reported growth curves for rural Kenyan children aged 6-60 months, along the same percentile (CBS,1983). The present population therefore appears similar to the general child population in Kenya and the data further reveal that the growth pattern following the third percentile continues up to the age of 11 years.

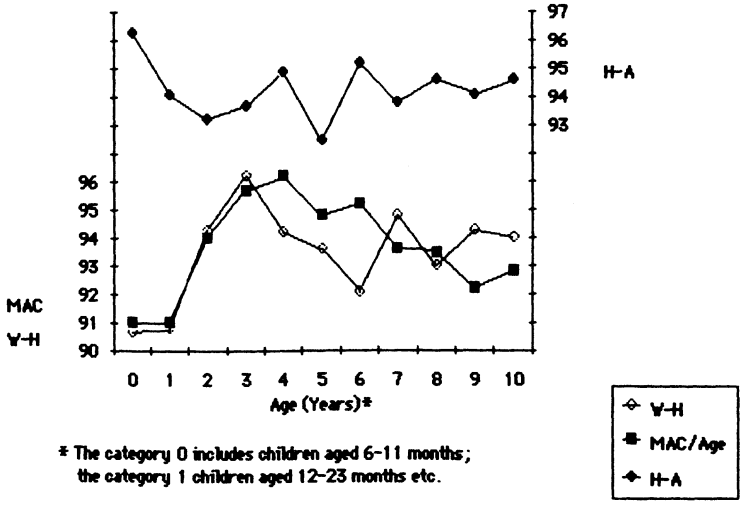
Figure 7.1A
HEIGHT BY AGE (Boys)

* The category 0 includes children, aged 6-11 months;
the category 1 includes children, aged 12-23 months; etc

Figure 7.1B
HEIGHT BY AGE (Girls)

* The category 0 includes children, aged 6-11 months;
the category 1 includes children, aged 12-23 months; etc

Figure 7.2
ANTHROPOMETRY (AVERAGE) BY AGE GROUP



* The category 0 includes children aged 6-11 months;
the category 1 children aged 12-23 months etc.

7.2 Height-for-Age

Height-for-age of the total group of 899 children reached an average of 94.2 percent of the reference standard. The average decreases from 96.3 among children under one year to 93.2 percent among the three-year-olds, indicating a slow-down in growth after the first year (Figure 7.2). This finding is similar to that of a study among rural children in Central Province (Hoorweg et al., 1983). From the age of four onwards height-for-age appears to stabilize at approximately 94 percent of the standard. However one age group forms an exception: the average height-for-age among the five-year-olds is low, with only 92.5.

Cross-sectional data such as presented in Figure 7.2 not only reflect age differences between the cohorts (age groups), but also variations in nutrition history. In this case, the low height-for-age values among the five-year age group are most probably related to the effects of a drought period in 1980. During that exceptionally dry year (see section 2.2, Table 2.1), this cohort was one year old, the age at which children are most vulnerable.

The data indicate a fair prevalence of stunting. Table 7.2 presents the distribution of height-for-age separately for the children under four and the children between four and eleven. In both age groups about 21 percent of the children are stunted with a height-for-age below 90. Another 35 percent of the children can be considered marginally stunted with a height-for-age between 90 and 95.

Table 7.2
Distribution of Height-for-Age by Age Group

	Children 6-47months (N=335)	Children 4-10yrs (N=558)
100 and over	13.4%	16.5%
95.0 - 99.9	29.6%	29.2%
90.0 - 94.9	34.9%	33.3%
85.0 - 89.9	17.6%	15.6%
80.0 - 84.9	4.2%	4.1%
75.0 - 79.9	0.3%	0.9%
70.0 - 74.9	-	0.4%
	100%	100%

Table 7.3
Distribution of Weight-for-Height and Mid-Upper Arm Circumference by Age Group

	Children 6-47months (N=335)	Children 4-10yrs (N=558)
Weight-for-Height		
110 and over	1.8%	2.0%
100.0 - 109.9	18.6%	17.3%
90.0 - 99.9	41.3%	50.6%
80.0 - 89.9	32.6%	26.0%
79.9 and below	5.7%	4.1%
Mid-Upper Arm Circumference-for-Age		
110 and over	2.4%	1.1%
100.0 - 109.9	16.0%	17.3%
90.0 - 99.9	43.8%	55.4%
80.0 - 89.9	33.1%	24.4%
79.9 and below	4.7%	1.8%

Table 7.4
Anthropometry : Cross-Tabulations by Age Group
(Percentage of Children falling in Different Cells)

A. CHILDREN, AGED 6-47 MONTHS (N=335)

		Height-for-Age Normal (>90)	Stunted (<90)
Weight-for-Height	Normal (>90)	50.3%	11.4%
	Marginally Wasted (80-90)	24.6%	8.1%
	Severely Wasted (<80)	3.0%	2.7%

B. CHILDREN, AGED 4-10 YEARS (N=558)

		Height-for-Age Normal (>90)	Stunted (<90)
Weight-for-Height	Normal (>90)	54.9%	15.1%
	Marginally Wasted (80-90)	20.8%	5.2%
	Severely Wasted (<80)	3.0%	1.1%

These height-for-age findings correspond closely with data from previous nutrition surveys in Kisumu District (Table 7.1; p.96) and it can be assumed that the nutritional history of the present survey population is generally similar to that of previous samples.

7.3 Weight-for-Height and Mid-Upper Arm Circumference

The results for the different age groups are shown in Figure 7.2 & 7.3. The values for weight-for-height and m.a.c. are similar; both are quite low in the younger age groups, i.e. 91 percent of the standard among the children under two years. The average weight-for-height summed over all age groups is 93.4 percent, compared to a national average of 100.7 reported for the 1982 national survey (CBS,1983). The average mid-upper arm circumference for all children is 93.6 percent. Both figures are relatively low.

Some 6 percent of all children under four had weight-for-height values below 80 percent of the standard, and a further 33 percent showed marginal wasting, i.e. a weight-for-height between 80 and 90 percent of the standard (Table 7.3). The distribution of weight-for-height and mid-upper arm circumference among the children between four and eleven years is quite similar to that of the younger age group.

Compared with previous surveys in the area, the present weight-for-height figures indicate a much higher incidence of wasting (Table 7.1; p. 96). In the previous section, however, it was noted that height-for-age values proved very similar to previous studies and the low weight-for-height figures are probably related to (seasonal) variations in food availability. The low (rainfed) cereal harvest of 1983 has already been mentioned, while the survey was furthermore held at the beginning of the long rains when food stocks are generally depressed anyway. (The 1982 Child Nutrition Survey, on the other hand, was conducted during the harvest period between July and September).

Table 7.5
Distribution of Weight-for-Age by Age Group

	Children 6-47months (N=335)	Children 4-10yrs (N=558)
90.0 and over	30.0%	24.5%
80.0 - 89.9	30.3%	31.7%
60.0 - 79.9	37.4%	40.6%
59.9 and below	2.4%	3.2%

Table 7.6
Child Health Complaints

	Age (months)*				
	06-11	12-23	24-35	36-47	48-59
During past two weeks:					
Number of days reportedly ill (Average)	8.8	6.6	6.5	5.5	4.7
Percentage of children visiting hospital/health centre/doctor for treatment	63%	44%	44%	41%	30%

* For corresponding N's, see Tables 4.2 & 4.3

Table 7.7
Nature of Child Health Complaints
(Percentage of children reportedly suffering from the various complaints listed below, during the previous 2 weeks)

	Age (months)*				
	06-11	12-23	24-35	36-47	48-59
Gastrointestinal	41%	23%	25%	20%	10%
Respiratory tract	13%	7%	11%	13%	9%
Malaria	11%	16%	13%	11%	11%
Childhood diseases	4%	16%	10%	8%	3%
General	20%	20%	19%	22%	29%
Miscellaneous	4%	1%	6%	5%	6%
No complaints	7%	18%	16%	22%	33%
Total	100%	100%	100%	100%	100%

* For corresponding N's, see Tables 4.2 & 4.3

7.4 Incidence of Malnutrition

Table 7.4 presents the cross-tabulations of height-for-age and weight-for-height, listing the percentages of children falling in the different cells. The most disadvantaged group consists of children who are both stunted and wasted. The number of children in this group reaches 2.7 percent of all children under four, and 1.1 percent of the children in the older age group. Both figures are high in comparison to the 1982 national figure of 0.5 percent of all children under five (CBS,1983).

