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<td>Author 2</td>
<td>MUHAMMAD, A.A.</td>
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<td>Author 3</td>
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THE IMPACT OF KANO RIVER PROJECT ON LOCAL FARMERS: 
A Case Study of Kadawa Irrigation Scheme

by

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ABSTRACT

A study was undertaken in the Kano River Project (Kadawa Irrigation Scheme), to assess the effectiveness of land and water management, of yield of some major crops grown (rice and wheat), and the socio-economic impact of the project on the local farmers. It was found that, weeding, fungicides and pest control, due to poor land and water management practices are the major problems affecting the productivity of the area. The yield of the major crops (rice and wheat) grown in the area are found to be fluctuating in Kadawa and chionawar areas, while they are fairly stable in Kofa and Kauri areas, in a period of five years from 1991 to 1995. Extremes of the scheme to cover a wider area, crop rotation including a fallow period, proper maintenance of irrigation and drainage channels, adopting sub-surface drainage, use of organic wastes as manure in place of inorganic, and provision of social services, to encourage education among children as well as adult education among farmers are highly recommended for the sustainability of agricultural production under the scheme.

1. INTRODUCTION

Irrigation means artificial watering of crops. With regards to cultivated lands, it could be said to be the process of artificially supplying water to soil, for raising crops in areas where total rainfall is either insufficient or ill-timed. It involves the harnessing and controlling of water resource for the benefit of agriculture (Kaushe dani and Mandhar, 1984).

Irrigation projects are not as universal a blessing. They have, as everything else, their dark side. As the climate becomes older and dumber, in and places, this will be an advantage, but in places which are already damp and cold, it is a nuisance. Careless irrigation may lead to creating flood breeding places for malaria vectors. Over-irrigation may lead to waterlogging of areas with poor drainage and cause efflorescence due to the deposition of soluble salts.

The Kano River Project (KRP), a v.v.i irrigation scheme covering approximately 230,000 acres width of Kano city, comprises the 150,000 acres Kano project Area proper (KPA) and the Extension Project Area (EPA) of 100,000 acres net. The project was initiated in 1970, when the Kano State Government constructed a dam on the Lafia River at Tiga. The project included the implementation of all technical and social activities required to derive full benefit from the stored water. It also the development of large-scale irrigation works. The project included extension services to farmers, a livestock program, and rural development (NEDCO, 1974).
1. Introduction

Irrigation means artificial watering of crops. With regards to cultivated lands, it could be said to be a process of artificially supplying water to soil, for raising crops in areas where the total rainfall is either insufficient or ill-timed. It involves the harnessing and controlling of water resources for the benefit of agriculture (Khushalani and Manohar, 1984).

Irrigation projects are not an unmixed blessing. They have, as everything has, their dark side:

(i) The climate becomes colder and damper; in arid places, this will be an advantage, but in places which are already damp and cold, it is a nuisance.

(ii) Careless irrigation may lead to creation of breeding places for mosquitoes.

(iii) Over-irrigation may lead to waterlogging of areas with poor drainage and cause efflorescence due to the deposition of soluble salts.

The Kano River Project (KRP), a vast irrigation scheme covering approximately 230,000 acres south of Kano city, comprises the 130,000 acres Kano Project Area proper (KPA) and the Extended Project Area (EPA) of 100,000 acres net. The project was initiated in 1970, when the Kano State Government constructed a dam in the Kano River at Tiga. The project included the implementation of all technical and social activities required to derive full benefit from the stored water. Besides the development of large-scale irrigation works, the project included extension services to farmers, a livestock programme, and rural development (NEDECO, 1974).

Tiga dam provides domestic water supply to Kano municipality and to most of the villages located within and around the
irrigation network. The dam provides irrigation water to Hadejia and to areas as far as Nguru and Gashua in Borno and Yobe States, respectively. Prior to the project, farmers in these areas cropped their land once in a year. With irrigation development, the farmers now crop their land twice in a year. The traditional food crops are grown during the rainy season while during the dry season cash crops such as wheat, tomatoes and vegetables are grown (Dauda, 1987). Irrigation development affected the farmers' rainy season crops, in that long-season crops such as guinea corn had to be replaced with early maturing crops such as millet, maize, groundnut, etc. This allows early harvesting of rainy season crops in order that dry season crops can be planted in October/November. Due to the intensive cropping, several tons of salt in the form of fertilizer are being added to the soil each year, in addition to intensive and uncontrolled use of irrigation water, resulting to several soil and water management problems (Dauda, 1985; Singh and Maurya, 1979).

