

Promoting Agricultural Resource Use and Farm Income Through Small-Scale Irrigation: A Case Study in Sokoto State

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Abstract

The role of small-scale irrigation in promoting agricultural resource use and farm incomes was examined. Analysis of the data collected from 50 randomly selected fadama farmers in the Kwalkwalawa area of Sokoto State revealed that small-scale pump irrigation has increased the utilization of agricultural resources, particularly land and labour, which would have probably remained idle, during the dry season. The farmers also obtained an average net farm income of N20,962.48/ha with a rate of return on investment of 132%. Crops grown by the respondents included onion, tomato, pepper, okra, sweet potato, rice and to a limited extent, wheat. Considering the fairly high financial returns obtained by the farmers, it was suggested that more farmers should be encouraged to participate in small-scale irrigated farming.

Introduction

Water is one of the most important requirements for plant growth. Unfortunately, rainfall, the most important source of agricultural water, is limited in amount and duration in most parts of the far north. This is particularly true for Sokoto State where annual rainfall could fall below 700 mm with a duration of five months (June to October) or less. During the remaining months of the year, land and other agricultural resources are virtually idle except where irrigated farming is practised. Low level of utilization of agricultural resources in some periods of the year certainly limits their capacity to generate income to rural farmers on a continuous basis. Irrigation development is seen, therefore, as one of the most important strategies for alleviating this constraint.

Irrigation farming in Nigeria, particularly in the fadama (low-lying land near river, stream or pond) has been in existence since the 9th century A.D. (Erhabor, 1986). Government involvement in irrigation development would, however, seem to be much more recent, dating back to 1918 when flood waters were impounded from Sokoto and Rima Rivers for irrigation. Thereafter, a number of irrigation projects have been established by governments at both federal and state levels. Most of the government-established irrigation schemes are large-scale projects which are often established with little prior involvement of farmers or landholders and are usually managed by a structured government organization on behalf of the resettled small-holders. Such projects are also usually capital-intensive and involve complex foreign technologies (Idachaba, 1980; Baba, 1993). More importantly, the development of large-scale irrigation schemes have failed to meet the expectation of expanding food production in Nigeria. It has, therefore, been suggested that irrigation development planners should pay more attention to the improvement of small-scale irrigation schemes which require simple technology, low capital investments and application of proven indigenous knowledge.

In apparent recognition of their potentials, attention appears to be shifting to the development of small-scale irrigation schemes. In Sokoto state, the Sokoto Agricultural Development Project (SADP) is the agency mainly responsible for small-scale irrigation development. The small-scale irrigation strategy in the state appears to be based on the distribution of motorised pumps to farmers at subsidised rates for lifting water to irrigate fadama lands either from open surface water, open wells, or tube-wells. The new technology is being introduced to replace the traditional small-scale irrigation devices such as the shadouf, buckets and calabashes which, though associated with fairly high returns to crop production (Orewa, 1978; Erhabor, 1982; Baba, 1993), are considered inadequate for the needed expansion in food production through irrigation.

One of the areas receiving concerted attention in small-scale irrigation development in the State is the Kwalkwalawa fadama lands located on the flood plains of the confluence of the Sokoto and Rima Rivers. The

objective of modern small-scale irrigation development in the State is apparently to achieve increased farm resource utilization during the dry season as a way of enhancing farm income of rural farmers. This study evaluated the extent to which this objective is being achieved, using the Kwalkwalawa fadama area as a case study.

Methodology

The study was conducted between October 1994 and January 1995 in the Kwalkwalawa area, in Wamakko Local Government Area of Sokoto State. Situated in the Sudan savanna ecological zone, the area receives an annual rainfall of less than 700 mm. The area is, however, endowed with fadama lands found along the plains of the Sokoto and Rima Rivers. In fact, the Kwalkwalawa settlement itself is located almost on the confluence of the two Rivers.

