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THE IMPACT OF MODERN SMALL-SCALE IRRIGATION ON RESOURCE USE AND FARM INCOMES IN WURNO AREA OF SOKOTO STATE.

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Abstract

Emphasis on irrigation development in Sokoto state appears to be shifting towards small-scale irrigation. In the Wurno area and some other parts of the state, rural farmers are being encouraged to adopt tube-well and pump irrigation technologies, as modern substitutes to the traditional devices such as shadouf, calabash, and buckets. This study evaluates the impact of the new technologies by comparing resource use and farm incomes of farmers using pumps with those using the shadouf. Forty-eight farmers were randomly sampled in the Wurno area and data collected from them were analyzed using descriptive statistics and farm budgeting. /the introduction of the new technologies appears to have increased resource use and farm incomes in the study area. But it appears that opportunities exist for increasing profits if solutions are found to the problems of water shortage, inadequate supply of fertilizer and untimely evacuation of produce. It was concluded that these constraints and a number of sustainability issues have to be addressed for the realization of the full potentials of small-scale irrigation in such a fragile ecological environment.

INTRODUCTION

Sokoto state could be classified as one of the semi-arid regions of the world where water is probably the most limiting factor to agricultural production. Rainfall, the most important source of agricultural water, is inadequate and erratic in supply. In some parts of the state, annual rainfall is about 600mm with a duration of about five months or less (Abdullahi, 1985). Even within this short rainy period the

distribution is not uinform. Frequent droughts are not uncommon, while the times of commencement and cessation are unpredictable.

The implications of the above rainfall characteristics are that large areas of land are left uncultivated., while only crops and crop varieties that are early-maturing and/or drought-tolerant are grown even if they are not the most productive in terms of yield and income. Inadequate rainfall in the state, therefore, hinders full employment of rural resources (especially land and labor) most of which are idle for the major part of the year.

Like in most other parts of the developing world, population pressure on land and demand for food in the state have continued to increase. To meet this demand, the constraint of inadequate water availability has to be alleviated and more land area put into cultivation while areas already being used have to be cultivated more intensively. The only reasonable way of achieving this, as Muazu and Abdulmumin (1991) pointed out, is through irrigation. The expected increased production from irrigation would, apart from making more agricultural products available to the populace, improve farmers' income and their living standard. Very significantly also, irrigation development is considered necessary to check the menace of drought and desertification which threatens the very survival of life in parts of the state.

The need for irrigation development in Nigeria generally and Sokoto State, in particular, appears to have long been recognized. It is not insignificant that the first recorded attempts at modern irrigation development, dated back to 1918 (Erhabor, 1982), were in the valleys of the Sokoto and Rima rivers. Today, both large and small-scale irrigation schemes have been established in the state. But probably because of the numerous shortcomings of large-scale irrigation schemes (Idachaba, 1980; Palmer-Jones, 1980; Etuk and Abalu, 1982 Kolawole, 1982; Makarfi, 1987; Baba, 1989 and 1993), emphasis seems to be shifting towards fadama development for small-scale irrigation, in recent times. The

small-scale irrigation being promoted is based on motorised water pump and tube-well technologies.

In an attempt to determine the impact of these newly introduced technologies in the study area, this paper compares resource use and farm incomes under the new technologies with those under traditional (shadouf) technology. The paper also examines the constraints to production in the study area, and highlights sustainability implications associated with the use of the modern technologies.

MATERIALS AND METHOD

The study was conducted in villages around Wurno located about 40 km North-East of Sokoto town (see figure 1). Annual rainfall in the area is about 600 mm and lasts for about 5 months (May/ June-September/October). Little or no rainfall is received in the remaining 7 months or so, which is usually a period of low economic activities for most rural farmers, except those that engage in dry season farming.

Six villages including Lugu. Gidan Mordi, Gidan Bongo, Dimbesu, Gyawa, and Gidan Kamba in the Wurno area were selected for this study. From these villages, 48 farmers including 30 who used tube-well (and pump) and 18 who used traditional irrigation method (shadouf) were randomly sampled. The farmers grew garlic, onion, pepper and tomato. While all the other crops were grown in mixtures, garlic was grown sole. Data were, however, collected only on garlic and onion/ pepper mixture which were the most widely cultivated. Data collection from the farmers was accomplished between December 1993 and January 1994 through interviews using questionnaires. The collected data were analyzed using descriptive statistics and farm budgeting.