Weight-for-age reflecting general growth performance, is often used for a classification in broad categories of malnutrition. The percentages of children falling in the respective categories are listed in Table 7.5.
Table 7.1 (p.96) presents a comparison with findings from previous surveys in Kisumu District, as well as the results from the 1982 Child Nutrition Survey. It can be concluded that the data indicate a considerable incidence of malnutrition, about 40 percent of the children falling below 80 percent. This amounts to nearly twice the national figure in 1982 and indicates that severe nutrition problems existed in the area at the time of the survey.

7.5 Morbidity and Mortality

The average number of days that children were reportedly ill, and the percentages of children visiting a health centre for treatment in the two weeks prior to the interview, are presented in Table 7.6. The data reveal a much higher prevalence of illness among the younger children. On average, children aged between six months and one year were reported ill during almost twice the number of days as the category of four years old. In addition, the former group had visited the health centre with a double frequency.

Table 7.8
Incidence of Diarrhoea and Vomiting
(Percentage of children reportedly suffering from these two disorders during the previous day)

	Age (months)*			
	06-11	12-23	24-35	36-47
Incidence	29%	18%	16%	13%

* For corresponding N's, see Tables 4.2 & 4.3

Table 7.9
Height-for-Age by Study Conditions

A. CHILDREN, AGED 6-47 MONTHS*

	Non-Rice Growers	Individual Rice Growers	Non-Resident Tenants	Resident Tenants	Total
Average	94.7	94.9	94.4	92.4	94.1
Percentage below H-A (90)	17.7%	13.6%	18.6%	40.9%	22.1

B. CHILDREN, AGED 4-10 YEARS*

Average	94.4	94.8	94.9	93.0	94.3
Percentage below H-A (90)	21.9%	17.5%	13.6%	29.9%	21.0

* For corresponding N's, see Tables 4.2 & 4.3

Table 7.10
Weight-for-Height by Study Conditions

A. CHILDREN, AGED 6-47 MONTHS*

	Non-Rice Growers	Individual Rice Growers	Non-Resident Tenants	Resident Tenants	Total
Average	92.4	92.1	95.0	92.0	92.9
Percentage below W-H (80)	5.9%	13.6%	0.0	5.6%	5.7

B. CHILDREN, AGED 4-10 YEARS*

Average	92.7	93.7	94.7	94.2	93.7
Percentage below W-H (80)	4.8%	3.2%	4.0%	3.5%	4.1

* For corresponding N's, see Tables 4.2 & 4.3

Table 7.7 presents information on the nature of the health complaints as reported by the mothers. The complaints are grouped into six broad categories:[22]

= gastrointestinal (diarrhoea, vomiting, stomach and abdominal pains, etc.);
= respiratory tract (colds, pneumonia, sore throat, coughing, etc.);
= malaria;
= childhood diseases (measles, chicken pox, etc.);
= general (fever, body pain, headache, etc.);
= miscellaneous (injuries, scabies, ringworm, etc.).

The pattern of complaints among the Kano Plain children reflects the general pattern of child health in rural Africa. There is a higher incidence of gastrointestinal complaints among the children below one year compared to the older groups, and a higher incidence of childhood diseases among the one-year-olds. A large proportion of the reported gastrointestinal complaints concerns weanling diarrhoea in particular. During the day preceding the interview twice as many children in the 6-12 months age bracket suffered from diarrhoea and vomiting than the older children (Table 7.8).

It should perhaps be noted again that the present findings reflect not the actual health situation, but rather morbidity as perceived by the mothers. Leeuwenburg et al. (1984), however, found indications that (Akamba) mothers considerably over-reported diarrhoea, even to the extent of 15 to 40 percent of the cases. However, even if the present figures would be corrected for this, the indications are that the incidence of diarrhoea and vomiting is high.

This is also suggested by comparison with the 1982 Child Nutrition Survey (CBS,1983) which reported a much lower incidence of illness and a lower frequency of visits to health centres in Kisumu District. Since the CBS survey and the present study employed very similar questions, the difference indicates that health conditions at the time of the present survey were less favourable, which is in line with the relatively high incidence of wasting.

Mortality estimates confirm the presence of major health problems in the Kano Plain at the time of the survey. Infant mortality (0-11 months) was estimated by means of a recall of births and deaths that had occurred in the previous period of 24 months, and amounted to 180 per 1000 live births.[23]. Most of the infant mortality (68 percent) occurred in the group of children aged 6 to 12 months. Moreover, 73 percent of the infant deaths in the course of these two years occurred in the period of 7 months prior to the study, and this suggests a link with the earlier mentioned (seasonal) variations in nutrition.

7.6 Nutritional Status and Rice Cultivation

Information on the nutritional status of the children in the different study conditions is presented in Tables 7.9 - 7.11. The study conditions, as explained, represent different kinds of participation in rice cultivation, and the results are presented separately for the two respective age-groups: 6-47 months and 4-10 years.

In respect of height-for-age the children resident at the large irrigation schemes distinctly show the least favourable growth pattern of the four groups (Table 7.9). The difference is evinced by a lower average height-for-age as well as a greater incidence of stunting. This finding applies to both younger and older children. The height-for-age results of the children in the three remaining study conditions are more favourable, and differ very little among each other.

Weight-for-height, indicating degree of wasting and momentary nutritional condition, is presented in table 7.10. Among the children, aged 4-10 years, the differences between the study conditions are only marginal. Among the younger age group there is one difference that stands out: weight-for-height is more favourable among children of non-resident tenants. Average weight-for-height is higher while -most striking- no wasted children (below W-H(80)) were found in this group. The other three groups, firstly the children of resident-tenants at the schemes,

but also the children of individual rice growers and non-rice growers show equally low weight-for-height levels.

The percentage of children under 80 percent of the weight-for-age standard is presented in Table 7.11. Weight-for-age, as a broad indicator of malnutrition, shows that the highest incidence of malnutrition occurs among the children of the resident-tenants at the large schemes. (This is, of course, as could be expected: these children scored low on height-for-age as well as weight-for-height). This pattern is repeated in both age groups. In the case of the older children, however, the group of non-rice growers has an equally high percentage of cases below W-A (80). On the other hand, the lowest prevalence of malnutrition occurs among the children of non-resident tenants at the large schemes.

Information on present health conditions is presented in table 7.12. The figures show the percentage of children reported to have suffered from diarrhoea or vomiting during the day prior to the home-visit. Although in this respect the differences between the study conditions are but small, the incidence appears lowest among the children of the two groups of tenants at the large schemes.