This study had the following objectives: (1) to assess the effectiveness of land and water management at the Kano River Project; (2) to assess the yield of some of the crops grown; and (3) to assess the socio-economic impacts of the Kano River Project especially on the farmers.

2. The Kano River Project

2.1. Location and Climate of the Area

The Kano River Irrigation Project (KRIP) lies between 8° 30' E - 90° 40' E and 11° 30' - 12° 03' N in the savanna zone of Nigeria. The project area receives about 660 mm (long term mean) of annual rainfall between May and September, the rest of the year being dry. Long-term monthly maximum air temperature during
the dry period varies from 26 to 36°C, and minimum from 12 to 19°C. Three seasons can be distinguished in northern Nigeria (NEDECO, 1976), namely: a cool dry season from October to February; a hot dry season from March to May; and a warm rainy season from June to September. The main crops that can be grown in the 3 seasons are wheat, potatoe, onions, tomato and vegetables in the cool dry season; maize, onion, cowpea and rice in the hot dry season; and cotton, groundnut, maize, millet, rice and guinea corn in the warm rainy season.

2.2. Soils of the Project Area

The Kano River Irrigation Project is a part of a dissected featureless peneplain developed on the crystalline pre-cambrian rocks of a basement complex. Dominant rock types are granites, gneisses, schists, gimmer schists and quartzites. Veins of pegmatic, aplite and quartz are found frequently (NEDECO, 1974). The soils of the area have been classified according to their physiography as follow (NEDECO, 1974): (1) Soils of the upland plain - well drained, deep, loamy soil, sloping topography; (2) Soils of the higher terrace - well drained, deep, loamy sand, sloping topography; and (3) Soils of the lower terrace - moderately to poorly drained, deep, loamy sand, irregular topography.

In general about 90 percent of the land suitable for irrigation is well drained loamy sand of various depths over laterite or bottom rock, often more than one meter deep, while the remaining 10 percent is poorly drained sandy loam over an impervious clay loam. Fig.1 shows the land forms on schematic cross-sections of the project area, after NEDECO (1974).
3. Soil and Water Management Problems

3.1. Waterlogging and Groundwater Table Build-up

Soils saturated with water are said to be waterlogged. Conditions which lead to waterlogging of the soil include seepage from irrigation canals, rise of the groundwater table due to excessive irrigation, presence of impermeable layers in the soil profile, and areas of low relief adjacent to or surrounded by areas of relatively high relief which usually receive water from these surrounding areas. According to Mudia and Dalhat (1994), high watertable conditions develop due to sub-optimal irrigation practices which arise from lack of drainage facilities, seepage losses from canals and excessive water application to fields.

Maurya and Sachan (1985) reported a groundwater survey conducted between 1966 and 1967 in the Kano River Project Area, which showed that the watertable was below a depth of 1.5 m from ground surface during the rainy season, prior to irrigation development. However, a similar study conducted from 1979 to 1984 shows high watertable conditions in the area, Fig.2. The high watertable (30 – 40 cm below soil surface) severely affected the maize crop during the rainy season. The yield from dry season wheat crop under high watertable conditions was half of the yield under low watertable conditions, Maurya and Siewierski (1984).

Nwa (1980) reported that the Kadawa Irrigation Project had been facing waterlogging and salinity problems due to increasing watertable rise. Also, Nwa (1982) found that high watertable conditions had become a problem in the Kadawa sector of the project within seven years of continuous irrigation. The watertable rose to within 80 cm below the ground surface at the peak of the rainy season, and within 40 cm of the soil surface during the irrigation season. As a result, crop failures have
been reported in the area. According to Mudziare and Muhammed (1987), the general trend has been a continuous rise in the watertable over the years at the Kadawa sector of the project.