RESULTS AND DISCUSSION

Resource Use

The average levels of resource utilization by tube-well/ pump users as compared to farmers using shadouf are presented in Table 1. The tube-well/pump users cultivated an average farm size of 1.88 ha, which was significantly ($p>0.01$)

higher than the average of 0.51 ha cultivated by traditional (shadouf) farmers. The larger plots cultivated by tube-well/pump users could be attributed to the higher discharge rate and pumping head of pumps over shadouf. The resulting higher volume of water pumped on to the land allows larger plots to be irrigated by pump users.

Another possible explanation for the larger plots irrigated by pump users could be better reliability of the water source. Tube-wells used by this category of farmers were more reliable than the open wells used by shadout farmers. Although some tube-wells also dried up, these were few when compared with the number of open wells that had this problem at the peak of the dry season.

Also presented in Table 1 is the average labour input by the two categories of farmers. Traditional farmers used more labour, on the average, than pump users. The latter used 1949 man hours/ha while the former used 2079 man-hours/ha. The higher labor input by traditional farmers could be attributed to the fact that the watering system (which is manually operated) requires more labour than the mechanically operated pumps. In fact, further analysis revealed that over 55% of the total labour used by the traditional farmers went for watering, as contrasted from only about 26% used by pump farmers for this operation.

It can also be seen in Table 1 that the average fertilizer input by the pump users was significantly higher than the average input of this resource by traditional farmers. While pump farmers used about 537kg/ha, traditional farmers only employed 434kg/ha. These figures were significantly different ($p<0.01$). The possible explanation for the higher level of fertilize input by the pump users could probably be that farmers who were rich enough to acquire pump and tube-well, also could afford more fertilizer. For the same reason, pump users also spent more on pesticides than traditional farmers. Curiously, however, traditional farmers appear to have spent more on seed than pump farmers.

Generally, from the results presented above, it would seen that the introduction of tube-well and

pump technologies has improved the use of inputs: land, fertilizer and pesticides, over the traditional technology, and has reduced dependence on manual labour. These results corroborate the findings of Baba (1993) and Baba and Alassane (1993) in Western Bauchi State and Tarka Valley of Niger republic, respectively.

Farm Incomes

Table 2 shows the average variable and fixed cost structure of the two types of irrigation systems. As presented in the table, variable coasts dominated the production costs accounting for more than 99% of total costs for traditional farmers and about 98% for pump users. A large proportion of the variable costs was, however, accounted for by labour input which was itself dominated by the imputed cost of unpaid family labour. Low fixed costs in this study could be attributed to the low level of fixed capital investment in irrigation farming in the area.

The distribution of respondents according to net farm income (NFT) is presented in tables 3 and 4 for garlic and onion pepper/mixture, respectively. Table 3 shows that while more than three quarters (77.78%) of the shadouf farmers earned less than N30,000/ha, all but one pump farmers obtained NFI greater than this figure in garlic production. In fact, 80% of the pump users were in the income group ranging from N30.001 – N40,00/ha. The average NFI of pump users in garlic production was N37,000.5/ ha, which exceeded the N25,000/ ha realized by shadouf farmers.

In onion/pepper enterprise (Table 4), more than 77% of shadouf users earned an income of N30,000 or less, as against pump users, 73% of whom earned more than N30,000. The average income of pump users in this enterprise was N33,333.83 as compared with N21,667.17 for shadouf users.

The foregoing results suggest that in the two enterprises considered, pump users realized significantly ($p<0.01$) higher income than shadouf users. Higher profits for pump users could probably be attributed to higher yields resulting from more fertilizer and pesticide application (see Table 1) and more reliable water source.