All in all, it can be concluded that the children of resident tenants at the large schemes are in the -relatively- poorest condition. Next follow the children of the non-rice growers and individual rice growers, in that order. The findings for the children of the non-resident tenants at the large schemes, on the other hand, are the most positive. These results correspond with earlier observed differences in social-economic conditions and food intakes between the respective groups, particularly as regards the children of resident tenants at the large irrigation schemes. In the previous chapter it was shown that the resident tenants generally have a smaller economic resource base (Chapter 5) and that the energy intake of the children in the households was less than that of children in the other study conditions (Chapter 6). That this group also shows the poorest anthropometric results is therefore in line with these previous

Table 7.11
Distribution of Weight-for-Age by Study Conditions

A. CHILDREN, AGED 6-47 MONTHS*

	Non-Rice Growers	Individual Rice Growers	Non-Resident Tenants	Resident Tenants	Total
90 and over	33%	33%	34%	18%	30%
80.0 - 89.9	30%	28%	35%	27%	30%
60.0 - 79.9	33%	35%	30%	55%	37%
59.9 and below	4%	3%	1%	0%	2%

B. CHILDREN, AGED 4-10 YEARS*

90 and over	24%	26%	26%	22%	25%
80-89.9	28%	37%	38%	27%	32%
60.0 - 79.9	44%	34%	35%	46%	41%
59.9 and below	4%	3%	1%	5%	3%

* For corresponding N's, see Tables 4.2 & 4.3

Table 7.12
Incidence of Diarrhoea and Vomiting
(Percentage of children, under four years, reportedly suffering from these two disorders during the previous day)

	Non-Rice Growers	Individual Rice Growers	Non-Resident Tenants	Resident Tenants	Total
Incidence	21%	22%	16%	19%	20%

findings, and the high percentage of malnourished and stunted children among this group gives serious reason for concern.

7.7 Discussion

Comparison with earlier surveys shows that in respect of long-term nutritional indicators (height-for-age), the child population studied is rather similar to that of Kisumu District, and of Kenya in general. However, in respect of short-term nutritional indicators (weight-for-height), the children scored much lower. Food intakes at the time of the study were very low, as a result of seasonal food shortages that may have been extra pressing because of a harvest failure in the previous year. These low intake levels are very probably related to the high incidence of wasting among the children on this occasion. The children under two years of age suffered from frequent diarrhoea and vomiting, and this may have created additional problems in this age group, as their weight-for-height proved particularly low. It is possible that the incidence of diarrhoea and vomiting is seasonally related as well.

As to differences between the various study conditions, one finding stands out. The average height-for-age of the children of resident tenants at the large irrigation schemes was lower and the number of stunted children in the former group much higher than in the other study conditions. This indicates a less favourable long-term nutritional situation among this category of tenants, who also have the lowest level of resources. Next, it should be mentioned, that the percentage of malnourished children is lowest among the non-resident tenants at the schemes and the individual rice growers. These two groups combine rainfed agriculture with irrigated rice production and consequently they may have been less affected by the prevailing dry conditions, compared with the farmers depending on rainfed cropping only.

The possibility that the momentary situation was exceptional does not invalidate the comparison between study conditions in respect of height-

for-age. This is different in respect of weight-for-height (and to some extent also for weight-for-age), which is sensitive to short-term fluctuations in food intake and health. The children of the non-resident tenants have the most positive weight-for-height values of the four groups. This appears related to the higher food intake of these children, and a much lower incidence of diarrhoea and vomiting. As noted in section 5.2, the non-resident tenants more often had improved sources of drinking water, which may have contributed to this lower incidence. The three other groups showed little or no differences in respect of weight-for-height.

The fact that these three groups show no differences in respect of weight-for-height does not seem to accord with the observed variations in food intake, which was by far the lowest among the children of the resident tenants at the large schemes. However, possible effects of the low food consumption may have been compensated by a lower frequency of diarrhoea and vomiting in this group. This in turn is probably related to the fact that the resident tenants more often draw water from improved sources during the wet season. The question remains, however, whether the weight-for-height differences observed between the study conditions are a seasonal or a permanent feature. Only a longitudinal survey covering a complete agricultural cycle could provide the necessary information to answer this question.

8. CONCLUSION

Agricultural development in Sub-Sahara Africa covers numerous aspects. New agricultural techniques are introduced; often new crops are introduced as well, alternative forms of farm management are developed in addition to the traditional smallholdings, while there is often a general reorientation towards cash crop farming. Such changes are not introduced independently of each other and most agricultural development projects imply changes in more than one respect.

If such projects are successful, in the sense that increases in agricultural production are realized, it is usually assumed that this will result in increased farm incomes and that this in turn leads to higher standards of living among the participating population. More and more information, however, indicates that this is not always the case, and that such a final impact can certainly not be taken for granted. There is a growing concern about the nutritional situation of the farming households involved in such projects, particularly about the development and condition of young children, who are often the first to be affected by adverse changes in economic and social conditions.

In Kenya, the introduction of irrigated agriculture is an important type of agricultural development. The growing attention for irrigated agriculture has resulted in several large-scale as well as small-scale irrigation schemes in different parts of Kenya. Among the schemes several produce rice, such as Mwea in Central Province, Bunyala in Western Province

and Ahero and West Kano, in Nyanza Province. The latter two are included in this study. The introduction of irrigated rice cultivation implies several critical transitions. Most important are the new agricultural techniques, new farm management practices and accompanying changes in the degree of dependence on the sale of cash crops for family subsistence. The introduction of irrigated rice cultivation in Nyanza Province is no exception to this. Irrigated rice has been cultivated in this area since the 1930's. Production was initially carried out on a small-scale by farmers cultivating irrigated plots along the shore of Lake Victoria, in seasonal and permanent swamps. With the establishment of the Ahero and West Kano schemes, in 1969 and 1976 respectively, and due to a growing interest on the part of individual smallholders, a large number of rural households in the Kano Plain is currently in some way involved in rice cultivation. In terms of crop production success has not been equivocal. At the large schemes production remained behind projected levels, although, on the other hand, the yields at the small schemes are unexpectedly high. More important, perhaps, is that the nutritional conditions of the participating farmers and their families have caused serious concern. The present study was aimed at assessing the nutritional conditions prevailing among farming households participating in irrigated rice production in the Kano Plain.

The four groups that were the subject of the study: non-rice growers; individual rice growers participating in small schemes; non-resident tenants at large schemes; and resident tenants at the latter schemes; reflect different degrees of participation and/or dependence on irrigated rice cultivation. At one end, there are the non-rice growers who are still largely dependent on traditional agricultural techniques and management practices. On the other hand there are the resident tenants at the large schemes who have undergone the most dramatic changes in circumstances and who are almost wholly dependent on irrigated cultivation, who no longer run their farms according to their own insights but are dependent on decisions of the schemes' management, and who, for their living, are almost fully dependent on the proceeds of their cash crops. The two remaining groups, the individual rice growers and the

non-resident tenants at the schemes fall somewhere in between. The first are less involved in rice cultivation than the second: they generally cultivate a smaller rice plot, manage their farms relatively independently and depend less on the sale of crops to secure a living. Because of these differences there exist important differences in the resource base of the study groups. The resident tenants appear to have access to few economic resources other than the production of rice. The other three groups, in contrast, have access to more diversified resources, including rainfed food and cash crop cultivation, livestock keeping, income from migrant labour and, with the exception of the non-rice growers, irrigated rice cultivation. Comparisons between these four groups are the major focus of the study.

A number of important observations can be made in respect of the entire population covered by the survey. Firstly, young children show a slowdown in height growth starting in the second half of the first year and continuing into the third year. This is the result of a combination of insufficient food intakes and a high incidence of diarrhoea and vomiting. Secondly, the incidence of stunting among young children did not prove higher than that of the Kenyan child population in general. However, weight-for-height was low for most age groups and indicated a considerable degree of wasting. This appears to be related to generally low levels of food intake at the time of the survey that were partly attributed to climatic seasonality, and to a partial harvest failure during the year prior to the survey. The findings indicate much larger seasonal fluctuations in weight among children, at least in this area, than previous information suggested - fluctuations which are not to be taken lightly because they appear to be accompanied by an increase in infant mortality. The average diet of the children was not deficient in protein but the quantities of foods consumed were rather small and did not meet caloric requirements, particularly not in the older age groups. There was, moreover, a discrepancy between the insufficient food consumption of small children, compared with the satisfactory compound consumption levels which points at differences in consumption levels between adults

and children. This calls attention to the intra-household distribution of foods as well as the bulky nature of the diet.