3.2. Soil Salinization

Allison (1962) conducted a soil salinity survey for proposed irrigation schemes in Northern Nigeria. Kano River water was classified in the lowest USDA salinity and sodium classes. On the poorly drained soils of the Kano River area, salt concentration was reported to rise due to low permeability of the subsoil and high evaporation demand (Maurya, 1982).

The results of 4 years of field and lysimeter studies under varying watertable conditions in the Kano River Irrigation Project show that high watertable have gradually increased soil salinity, Fig.3 (Maurya and Sachan, 1985). Reducing irrigation frequency can help to decrease the excessive build up of salts in the root zone. However, with soil salinity already high, frequent irrigation is necessary to reduce the salinity level in the root zone. This dilemma can be resolved only by the installation of an artificial drainage system.

4. Case Study Methodology

During the course of this study, data was obtained by the use of a questionnaire, personal interviews with farmers and agricultural extension staff of the Kadawa Irrigation Scheme, observations and field survey. One hundred copies of the questionnaire were distributed to randomly selected farmers at Chirosawa, Kadawa, Kura and Karfi villages of the Kadawa Irrigation Scheme.

Most of the farmers selected could not read and/or write in
English. The questionnaire had to be interpreted to them and the answers were recorded on the spot. Personal interviews with farmers and agricultural extension workers were also conducted along with the administration of the questionnaire, a copy of which is given in Appendix I.

Observations were also made of the fields with respect to water channels, water application and control.

The data collected were subjected to simple analyses, such as percentages, means/averages and histogram plotting.

5. Results and Discussion

The results of the study are given below. A general information on the villages visited is given in Table 1, and some of the crops grown in the area are shown in Table 2.

Table 1: Descriptive Features of Four Villages in Kadawa Irrigation Scheme

<table>
<thead>
<tr>
<th>Villages</th>
<th>Chironawa</th>
<th>Kadawa</th>
<th>Kura</th>
<th>Karfi</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Respondents</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Gender Profile</td>
<td>Male 100%</td>
<td>Female 0%</td>
<td>Male 100%</td>
<td>Female 0%</td>
</tr>
<tr>
<td>Family size</td>
<td>Extended</td>
<td>Extended</td>
<td>Extended</td>
<td>Extended</td>
</tr>
<tr>
<td>Farm size</td>
<td>51, 1-5 acres</td>
<td>51, 1-4</td>
<td>51, 1-8</td>
<td>51, 1-6</td>
</tr>
<tr>
<td>Type of farming</td>
<td>Rainfed &amp; Irrigation</td>
<td>Rainfed &amp; Irrigation</td>
<td>Rainfed &amp; Irrigation</td>
<td>Rainfed &amp; Irrigation</td>
</tr>
<tr>
<td>Farm operation</td>
<td>Semi</td>
<td>Semi</td>
<td>Semi</td>
<td>Semi</td>
</tr>
</tbody>
</table>

Types of farming: Rainfed & Irrigation.
Table 2: Some of the Crops Grown in Kadawa Irrigation Scheme

<table>
<thead>
<tr>
<th>Crop</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chiromawa Kadawa</td>
</tr>
<tr>
<td>Sorghum</td>
<td>b</td>
</tr>
<tr>
<td>Maize</td>
<td>c</td>
</tr>
<tr>
<td>Millet</td>
<td>b</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>c</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>c</td>
</tr>
<tr>
<td>Wheat</td>
<td>a</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>b</td>
</tr>
<tr>
<td>Rice</td>
<td>a</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>b</td>
</tr>
</tbody>
</table>

Legend:  
- a = grown by > 60% of the farmers  
- b = grown by 30-50% of the farmers  
- c = grown by < 30% of the farmers

Many of the randomly selected farmers had no western education, which made it difficult or almost impossible for them to keep records of production. About 67% of the respondents attended Quranic schools, 25% higher schools and 8% attended adult education classes, see Table 3 below.