A total of 50 farmers using irrigation pumps to produce mainly vegetable crops (onion, tomato, and pepper) were randomly selected in the study area. Data collection was accomplished through weekly interviews using structured questionnaires. Data were collected on resource use as well as on costs and returns in crop production under this irrigation system. The collected data were analysed using descriptive statistics and farm budgeting technique.

Results

Resource use

Land

The analysis of land use reveals that a total of 28.8 ha were cultivated by all the respondents and the individual plot sizes ranged from 0.13 ha to 1.5 ha with a mean of 0.58 ha. Table 1 shows the distribution of respondents according to farm size. As can be seen from the table, majority (96%) of the farmers cultivated less than 1 ha while only 4% cultivated above 1 ha. This indicates that majority of farmers in the study area were small holders.

The distribution of respondents according to method of land acquisition presented in Table 2 shows that inheritance and borrowing were the major methods of land acquisition. It would appear that dependence mainly on inheritance has caused fragmentation of land holdings. The evidence of sub-division of holdings and fragmentation could be seen in Table 3 which shows that only 26% of the respondents owned one plot; the majority (74%) owned between two and five plots.

Table 1: Distribution of respondents according to farm size

Farm size range (ha)	Number of respondents	Percentage
0.11-0.25	11	22
0.26-0.40	6	12
0.41-0.55	11	22
0.56-0.70	4	8
0.71-0.85	8	16
0.86-1.00	8	16
>1.00	2	4
Total	50	100

Table 2: Distribution of respondents according to method of land acquisition

Method of acquisition	Number of respondents	Percentage
Inherited	35	70
Borrowed	15	30
Hired	0	0
Gift	0	0
Total	50	100

Source: Field survey, 1994/95

Table 3: Distribution of respondents according to number of plots

Number of plots	Number of respondents	Percentage
one	13	26
Two	11	22
Three	15	30
Four	6	12
Five	5	10
Total	50	100

Source: Field survey, 1994/95

Labour

Farmers in the study area utilised both hired and family labour. The level of labour use according to farm operations is presented in Table 4. The table reveals that a total of 300.83 man-days/ha of labour input were used. Hired labour accounted for 55.82% of total labour input, while family labour contributed 44.18%.

Capital

The analysis of capital inventory in the study area reveals that the farmers utilised both durable and non-durable capital. The durable capital included pumps, hoes and cutlasses. All respondents owned cutlasses and hoes which were used for manual operations. While 52% of the respondents owned the pumps they used, the remaining 48% borrowed from neighbours at no cost.

The non-durable capital inputs employed in the study area included fertilizer, pesticides, seeds, fuel and lubricants. Table 5 shows the distribution of farmers according to fertilizer use. As depicted in the Table, 94 % of the respondents used 500 kg of fertilizer per hectare or less, while the remaining used more than 500 kg/ha. The average fertilizer input was 243 kg/ha.

All the respondents in the study area spent money on petrol for the water pumps but only those who owned pumps bought lubricants. Although 74% of the respondents used pesticides, none indicated using herbicide. In the study area, materials used for planting and transplanting were obtained locally from the market or neighbours. None of the respondents used improved variety of planting material. The vegetable

seeds were either planted directly in the field or raised on nursery beds before transplanting to the field.

Water for irrigation was pumped directly from the Rima and Sokoto Rivers, through small petrol pumps. Even distribution of water was achieved through repeated opening and closing of series of water channels.

Table 4: Family and non-family labour input by operations (man-days/ha)

Operation	Family	Hired	Total	% of total
Nursery	10.50	4.80	15.30	5.09
Land prep.	8.50	67.13	75.63	25.14
Planting	16.40	46.03	62.43	20.75
Watering	52.84	0.00	52.84	17.56
Weeding	15.30	29.86	45.16	15.01
Harvesting	12.86	20.09	32.95	10.95
Others	16.52	0.00	16.52	5.49
Total	132.92	167.91	300.83	100.00

Source: Field survey, 1994/95

Table 5: Distribution of farmers according to level of fertilizer use (kg/ha)

Level of fertilizer	Number of respondents	Percentage
101-200	22	44
201-300	17	34
301-400	5	10
401-500	3	6
>500	3	6
Total	50	100

Source: Field survey, 1994/95

Cropping Systems

Farmers in the study area practised both mixed and sole cropping. Table 6 shows the distribution of farmers according to type of crops cultivated. As shown in the table, 52% of the respondents combined onion, pepper and tomato on the same farm land, while two per cent grew pepper, cassava and tomato together. Another 20% combined onion, okra and potato. Rice and Wheat were grown sole by 24% and two per cent of the respondents, respectively.