Constraints

Although returns on production were quite high in the study area, it appears opportunities still exist for improving them if the constraints identified by the farmers are addressed. The constraints identified by the respondents include water shortage (17.4%), untimely evacuation of produce (52.08%), high cost of herbicide (72.92%), and fertilizer shortage (100%). The farmers reporting water shortage were mainly shadoof users who depended on wells. Some of the wells dried-up within the irrigation season and this led to reduced yields and returns. Only two of the pump farmers reported drying-up of tube-wells as a constraint.

The problem of untimely evacuation of products resulted in gluts in the market and the accompanying reduction in product prices. The farmers were often compelled to sell urgently to middlemen who were better prepared for storage and long-distance transportation.

Farmers generally complained about high cost of chemicals. Although most of them indicated their willingness to apply chemicals, it appears they were constrained by the high cost of the input. The situation was similar for fertilizer where farmers reported that the commodity was not only costly but difficult to obtain.

Sustainability Implications

The first sustainability implication to be discussed is economy. Small-scale irrigation has been demonstrated to enhance increased rural income and, perhaps, standard of living. It must be quickly pointed out, however, that caution should be exercised in this interpretation, given the high inflationary trend in the economy. The cost of fuel, on which pumps depend, as well as that of developing ground water for small-scale irrigation, are on the increase and this could result in rapid decline in profits. A counter-argument could be that prices of products are also going up. While this may be true, it has been demonstrated (Baba *et al.*, 1990) that in an inflationary situation, prices of inputs usually rise faster than those of products. Under such a scenario, it is

difficult not to anticipate reduction in profitability of small-scale irrigation farming unless alternative and cheaper energy sources (such as solar and wind energy) are developed for lifting water.

The second sustainability implication is technical. Except for a few earth dams, most small-scale irrigation schemes in the state are based on ground water development. The technologies involved are not indigenous and the dependency and maintenance problems created are too well-known. The same problem applies to the motorized pump and tube-well technologies which have to be imported at high costs. To be sustainable in the long-run, small-scale irrigation development should be based on technologies that are cheap, renewable and that use locally available resources.

The last sustainability implication has environmental ramifications. Irrigation based on ground water requires bringing to the surface, water from the ground water table. Such water is said to contain high salt concentration. Continuous use of such water could lead to soil salinity which, if not ameliorated could drastically reduce crop yield .

Perhaps more serious environmental consequence of continuos irrigation with ground water is that it could result in the depletion of the water table both in the cultivated and surrounding areas. This could result in drier top soils and create wind erosion and desertification problems. It could also have economic repercussions since the cost of drilling increases with depth. Whether or not the ground water table would decrease with prolonged use would, however, depend on the hydrological processes in the area. In particular, it would depend on the rate of evapotranspiration and ground water flow. If the retiring is lower than evapotranspiration, there could be a problem. This suggests that constant monitoring of ground water table is essential for long-term sustainability of irrigation based on ground water development.

CONCLUSION AND RECOMMENDATIONS

Judging from the fairly

high incomes recorded in this study, modern ground water development seems to have good potentials for increasing rural incomes. It, however, appears that opportunities still exist for increasing these if some of the constraints identified in the study are addressed. In particular, farmers could be assisted in the storage of some of the products by establishing cold stores to be rented out to farmers in the area. This would enhance their ability to regulate supply and stabilize product prices. Such policy of price stabilization could also be enhanced through the establishment of vegetable and fruit processing plants, which are presently lacking in the state. Efforts should also be made to reach farmers still using traditional technologies with pump and tube-wells to improve water availability. The State Government, in conjunction with some international creditors, has already started this by distributing pumps on credit to rural farmers. The present exercise would, however, need to be expanded to cover larger number of farmers to make meaningful impact. Further subsidization as well as timely availability of inputs, such as fertilizers and (agro-chemicals) chemicals, is also necessary to maximise the usage of the irrigation facilities and enhance yields and incomes

In conclusion, to ensure long-term sustainability of small-scale irrigation in semi-arid area such as Sokoto State, research is needed to constantly monitor ground water table and to generate water-lifting technologies superior to the shadouf and other traditional devices, but cheap enough to be afforded by rural farmers. In this respect, solar and wind energy-based water-lifting devices deserve some attention.

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