Table 3: Level of Education of Respondents

<table>
<thead>
<tr>
<th>S/N</th>
<th>Educational Level</th>
<th>Respondents</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quranic/Primary school</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>2</td>
<td>Higher school</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Adult literacy class</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Survey, 1996

Table 4: Farmers' Occupational Level

<table>
<thead>
<tr>
<th>S/N</th>
<th>Occupational level</th>
<th>Respondents</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full time</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>Part time</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Survey, 1996.
From Table 4 it can be seen that full-time farming is dominant even though there were a lot of complaints on the high cost of production within the area. Also, from Table 5 it is clear that a greater number of the farmers owned the land. The types of irrigation system commonly used by the farmers are basin, border strips and furrow for rice, wheat and tomato respectively. The frequency of irrigation depends on the crop, stage of development, soil characteristics and weather conditions. The farmers irrigate their crops when they observe (through digging the soil with their fingers and squeezing it) that the soil moisture is low. As for the quantity of water applied, it depends on the irrigation method being used. In the basin method, the farmers make sure that each basin is filled up with water, one after the other, and in the border strip or furrow method, each strip or furrow is flooded with water.

According to the farmers, excess water from the farm is drained through drainage ditches, but the ditches are now blocked by weeds and litter of trees and shrubs due to lack of maintenance. Therefore, instead of the excess water draining out it remains on the farm resulting to soil waterlogging.

Irrigation water supply from the reservoir is controlled by extension agents of the Hadejia Jama'are River Basin Development.
Authority (HJRDBA). But irrigation water from the main canal to the field is absolutely under the control of farmers, by opening the gates as required. It was observed that some farmers were of the habit of breaking field channels, instead of using a syphon, to irrigate their farms. This contributed to seepage losses and waterlogging of the farms.

Maintenance of soil fertility is one of the major problems facing the farmers due to continuous cropping (twice every year, i.e. wet and dry seasons) without a fallow period. There is a high level of fertilizer application on farms. The types of fertilizer commonly used by the farmers are single superphosphate, NPK and urea, Table 6.

Table 6: Average Rate of Fertilizer Application at Kadawa Irrigation Scheme

<table>
<thead>
<tr>
<th>Village</th>
<th>SPP</th>
<th>NPK</th>
<th>Urea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiromawa</td>
<td>250</td>
<td>400</td>
<td>250</td>
</tr>
<tr>
<td>Kadawa</td>
<td>250</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>Kura</td>
<td>250</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>Karfi</td>
<td>250</td>
<td>450</td>
<td>300</td>
</tr>
</tbody>
</table>

Source: Field Survey, 1996.

The average rice and wheat yields of randomly selected farms in the four villages of Kadawa Irrigation Scheme are shown in Figs. 4 and 5, respectively. It can be seen that the yield of rice at Chiromawa decreased gradually from 1991 to 1994, ranging between 3.14 and 2.39 tons/ha, but rose sharply in 1995 to 3.3 tons/ha. The rice yield at Kura decreased gradually from 1991 to 1995 ranging between 3.96 and 3.5 tons/ha. At Kadawa, the rice yield fluctuated in the range of 3.19 to 2.43 tons/ha, while at Karfi it was fairly stable at about 3.55 tons/ha.
Similarly, from Fig. 6, the average wheat yield at Chiromawa remained fairly stable from 1991 to 1994, ranging between 1.26 to 1.33 tons/ha, and rose sharply in 1995 to 1.86 tons/ha. The yield of wheat at Kadawa indicated a fluctuating trend similar to the yield of rice at the same location. The yield at Kura depicted a fairly stable pattern from 1991 through 1995, ranging between 1.6 and 1.7 tons/ha, with a slight increase to 1.8 tons/ha in 1995. The yield at Karfi was the most stable during the years ranging from 1.75 to 1.8 tons/ha.

The yield variations can be generally attributed to the following:

1. Untimely and inadequate supply of inputs (e.g. improved seeds, fertilizers, etc.) to the farmers of the area.
2. Soils of Karfi and Kura are more fertile than soils of Kadawa and Chiromawa villages; this accounts for the yields of rice and wheat at Kura and Karfi being higher and more stable over the years.
3. Soil salinity problems were found to be more in Kadawa and Chiromawa villages than in Karfi and Kura.
4. Finally, because Karfi and Kura are an extension of the Kadawa Irrigation Scheme, the soils were brought under irrigation more recently. Thus, both the problems of soil salinity and loss of natural fertility were relatively less than those at Kadawa and Chiromawa.