In the light of the above observations some suggestions can already be made regarding possible intervention measures. Firstly, weanling diarrhoea seems to be an important factor, especially during the start of the rains. This means that attention should be given to the provision of drinking water and general hygiene. The introduction of shallow wells in the area is an important step forward and should be further stimulated. Health education should stress the importance of good drinking water and general hygiene in child care. The fact that some people switch to unimproved water sources during the wet season clearly indicates that attention needs to be given to this aspect. Second, as noted, the weaning diet could be improved by stimulating milk consumption. This requires increased milk production possibly through the introduction of graded cattle, while extension services should stress the necessity of milk as a weaning food either as dish or as an ingredient in thin porridge, already while the child is still breastfed. Finally, the importance of feeding children large portions of food and at frequent intervals has to be stressed. Nutrition education often emphasizes the quality of the diet but this should not deflect attention from the quantitative requirements. In particular the older children (2-3 years of age) should receive more attention in this respect. The current practice is to feed them three meals per day only, together with the adults, which appears to be insufficient. Health educators should stress the need to pay more attention to the children of this age group and the necessity of providing snacks in between meals for these children, too.

In respect of the participation in rice cultivation, the first finding to note is that there are important differences between the resource base of the different study groups. The resident tenants at the large schemes appear to have access to few economic resources other than the production of rice. The other three groups, in contrast, have access to more diversified resources, including rainfed cultivation of food crops and

cash crops, external remittances, livestock keeping and, of course, irrigated rice cultivation, with the exception of the non-rice growers.

The observed differences in nutritional status between the four groups appear first and foremost related to differences in resources. The groups with the smallest resource base, i.e. the resident tenants at the large schemes, showed the lowest food intake levels among young children. The children, in turn, showed a higher incidence of stunting compared to the other groups. The differences among the three remaining groups are much smaller, although the nutritional status of the children belonging to the group of non-rice growers was generally less favourable than that of the children of the groups of individual rice growers and non-resident tenants. The most consistent finding is that the group with the smallest resource base, the resident tenants at the large schemes, shows the poorest results in all respects. They are followed by the non-rice growers who have the smallest resource base of the three remaining groups. The two groups with a wider resource base, and with a firm involvement in rainfed cropping as well as irrigated cultivation, do consistently better, with the non-resident tenants showing the most favourable results.

Evidently it is not possible to draw one single conclusion about the nutritional consequences of participation in irrigated rice cultivation. The assumption made at the time of the start of the schemes, that the livelihood of rural families can be fully covered by means of cash farming appears not to be valid. The negative conditions among the resident tenants show this convincingly. However, it cannot be said that participation in rice cultivation, in itself, has detrimental effects - this is not even true about participation in the large schemes managed by the N.I.B. Only the group which is solely dependent on their plots at the large schemes show symptoms of severe stress. Any efforts to provide assistance should therefore go to this group first.

In the introduction four explanations were suggested for possible lower levels of nutrition of farming households participating in irrigated rice

production: low income levels, poor health conditions, unbalanced diets and low food expenditures. The survey results do not indicate that health conditions or unbalanced diets are responsible. Rice is primarily produced for cash purposes, and serves at best as an additional food to maize, the main staple food among both rice growers and other farmers. At the time of the survey, not long after the main paddy harvest, rice contributed 10 percent or less of the energy intake of the different study groups. In fact the meal composition was surprisingly independent of the degree of participation in rice cultivation. There were also no indications of differences in morbidity among young children in the different study conditions, apart from the higher incidence of malnutrition. Although the incidence of diarrhoea and vomiting was relatively high, it was not higher among, for example, the resident or non-resident tenants at the large schemes. Rather the indications are that unfavourable nutritional conditions are associated with low incomes and/or unbalanced spending of household budgets. Which of these two explanations must be given more emphasis can not be determined on the basis of the present survey data.

Whatever the case it is clear that a diversified resource base is of great importance and in future schemes (or even the present schemes) every effort should be made to assure such a diversification. This diversification, however, should consist of more than a mere vegetable garden, and could be realized in different ways. In the existing or future schemes the plots could be reserved for the cultivation of other crops, something which will become a distinct possibility when the planned shift towards single cropping in the large schemes becomes reality. Another alternative is to reserve, from the outset, sufficient land for rainfed cropping, wherever climatic circumstances allow this. Another alternative is to create more possibilities for livestock keeping, for example in the form of zero grazing (in which cattle are kept and fed in pens). The possibilities of future dairy farming among tenants at schemes (but also among farmers in general in the area) need to be explored and encouraged so as to increase the availability of milk for home consumption.

Individual rice cultivation as realized in the small schemes by individual growers does not appear to carry negative nutritional effects as found among the resident tenants. The problem of periodic floods, however, may endanger continued participation in this kind of schemes. The investments needed in preparing bunds, ploughing and levelling are considerable and destruction by floods may discourage further expansion of rice cultivation. Irrigated rice cultivation greatly declined after the floods in the early sixties and it remains to be seen what will be the consequences of the recent floods in 1985. This type of participation in rice cultivation, however, merits serious attention and support because it is a means to enlarge the resource base of the participating farmers, even though its contribution to the family's livelihood, as yet, remains modest.

APPENDICES

Appendix 1

RECORD FORM

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
M1. Mastersheet

NAME COMPOUND HEAD:

AREA:

PERSON MET:

ENUM:

		Day	Month	Enum
SCHEDULED	DATE			
	DATE			
	DATE			
INTERV.	DATE			

SUPERVISOR:

CODING BY:

CHECKED BY:

SUPERV. BY:

MAP OF COMPOUND:

Legend: M=Main house
B=Boys house
H=Ordinary house
K=Kitchen
G=Granary
L=Latrine
Ba=Bathroom
Ku=Kul
A=Abila
O=Other structures

COMMENTS:

WATERSOURCE:

DRINKING WATER source	DRINKING WATER distance		OTHER WATER source	OTHER WATER distance
		DRY SEAS.		
		WET SEAS.		

Codes:

Source:	Distance:
1=river/canal	1=at house
2=well	2= - 5 min
3=improved well	3=6 -10 min
4=pond/dam	4=11-30 min
5=borehole	5=31 +
6=piped water	
7=tank 8=other	

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
C1. General information on compound.

NAME RESPONDENT:

HEAD OF COMPOUND:

ENUM:

DESCRIPTION OF COMPOUND:

Nr	Type	Roof	Wall	Floor	Nr of rooms	Sofa set	Radio etc	Nr of bikes	Gran roof	Kit. type	Person cooking
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

Codes:

Type:
1=main hse
2=ord. hse
3=boys hse

Roof:
0=n.a.
1=grass
2=sheets
3=other

Walls:
0=n.a.
1=mud
2=cemented
3=blocks
4=sheets
5=reeds
6=other

Sofaset/
Radio etc/
Kul/Abila:
0=none
1=present

Granary roof:
0=n.a.
1=grass
2=sheets
3=other

Kitchen type:
0=n.a.
1=grass roof
2=sheets roof
3=temporary
4=other

Floors:
1=mud
2=cement
3=sheets
4=timber
5=gravel
6=other

Sanitary Facilities:

	Roof	Wall	Floor
Latrine:			
Latrine:			
Bathroom:			
Bathroom:			

Other structures:

Kul: Abila:

COMMENTS:

FOOD AND NUTRITION STUDIES PROGAMME (FNSP-1)
C2. Compound membership.