Table 6: Distribution of respondents according to crops grown

Crop	Number of respondents	Percentage
Onion/pepper/tomato	26	52
Pepper/cassava/tomato	1	2
Onion/okra/potato	10	20
Rice	12	24
Wheat	1	2
Total	50	100

Source: Field survey, 1994/95

Costs and Returns

The total cost of production, as indicated in Table 7, was N15,826.80/ha. The table further reveals that variable costs accounted for 97.97% of the cost of production, while fixed cost accounted for only about two per cent.

Table 7: Cost structure in small-scale irrigation (N/ha)

Cost items	Average cost	Percentage
Variable cost		
Seed	1,324.55	8.37
Fertilizer	1,497.94	9.46
Chemical	599.17	3.79
Pump repair	904.02	5.71
Fuel	2,217.33	14.01
Labour	8,547.85	54.01
Marketing	413.89	2.62
Total variable cost	15,504.75	97.97
Fixed cost		
Depreciation on pump	250.59	1.58
Depreciation on farm tools	71.46	0.45
Total fixed cost	322.05	2.03
Total cost	15,826.80	100.00

Source: Field survey, 1994/95

The average gross income realized was N36,467.03/ha, while the net income was N20,962.23/ha. The average rate of return on investment was 132%, which implies that a return of N1.32 was realised on every naira invested. Table 8 shows the distribution of farmers according to net farm income. The table reveals that only six per cent of the respondents produced at a loss; the remaining 94% realised between N1.00 and N35,000.00, or above, as profits.

Table 8: Distribution of respondents according to net farm income (N/ha)

Net farm income range	Number of respondents	Percentage
<0	3	6
1-5,000	4	8
5,001-10,000	9	18
10,001-15,000	13	26
15,001-20,000	3	6
20,001-25,000	7	14
25,001-30,000	1	2
30,001-35,000	3	6
>35,000	7	14
Total	50	100

Source: Field survey, 1994/95

Discussion

Resource Use

The analysis of land under cultivation in Table 1, revealed that the farmers in the study area were small-scale producers cultivating mostly less than one hectare. Land tenure is mainly by inheritance with a few farmers also using borrowed plots. The system of land tenure by inheritance encourages fragmentation and sub-division of land holdings. The principal economic effect of this, as Araka (1990) pointed out, is a potential reduction in the efficiency of labour due to movement from one plot to another. At the same time, land improvement and conservation measures may be hampered owing to the need for cooperation among neighbours. The lack of use of mechanical equipment for land cultivation in the study area may also be partly explained by the small sizes of farm holdings.

Furthermore, the fact that the system of acquisition is mainly by inheritance and borrowing means that there is no commercial transaction in fadama land. This may present difficulty to an "outsider" who may wish to acquire land in the area. Nevertheless, the results have shown that the 50 farmers studied jointly cultivated almost 30 ha which would have most likely remained fallow without small-scale irrigation in the area.

The analysis also revealed that hired labor constitutes a major source of labour input for farm activities. The implication of this is that small-scale irrigation has not only increased the use of family labour but has served as a source of employment to others who would have been idle during the dry season. This is significant in terms of rural income and commercial activities, through its multiplier effects. Those who obtain income either as farmers or labourers will spend such income, which will constitute income to others who will also spend it, and so on.

