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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

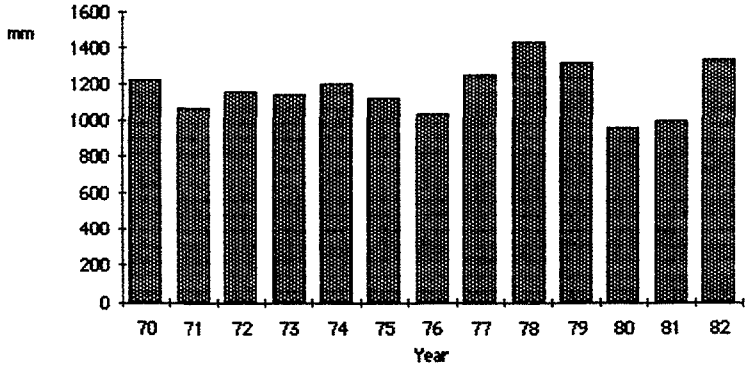
average rainfall quantities over the period 1970 - 1982 do not show important fluctuations (Figure 2.1).

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.

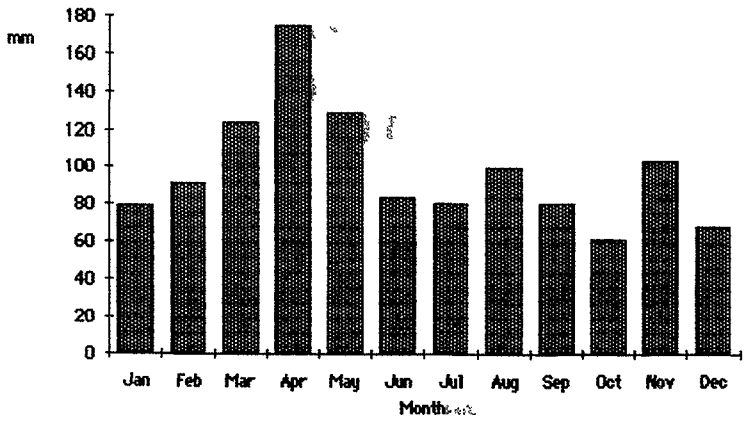
As a result of their limited capacity, the existing rivers in the area are not able to match their high discharges during the wet periods. Consequently, flooding occurs frequently. The sometimes high rainfall during heavy, local, rainstorms in combination with the heavy and impermeable soils with their 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 Kanc 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