LIST OF PERSONS GROUPED ACCORDING TO MEALTIME ARRANGEMENTS:

Grp nr	Prs nr	Name	Rel to hd.	Sex	Age	Mar st.	Ed.	Off frm act	Residence Type	Residence Reas abs.	Residence Freq vis.	Persons cooking for group
	01											
	02											
	03											
	04											
	05											
	06											
	07											
	08											
	09											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Codes:

Relation to comp. head:
1=head
2=wife
3=parent
4=child
5=spouse of ch.
6=broth/sister
7=spouse of broth/sister
8=grandchild
9=spouse of grandchild
10=oth. relat.
11=maid/labour.
12=other

Sex:
1=male
2=female

Age:
0=unknown
1=below 5
2= 5 - 10
3=11 - 16
4=17 - 19
5=20 - 29
6=30 - 39
7=40 - 59
8=60 +

Marital status:
1=single
2=married monog.
3=married polyg.
4=divorced/ separated
5=widowed

Education:
1= no formal education
2=adult class. only
3=prim 1 - 4
4=prim 5 - 8
5=beyond primary

Off-farm activities:
1=none
2=schooling
3=casual labour
4=temp. wage employment
5=regul. wage employment
6=self-employ.

Residence type:
1=in comp.
2=usually elsewhere
3=sleeping only
4=eating only
5=visitor

Residence reason for absence:
0=not appl.
1=schooling
2=working
3=looking for work
4=main home elsewhere
5=other

Residence frequency of visits:
0=not appl.
1=between terms
2=several times per week
3=weekly
4=several times per month
5=monthly
6=several times per year
7=once a year
8=less frequent

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
C2. Compound membership (continued)

LIST OF PERSONS GROUPED ACCORDING TO MEALTIME ARRANGEMENTS:

Grp nr	Prs nr	Name	Rel to hd.	Sex	Age	Mar st.	Ed.	Off frm act	Residence Type	Residence Reas abs.	Residence Freq vis.	Persons cooking for group
	21											
	22											
	23											
	24											
	25											
	26											
	27											
	28											
	29											
	30											
	31											
	32											
	33											
	34											
	35											

Codes:

Relation to comp. head:
1=head
2=wife
3=parent
4=child
5=spouse of ch.
6=broth/sister
7=spouse of broth/sister
8=grandchild
9=spouse of grandchild
10=oth. relat.
11=maid/labour.
12=other

Sex:
1=male
2=female

Age:
0=unknown
1=below 5
2= 5 - 10
3=11 - 16
4=17 - 19
5=20 - 29
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Marital status:
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2=schooling
3=casual labour
4=temp. wage employment
5=regul.wage employment
6=self-employ.

Residence type:
1=in comp.
2=usually elsewhere
3=sleeping only
4=eating only
5=visitor

Residence reason for absence:
0=not appl.
1=schooling
2=working
3=looking for work
4=main home elsewhere
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Residence frequency of visits:
0=not appl.
1=between terms
2=several times per week
3=weekly
4=several times per month
5=monthly
6=several times per year
7=once a year
8=less frequent

Comment

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
C4. Vital statistics, farm equipment and proceeds from livestock.

VITAL STATISTICS:

During the past 24 months, has any member of this compound given birth to a child?

Pers nr moth	Name of mother	Date of birth day	month	year	Sex of child	Presently alive? 0=no 1=yes	If not alive, date of death day	month	year

During the past 24 months, has any (other) member of this compound died? (Use for this section the codes of c2 and c3)

Name	Rel to comp hd	Residence Type	Reas	Freq	Sex	Age at death in years	Date of death day	month	year

FARM EQUIPMENT AND PROCEEDS FROM LIVESTOCK:

Record below all persons owning any of the indicated farm equipment or who have sold or bought any livestock during the past 12 months.

		Codes: 0=not present 1=present				Code the number owned, bought or sold.					
Pers nr	Name owner	plough	wheel barr.	oxcart	tract	nr of oxen	nr of donk.	CATTLE bght	CATTLE sold	GOATS SHEEP bght	GOATS SHEEP sold

COMMENTS:

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
C5. Proceeds from sugarcane and rice, employment as farm labour and wage labour employed.

PROCEEDS FROM SUGARCANE:

Record below all persons growing sugarcane.

Pers nr	Name grower	Area grown acres	Tasks for which labour is hired

PROCEEDS FROM RICE:

Record below all persons growing rice. Make a separate entry for each crop grown during the past 12 months.

Pers nr	Name grower	Area grown acres	Ten. type	Planting time month	year	Quantity harvest. bags	Harvest time month	year	Quantity sold bags

EMPLOYMENT AS FARM LABOUR:

During the past 12 months, has any member of this compound done casual farm labour of any kind? (weeding, cutting, transplanting, digging, ploughing etc.)

Pers nr	Name	Crop concerned	Tasks performed

EMPLOYMENT OF FARM LABOUR:

Record below all persons employing farm labour during the past 12 months. (excluding sugarcane)

Pers nr	Name	Crops for which labour was hired

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
F1. Farm production.

NAME RESPONDENT:

GARDEN OF:

1983 LONG RAINS:		1983 SHORT RAINS:		1984 LONG RAINS:	
Plots planted crop mixture	Area acres	Plots planted crop mixture	Area acres	Plots planted crop mixture	Area acres

HARVEST 1983 LONG RAINS:

Crops grown	Quantity harvested	Harv. time	Quantity sold	Purposes for which money was used	Lasted till
maize	bags		bags		
sorgh(bel)	bags		bags		
beans	debes		debes		
gr.grams	debes		debes		
sweet p.	bags		bags		
cotton	bags		bags		
cowpeas	debes		debes		

HARVEST 1983 SHORT RAINS:

OTHER FARM PRODUCE:

During the past 12 months, how many of your own chicken have you

sold

slaughtered

On the average, how many eggs do you get per week?

If you have cows, what is the average milk production?

Bottles daily

dry season

wet season

Do you sell milk?

1. never
2. sometimes
3. regularly

	Estim. nr of stems
cassava	
rabond nyaluo	

COMMENTS:

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
P1. Food preferences and weaning.

NAME RESPONDENT:

Q.: Chiemo mane madiher miyo nyathi ma ja higni ariyo?

Examples: machunga - mawembe
oduma - mchele
oganda - olayo
rabuond nyal. - rabuond ngwa.

1	Repeat q.	9	kuon	- olayo	2
2		11	mchele	- oganda	1
3		10	nyuka kal	- tong'	3
4		5	sukuma	- ring'o	4
5		8	rabolo mit.	- kuon	9
6		11	mchele	- rabuond ny.	7
7		6	kabich	- nyuka kal	10
8		5	sukuma	- machunga	13
9	Repeat q.	8	rabolo mit.	- oganda	1
10		2	olayo	- rabuond ny.	7
11		3	tong'	- mchele	11
12		4	ring'o	- kuon	9
13		10	nyuka kal	- rabolo mit.	8
14		7	rabuond ny.	- sukuma	5
15		1	oganda	- kabich	6
16		13	machunga	- olayo	2
17	Repaet q.	3	tong'	- rabolo mit.	8
18		7	rabuond ny.	- ring'o	4
19		9	kuon	- kabich	6
20		13	machunga	- mchele	11
21		1	oganda	- nyuka kal	10
22		2	olayo	- sukuma	5
23		6	kabich	- tong'	3
24		4	ring'o	- machunga	13

Nyathi nyalo chako chamo chiemogi ka en gi higni adi?

kaka: nyuka ___ months
kuon gi alot ___ months
rabolo mokuogi ___ months
oganda motedi ___ months
rabolo mitedo ___ months

Ka nyathi diewo chiemo mage kata gik mimadho mochuni miye?