Investment in durable capital goods in the study area is generally low. This may be due to lack of fund

which all the respondents identified as a major constraint to farming in the area. It is this shortage of funds that probably compelled 48% of the respondents to borrow pumps instead of purchasing pumps for themselves. Undoubtedly, personal ownership of a pump will give the farmer the necessary flexibility in terms of control of timing of water application which could, in turn, have positive impact on yield and returns.

All the respondents in the study area used inorganic fertilizers. Seventy per cent of them, however, complained of the inadequate supply of the commodity. It is probably the inadequate supply that accounted for low level of utilization of the commodity (see Table 5). For instance, the average application of fertilizer was 243 kg/ha which falls far short of the recommended 500 kg/ha for vegetable crops in the fadama (AERLS, 1985). It would seem, therefore, that increased accessibility to the commodity could increase returns to small-scale irrigation.

Most of the respondents in the study area purchased seeds of different crop varieties directly from the market or neighbors, while few raised seedlings on nursery beds. None of the respondents used improved varieties of crops grown. Most of the farmers demonstrated a lack of knowledge of where to obtain improved seeds, notwithstanding the fact that there were at least, two farm service centers within 10 km radius of the location of the fadama. This may be an indication that the Sokoto State Farmers' Supply Company which operates the centres is not making much impact. The use of improved seeds could increase yield and returns in the area.

Again, most of the respondents used pesticides to control pests on their farms. The quantities used, however, were generally inadequate, a problem which the farmers attributed to the high cost of the chemicals. No farmer indicated using herbicide. All weeding was done manually using hoes. Apart from the cost, a possible reason for non-use of herbicides may be the high supply of labour. Small-scale irrigation farming is undertaken in the dry season when most of the labour force is free, making it easy for the irrigation farmers to obtain enough supply of hired labour. This again is an indication that fadama farming makes good use of slack labour and confirms the assertion that fadama farming complements rather than competes, with upland (rain fed) agriculture (Singh, 1982).

There was evidence of over-supply of water in the study area. While most of the farmers tried to control water application by pumping the amount of water considered necessary, these efforts were thwarted by sudden releases of water up-stream from the Bakolori and Goronyo Dams. This caused over-flooding of most plots in some parts of the season. The danger of over-flooding is that it causes water-logging and accumulation of excess salt in the root zone and reduces yields and returns.

Costs and Returns

The farm budgeting analysis revealed that nearly 98% of total cost of production incurred by all the respondents was accounted for by variable costs. This finding is in agreement with those of Ofojekwu (1982), Makarfi (1985) and Baba (1989) who in separate studies found variable costs accounting for 99.44%, 99.4% and 99%, respectively, of total cost under small-scale irrigation. Fixed costs accounted for only about two per cent. This may be an indication that fixed capital investment in the study area is low.

Among the variable costs, the cost of labour input alone constituted 54.01% of the total cost of production. This suggests that labour input is the most costly single item in crop production in the area. This, again, is in agreement with the findings of Baba (1989). In his study, in Bauchi State, labour input constituted 67.77% of the total cost of production under small-scale irrigation.

The net farm income in the area was fairly high, with the rate of returns to investment reaching 132%. This indicates that vegetable farming during the slack period of dry season is highly profitable and has great potentials for increasing rural income.

Conclusion and Recommendations

Majority of farmers producing crops under pump irrigation system in the study area realised profits. This reveals that small-scale pump irrigation system is profitable and has increased income of farmers. Therefore,

given adequate attention, the available rural resources during the slack period of dry season could be gainfully employed through the promotion of widespread adoption of small-scale irrigation.

One of the major problems encountered by farmers during the season was over-flooding caused by sudden release of water up-stream from Bakolori and Goronyo Dams. A more cautious release of water is suggested, in the future.

To improve accessibility to improved inputs such as fertilizer, pesticides and institutional credit, farmers in the study area, should be encouraged to form fadama users' associations. The adoption of such inputs could further be enhanced through a more effective extension service, particularly in view of the fact that some of the farmers interviewed demonstrated a lack of awareness of some of the improved inputs.

Finally, to sustain small-scale irrigation, continuous monitoring of its environmental impact is essential.

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