According to the farmers interviewed, some of the major advantages of the Kano River Project (Kadawa Irrigation Scheme) are: (1) increased farmer's per-capita income; (2) reduced unemployment; (3) family self-sufficiency in food production; and, (4) general improvement in farmers' living conditions. The
following major disadvantages were also indicated: (1) decline in education of farmers' children and in adult-education of farmers - a social consequence of the scheme; (2) reduced fertility and increased salinity of the soil; and, (3) environmental health problems due to the inadvertent creation of breeding grounds for mosquitoes and other pests.

6. Conclusion

It is noteworthy that the per-capita income of farmers in the command area of the Kadawa Irrigation Scheme has greatly increased. The scheme provides employment, family self-sufficiency in food production, as well as improved living conditions to the farmers. However, continuous cropping throughout the year without crop rotation, falling, and application of manure (organic fertilizer) have tended to exhaust soil fertility in the area. Lack of proper use/maintenance of irrigation and drainage channels have caused waterlogging in the soil of the greater part of the area under the scheme. This, together with a high level of fertilizer application by farmers, have resulted to salinization of soils in the area. Also, this study reveals that formal education of farmers' children, as well as adult-education of the farmers themselves, have tended to decline as a social consequence of the scheme.

For the sustainability of agricultural production under the scheme, the following are highly recommended: (1) extension of the scheme to cover a wider area; (2) crop rotation including a fallow period; (3) proper maintenance of irrigation and drainage channels; (4) installation of subsurface drainage systems; and, (5) the use of organic manure in place of fertilizers. Social services to encourage formal education in the farming community.
are also recommended.

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Hadejia Jama'are River Basin Development Authority (1987). Brief on the activities of Hadejia Jama'are River Basin Development Authority, Kano, pp.4-5.


Fig. 1 Schematic cross-sections.

Fig. 2 Mean Groundwater table fluctuation at Kadawa Research Farm

(Maurya and Sachan, 1985)
Fig. 3 Mean electrical conductivity of saturation extract during 1983 and 1984 under high and low-water table at Kadawa Research Farm.

Fig 4: Average Rice Yield of Randomly Selected Farms in the Four Villages of Kadawa Irrigation Scheme.
Fig 5: Average Wheat Yield of Randomly Selected Farms in the Four Villages of Kadawa Irrigation Scheme.
## THE IMPACT OF KANO RIVER PROJECT ON LOCAL FARMERS
### (A CASE STUDY OF KADAWA IRRIGATION SCHEME)

### QUESTIONNAIRE:

The objective are to:-

1. Assess land and water management at the Kano River Project.
2. Assess the yield of some crops grown.
3. Assess the socio-economic impacts of the Kano River Project especially on the local farmers.

**Code Number: ..................  Date: ..................**

**State: .................. L.G.A.: ..................**

1) Farmer's name: ..................

2) Sex (Male / Female): ..................

3) Age group (25, 26-35, 36-45, 46-55, >55): ..................

4) Family size: ..................

5) Full time / Part time farmer: ..................

6) Number of household that work in the field: ..................

7) Was the field visited? YES / NO: ..................

8) Educational level: (a) None (b) Quranic/Primary School (c) Higher school; (d) Adult literacy class

9) Land tenure: (a) Owner; (b) Tenant; (c) Both; (d) Others

10) Farm size: ..................

11) Crops grown: ..................

12) How long have you been cultivating such crops: ..................

13) Land preparation method: (a) Manual; (b) Semi-mechanized (c) Fully mechanized (d) Others

14) Types of irrigation system: (a) Furrow (b) Basin (c) Border strip (d) Others

15) Number of irrigations / week: ..................

16) How do you drain excess water?: ..................
17) Who controls the irrigation water?

18) Water charges:

19) How do you maintain soil fertility?

20) What type of fertilizer do you apply?

21) What is the rate of fertilizer application?

22) Yield revenue:

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield / Acre</th>
<th>Crop Revenue (N)</th>
<th>T/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23) What is the farmer's production level?
   (a) Home consumption
   (b) Commercial production
   (c) Both

24) What, in your opinion, are the advantages and disadvantages of the Kano River Project?