Inyalo chungo nyathi ethuno ka en gi higni adi? ___ months

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
R1. Food preparation.

NAME WOMAN RESPONSIBLE:

NAME WOMAN COOKING:

Codes T: I=ingredient W=water M=maize R=rice

	DISH/INGREDIENTS	COMMENT	T	VOLUME	LEFT OVER	ORIG	AVAI	CONSUMED BY
B								
L								
S								

Codes:

Origin:
1=own production
2=purchased
3=bart./borrow. within compound
4=bart./borrow. outside compound

Availability:
1=always bought/bart./borrow.
2=sometimes bought/bart./bor.
3=always home production

Fuel types used throughout the year	Origin	Availability
1		
2		
3		
4		
5		
6		

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
R2. Dietary recall.

RESP:

RECALL OF:

AGE

HEALTHY

ILL

DIARRHOEA

VOMITING

(TICK WHEN APPROPRIATE)

PROBE FOR FOOD CONSUMED BETWEEN MEALS!

Codes T: W=water M=maize R=rice I=ingredient

	DISH/INGREDIENTS	COMMENT	T	VOLUME	LEFT OVER	COMP.CODE
B						
L						
S						

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
A1. Anthropometry.

NAME FATHER:		Is he alive?	1. yes	2. no
NAME MOTHER:		Is she alive?	1. yes	2. no

If the mother is not a full-time resident in the compound, who is looking after the children?

NAME FEMALE GUARDIAN:	

CHILDREN BELOW 5:

Pers nr	Name	Birthdate month year	Nr of days ill past 2 weeks	Complaints	Treat-ments	Result

Present age	Sex	Brfed?	Weaning age	Height cm	Weight kg	MAC cm	Remarks
				.	.	.	

Pers nr	Name	Birthdate month year	Nr of days ill past 2 weeks	Complaints	Treat-ments	Result

Present age	Sex	Brfed?	Weaning age	Height cm	Weight kg	MAC cm	Remarks
				.	.	.	

Pers nr	Name	Birthdate month year	Nr of days ill past 2 weeks	Complaints	Treat-ments	Result

Present age	Sex	Brfed?	Weaning age	Height cm	Weight kg	MAC cm	Remarks
				.	.	.	

Pers nr	Name	Birthdate month year	Nr of days ill past 2 weeks	Complaints	Treat-ments	Result

Present age	Sex	Brfed?	Weaning age	Height cm	Weight kg	MAC cm	Remarks
				.	.	.	

Codes:

Sex:	Breastfed:	Treatments:		Result:
1=male	1=yes	0=not appl.	4=ithiedhe kendi	0=not ap.
2=female	2=no	1=idhi e od thieth	5=no treatment	1=ill
		2=ingiewo yath e duka		2=impr.
		3=idhi ka ja thieth nyaluo		3=healthy

FOOD AND NUTRITION STUDIES PROGRAMME (FNSP-1)
A2. Anthropemtry (continued).

CHILDREN 5 - 10:

Pers nr	Name	Age in years	Sex	Height cm	Weight kg	MAC cm	Remarks
				.	.	.	
				.	.	.	
				.	.	.	
				.	.	.	
				.	.	.	
				.	.	.	

MOTHER (IF PRESENT AT COMPOUND):

Nr of days ill past 2 weeks	Complaints	Treat-ments	Result

Height cm	Weight kg	MAC cm	Remarks
.	.	.	

Is mother pregnant at present? 1. yes 2. no

Codes:

Sex:
1=male
2=female

Treatments:
0=not app.
1=idhi e od thieth
2=ingiewo yath e duka
3=idhi ka ja thieth nyaluo
4=ithiedhe kendi
5=no treatment

Result:
0=not app.
1=ill
2=improving
3=healthy

COMMENTS:

Appendix 2.

FARM SIZE AND LAND USE IN THE LOWER KANO PLAIN (ha)

Farm survey in N.E. and W. Kano locations; 1977, n = 30*

Farm survey in Upper Bwande sub-location, W. Kano location; 1980, n = 53**

FARM TYPES				SIMPLIFIED FARM MODELS		
crop	small	medium	large	crop	Type I with sugar cane	Type II without sugar cane
maize	0.2	0.3	0.2	maize	0.11	0.09
sorghum	0.1	0.2	0.1	sorghum	0.10	0.09
cotton	0.2	0.3	0.5	cotton	0.08	0.08
maize/ sorghum	0.2	0.2	0.6	maize/sorghum/ cotton	0.06	0.03
maize/ beans	0.1	0.2	0.8	maize/beans	0.08	0.04
other	-	0.2	-	sorghum/beans	0.03	0.02
TOTAL CROPLAND	0.8	1.4	2.2	maize/cotton	0.08	0.04
				sugar cane	0.25	-
grazing/ forage	0.4	0.8	1.5	vegetables	0.01	0.01
GRAND TOTAL	1.2	2.2	3.7	TOTAL CROPLAND	0.80	0.40

* no household size indicated

** average household size 5.4 persons; survey based on aerial photographs by which the total cropped area of the area under study was established. This was used to calculate the average cropped area per household unit.

Source: Jaetzold and Schmidt, 1982; Republic of Kenya, National Irrigation Board/Agrar- und Hydrotechnik, 1981.

Appendix 3.

CROP BUDGET PER HA AND AVERAGE FARM BUDGET IN UPPER-BWANDE SUB-LOCATION, WEST KANO LOCATION

Crop	Cropped Area per Family (Ha)	Yield per Ha (kg)	Gross Return per Ha (Ksh)	Costs per Ha (Ksh)	Family Income per Ha (Ksh)	Family* Income (Ksh)	Contribution to Family Income (%)
Maize	0.10	1,800	1,782	643	1,139	114	8
Sorghum	0.10	1,300	800	572	228	23	2
Cotton	0.08	600	1,914	1,262	652	52	4
Sugar Lane	0.13	25,000	3,325	3,286	39	5	< 0,5
Maize/ Cotton	0.06	1,100/ 300	2,046	723	1,323	79	5
Maize/ Beans	0.06	1,400/ 450	2,192	685	1,507	90	6
Sorghum/ Beans	0.03	1,100/ 450	1,483	678	805	24	2
Maize/ Sorghum/ Cotton	0.05	700/ 500/ 200	1,639	698	941	47	3
Vegetables	0.01	-	-	-	7,055	71	5
Livestock	-	-	-	-	-	916	65
	0.62					1,421	100

* Family Income = Net Margin + Family Labour Costs
Source: Adapted from G.O.K, National Irrigation Board/Agrar und Hydrotechnik, 1981

Appendix 4

FARM BUDGET FOR DIFFERENT CATEGORIES OF PADDY CULTIVATORS IN AHERO SCHEME, 1980

	CATEGORY I*			CATEGORY II*			CATEGORY III*		
	costs**	returns	income**	costs	returns	income	costs	returns	inco
rice***	8,340	9,077	737	8,126	12,291	4,165	8,214	17,424	9,21
kale	12	240	228	48	836	788	80	826	74
other food crops	103	177	74	69	166	97	119	691	57
cotton	-	71	71	-	70	70	-	79	7
banana	-	80	80	-	-	-	-	101	10
livestock:									
produce	-	108	108	-	29	29	-	652	65
puddling	-	-	-	-	18	18	-	572	57
TOTAL AGRICULTURE	8,455	9,758	1,298	8,243	13,410	5,167	8,413	20,345	11,93
off-farm income	-	-	378	-	-	81	-	-	
TOTAL	-	-	1,676	-	-	5,248	-	-	11,93

* Categories of farmers: I = yield level under 25% of average
II = yield level in between plus or minus 10% of average
III = yield level above 25% of average

** Costs: excluding family labour costs
Income: excluding illegal sales of paddy

*** Figures based on 1.5 crops per year

Source: Houtman, 1981

Appendix 5.

FARM BUDGET FOR DIFFERENT CATEGORIES OF PADDY AND CANE CULTIVATORS IN WEST KANO SCHEME, 1980*

	CATEGORY I & II			CATEGORY III		
	costs**	returns	income**	costs	returns	income
rice***	6,181	7,714	1,533	6,168	10,098	3,930
non-scheme crops	63	315	252	198	749	551
banana	-	34	34	-	-	-
livestock	-	99	99	-	-	-
sugar cane****	4,091	4,955	864	4,091	4,955	864
TOTAL AGRICULTURE	10,355	13,117	2,762	10,457	15,802	5,345
off-farm income	-	-	1,646	-	-	2,034
TOTAL INCOME	-	-	4,408	-	-	7,379

* Figures refer to the entire holding, i.e. 0.8 ha paddy and 0.8 ha sugar cane.
** Costs: excluding family labour costs;
Income: excluding illegal sales of paddy
*** Figures based on two crops per year.
**** The costs and returns of sugar production per year are estimated for a plant crop of 30 months and two ratoon crops of 18 months each.

Source: Houtman, 1981.

Appendix 6
WEIGHT CONVERSION STANDARDS : RAW FOODS

A. CONVERSION OF VOLUMES INTO WEIGHTS

	volume (cc)	weight (grs)
Beans, dry	1000	785
Cabbage	1000	180
Cassava, flour	1000	610
Cowpeas	1000	785
Fat	1000	880
Fingermillet, flour	1000	610
Fish, dried (omena)	1000	500
Green grams	1000	850
Maize, dry	1000	760
Maize, flour	1000	610
Rice	1000	860
Sorghum, flour	1000	610
Sugar	1000	880
Vegetables, dark leafy	1000	180
Vegetables, light leafy	1000	100

B. CONVERSION OF PORTIONS/PIECES INTO WEIGHTS (GRS)

	SIZE				
	SMALL	MEDIUM	BIG	VERY BIG	STANDARD
Banana, sweet:					
Rabond nyaluo	--	71	103	--	--
Rabond odhigo	--	44	--	--	--
Rabond sit	42	--	--	--	--
Bread:					
loaf	--	--	--	--	484
slice	--	--	--	--	30
Cassava	211	359	517	--	--
Chapati	--	108	--	--	--

Appendix 6B, continued

	SMALL	MEDIUM	BIG	VERY BIG	STANDARD
Chicken:					
chest	--	--	--	--	180
hip	--	--	--	--	65
intestines	--	--	--	--	85
leg	--	--	--	--	32
neck	--	--	--	--	65
shoulder	--	--	--	--	89
thigh	--	--	--	--	70
wing	--	--	--	--	24
Egg	31	38	49	--	--
Fish, piece	7	15	25	--	--
Fish, whole					
dhira	--	80	--	--	--
kamongo	60	--	--	--	--
ngege	60	300	500	--	--
okoko	50	--	--	--	--
opato	25	50	--	--	--
Irish potato	20	35	85	--	--
Lemon	31	37	48	--	--
Mandhasi	35	48	62	--	--
Mango	56	103	178	--	--
Meat	7	15	25	--	--
Orange	35	48	--	--	--
Pineapple:					
whole	480	620	1040	--	--
slice	79	100	135	--	--
Sweet potato	48	74	188	1010	--
Tomato	37	48	66	--	--

Appendix 7

WEIGHT CONVERSION STANDARDS : COOKED FOODS

A. CONVERSION OF VOLUMES INTO WEIGHTS

	volume (cc)	weight(grs)
Eggs	1000	800
Fish, dried*	1000	600
Fish, fresh*	1000	800
Kuon, soft, normal, hard	1000	800
Ndengu	1000	1000
Nyoyo	1000	800
Nyuka, thin, medium, thick	1000	1000
Rice, normal, soft	1000	800
Soup	1000	1000
Tea	1000	1000
Vegetables, aboka, aruda, alunga	1000	840

B. CONVERSION OF COOKED DISHES INTO INGREDIENTS

DISH (1000 grs)	STANDARD INGREDIENTS (grs)		OPTIONAL INGREDIENTS (grs)	
Chapati	cereal flour	=685	--	
	fat, butter	=176		
Eggs	eggs	=950	milk	= 50
	fat, butter	= 50	tomato	= 50
Fish, dried	fish, dried	=521	milk	= 28
	fat, butter	= 20	tomato	= 16
Fish, fresh	fish, fresh	=570	milk	= 28
	fat, butter	= 20		
Kuon, hard	cereal flour	=466	--	
Kuon, soft,normal	cereal flour	=365	--	

* The amounts of fish eaten were usually estimated by means of specific information on type and size, as listed in Appendix 6B. Only when this was not possible, did the respondents estimate the size of the cooked volume.

Appendix 7, continued

DISH (1000 grs)	STANDARD INGREDIENTS (grs)		OPTIONAL INGREDIENTS (grs)	
Mandhasi	cereal flour	=689	--	
	fat, butter	= 98		
	sugar	= 49		
Ndengu	cowpeas + green grams	=215	milk	=136
			fat, butter	= 9
Nyoyo	maize + beans	=500	--	
Nyuka, medium	cereal flour	=107	sugar	= 47
			milk	=189
Nyuka, thick	cereal flour	=132	sugar	= 47
			milk	=189
Nyuka, thin	cereal flour	= 96	sugar	= 47
			milk	=189
Rice, normal	rice	=412	fat, butter	= 9
Rice, soft	rice	=340	fat, butter	= 9
Soup, meat	beef	= 50	milk	=200
			tomato	=219
			fat, butter	= 50
Soup, fish dried	fish, dried	= 50	milk	=200
			tomato	=219
			fat, butter	= 50
Soup, fish fresh	fish, fresh	= 50	milk	=200
			tomato	=219
			fat, butter	= 50
Soup, vegetables	vegetables	= 50	milk	=200
			tomato	=219
			fat, butter	= 50
Tea	--		sugar	= 68
			milk	=158
Vegetables aboka, aruda	vegetables	=666	milk	= 63
			tomato	=185
			fat, butter	= 37
Vegetables alunga	vegetables	=666	milk	= 6
			tomato	= 19
			fat, butter	= 19

Appendix 8
CONSUMPTION OF DISHES

A. Average Consumption Per Day (grs)

	Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
Nyuka	538	503	529	517	432
Kuon	20	81	188	218	272
Rice	5	26	14	44	45
Roots	0	5	24	15	6
Vegetables	10	31	69	77	93
Meat, Fish & Eggs	1	16	15	19	29
Soup	11	49	80	43	54
Milk & Buttermilk	50	25	45	45	21
Tea with Milk	6	74	130	198	73
Tea (without Milk)	-	38	45	80	85
Miscellaneous	7	3	11	13	17
Total	648	851	1150	1269	1127

B. Frequency of Consumption Per Day

(Number of times that the respective dishes were served : total for the day for all children)

	Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
Nyuka	123	167	56	76	70
Kuon	20	104	62	98	117
Rice	3	22	4	17	14
Roots	0	5	3	8	3
Vegetables	11	50	35	56	71
Meat, Fish & Eggs	5	45	23	39	45
Soup	9	60	41	39	45
Milk & Buttermilk	12	9	6	11	5
Tea with Milk	2	28	19	36	15
Tea (without Milk)	0	15	4	17	16
Miscellaneous	12	9	5	13	9
Total	197	514	258	410	410

Appendix 8, continued

C. Portion Size

(Average amount (grs) consumed per meal sitting by children actually consuming the dishes)

	Infants	BF 12+	1yr	2yr	3yr
Nyuka	210	286	350	443	441
Kuon	48	74	112	145	166
Rice	87	112	130	167	232
Roots	0	101	296	123	137
Vegetables	44	59	73	89	92
Meat, Fish & Eggs	13	33	24	32	47
Soup	59	77	72	71	87
Milk & Buttermilk	199	259	275	268	305
Tea with Milk	140	251	254	357	350
Tea (without Milk)	0	241	415	307	381
Miscellaneous	30	46	82	66	177

Appendix 9

Average Intake of Nutrients by Food Group

	Infants (N=48)	BF 12+ (N=95)	1yr (N=37)	2yr (N=65)	3yr (N=72)
A. Calcium (mg)					
Cereals	16	12	13	42	24
Animal Products*	105	142	188	291	237
Vegetables	13	46	109	100	133
Others	2	1	7	5	2
Total	136	201	317	437	397
B. Iron (mg)					
Cereals	1.5	1.9	2.7	3.3	3.5
Animal Products*	0.1	0.5	0.5	0.8	0.8
Vegetables	0.2	0.7	1.7	1.6	2.1
Others	0.0	0.0	0.3	0.2	0.2
Total	1.8	3.2	5.3	5.9	6.6
C. Thiamine (mg)					
Cereals	.05	.07	.08	.12	.14
Animal Products*	.03	.03	.04	.05	.03
Vegetables	.01	.02	.05	.05	.06
Roots & Tubers	--	--	.02	.01	.01
Others	--	--	.01	.00	.01
Total	.09	.13	.19	.24	.26
D. Riboflavine (mg)					
Cereals	.02	.03	.04	.06	.07
Animal Products*	.12	.12	.14	.17	.10
Vegetables	.02	.06	.13	.12	.16
Others	--	--	.01	.01	--
Total	.16	.21	.33	.36	.33
E. Ascorbic Acid (mg)					
Animal Products*	0.8	0.5	0.7	0.8	0.4
Vegetables	1.0	2.2	2.7	7.1	5.5
Roots & Tubers	--	1.3	7.2	4.2	1.6
Fruits	2.4	--	--	0.2	0.4
Total	4.2	4.0	10.6	12.3	7.9

* Includes milk & buttermilk

NOTES

1. Kisumu Municipality and the largest part of Nyakach Division are excluded.

2. This is caused by a narrow belt of falling winds (Jaetzold & Schmidt,1982).

3. According to the Kenya Fertility Survey 1977/78, the Luo with 43 percent of polygamous households rank rather high in natural population growth among the different ethnic groups in Kenya (CBS,1979).

4. The size of the holding refers to the arable land per compound with on average 9.3 residents.

5. These figures include grazing land.

6. Figures are based on major crops and crop mixtures only. In other words, the actual holding size would be larger when minor crops and grazing land are included. Moreover, it should be noted that the actual size of the area under cash crop per holding in the Kano Plain is difficult to establish in view of the prevalence of inter-cropping.

7. Sterkenburg et al. (1982) point out the danger of drawing conclusions on the basis of single visit surveys. Moreover, the authors indicate that their survey took place during a period when rainfall conditions in the Kano Plain were particularly unfavourable for cotton cultivation, and the cotton area was greatly reduced.

8. In 1980, oxen could be hired at a saving of Ksh 50/-- per ha compared to using a tractor. This makes mechanized ploughing desirable (Ital Consult,1981).

9. Cotton seed is provided through the Farm Input Supply Scheme of the Kisumu District Co-operative Union; seed cane is given as 'credit in kind' by the sugar cane co-operatives, and vegetable seeds are usually obtained on the market in Kisumu Town.

10. Luo terms for foods and dishes are presented by Veenstra (1985).

11. Houtman distinguishes three types of farmers according to the yieldlevels they realized during a number of cropping seasons. For Ahero, these were crop 17 to 22, and for West Kano, crop 1 to 7. Farmers with a yield below 25 percent of the average yield level were classified as 'category I' farmers. Those with a yield of plus or minus 10 percent of the average yield level were put in 'category II', and farmers with a yield higher than 25 percent above the average were put in 'category III'.

12. The management subtracts the costs for land preparation and inputs, as well as part of the debt in the case a tenant is indebted to the scheme, from the value of the paddy delivered by the tenant.

13. The sampling method employed was not intended to provide an estimate of the number of non-resident tenants versus resident tenants. In some villages many tenants have left their houseplots while in others only very few have done so. The cluster sampling method used (blocks of adjacent houses in a small number of villages) therefore leads to relatively inprecise estimates of the number of non-resident tenants. Greater precision was not considered necessary as the aim was mainly to include comparable numbers of both resident and non-resident tenants.

14. The results for the adult women are not presented in this report.

15. The actual conversion factors that were used are the following: Adult (1.0); Child, 11-16 years (1.0); Child, 5-10 years (0.8); Child, 0-4 years (0.5). Greer & Thorbecke (1984) suggest different conversion factors to calculate adult equivalents. They also adopt a lower required intake per adult equivalent or consumption unit (2250 Kcal versus 2600 Kcal). Their main argument for choosing different required intakes rests on the lower weights of Kenyan adults and children compared to those used for the WHO estimates. While it is generally accepted that the WHO recommendations may overestimate the actual requirements, it should be pointed out that any argument concerning minimum requirements has a danger of being circular: lower consumption levels are possibly leading to lower weights of the population which then in turn suggest lower minimum energy requirements. A further difficulty is that to estimate the actual requirements several assumptions have to be made regarding the activity levels of the population involved, levels which also depend on the realized energy intake. The position taken here is to use the WHO recommendations which set a minimum requirement to sustain optimal growth and health for the population and then to consider different levels of achieved energy intakes. Therefore, in our discussions, we refer to several cut-off points such as 60 percent of the recommendations (1560 kcal), 80 percent of the recommendations (2080 kcal) and 100 percent (2600 kcal per consumption unit).

16. More detailed calculations take into account the absence of some of the compound residents during certain meals, the occasional visitors partaking in meals, and the various ways in which food is shared. Such calculations, however, require a complex weighting procedure and are not necessary for group comparisons where individual variations tend to average out.

17. The information refers to all residential structures in the compound.

18. These figures reflect average yield levels of 4,250 kg/ha for the N.I.B. tenants and 3,375 kg/ha for the individual rice growers. It

may also be noted that there is a considerable difference between the yield levels at the Ahero and the West Kano Scheme. The tenants at the first scheme realized a yield of more than 3500 kg/ha, at the second scheme this was more than 5500 kg/ha.

19. The farmers' own estimates of the duration of the maize and sorghum stocks, mentioned earlier (Table 5.8), tend to be somewhat higher than the estimates calculated on the basis of the harvest figures. This is because the latter figure indicates the number of days that can be fully covered by the available cereals while the first figure indicates how long the stocks actually lasted, a longer period because in the meantime households also consume purchased foods.

20. The age group of three-year-olds includes two children reportedly still being breastfed.

21. The FAO/WHO recommendations are based on milk or egg protein. The diet of the present group, however, consists of a mixture of animal and vegetable proteins; consequently the protein requirements will be slightly higher.

22. This listing should not be regarded as a strict medical classification. For instance, the child's complaint was recorded to be malaria only when the mother specifically used the vernacular word for malaria. However, other types of complaints may have resulted from malaria as well.

23. Deceased children were only counted in the event that the mother and other siblings were actually resident in the compound at the time of the survey. Children born in the compound, but living elsewhere during the interview were excluded from the calculations. There was evidence of the common tendency to omit children who had died within the first month after birth. In total, 259 children were born during the preceding 24 months, while 22 infants had died during the preceding 12 months.

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