

**TITLE: DOCUMENTARY ON TREADLE PUMP TECHNOLOGY
DISSEMINATION IN NIGERIA**

(1991 – 1998)

VIDEO/C.G./INSTRUCTION NARRATION

INTRODUCTION

Nigeria is blessed with abundant surface and groundwater resources most especially in the Northern States placing the much-needed irrigated agriculture at an advantage position. The expansion and development of irrigated agriculture to an enviable position can be achieved not only by tapping surface water resource, but also the shallow groundwater resources; through the use of tube well and wash bore irrigation technology. Water lifting devices are integral part of ground water exploitation technology. Motorized pumps were used and became very popular with this technology. These pumps have been effectively used to lift water for small-scale irrigation. Until recently, the initial investments, operation and maintenance cost for the motorized pumps became fairly low and affordable by farmers. However, with the worsened economic situation and difficulties in obtaining spare parts. And frequent breakdowns of these pumps as well as the sudden acute shortage of fuel in many parts of the country, farmers were forced to look for alternative water lifting devices. Many farmers resorted to irrigating their fields annually using watering cans or buckets while others abandoned irrigation farming completely. The enormous contribution of this group of people in the agricultural sector for national economic development for Nigeria has long been recognized.

To address this problem and still encourage small scale irrigation farmers to participate in developing the irrigated agriculture, past administration again reorganized most state Agricultural Development Projects (ADPs) where Fadama Development Department (FDD) were created. The ADPs through these departments continue to play similar roles as that of River Basin Development Authorities (RBDAs) in these respective states. Modernization was brought to small-scale fadama irrigation through well drilling

and wash boring technologies. This was backed up by inputs supply such as pumps, agro chemicals, improved seeds and other exigencies of irrigated agriculture. Achievements of ADPs in this direction are quantifiable. It is on record that prior to the involvement of ADPs in fadama development in 1985; about 20,000 hectares were under annual irrigation using traditional systems. By the end of 1992, hecterage developed under the various types of irrigation technologies employed in Middle and Northern Zones States ADPs was 179,020ha. In spite of the remarkable achievements to the ADPs, several obstacles have had to be faced. Difficulties in land preparation due to inadequate equipment, conflicting uses of fadama lands, inadequacy of qualified personnel especially in critical areas of irrigation technology transfer and poorly organized marketing; systems of inputs and produce are some of these constraints.

Importation of motorized pumps is smoothly carried out through the ADPs, but when the terms of reference of either the ADPs or the NFDP expires, it will be difficult for farmers to acquire and manage these pumps. A logical solution is therefore to develop or introduce a water lifting device that can be constructed, maintained and operated by farmers themselves. A water lifting device that can improve traditional technology is most preferable. Thus, a simple, cheap, efficient, adaptable and foot operated pump known as Treadle Pump Technology (TPT) originally invented by Narendra N. Deh and designed by Carl Bielenberg of Appropriate Technology International (ATI) was introduced into Nigeria for small-scale irrigation farmers. This was under a programme known as 'NAERLS/ATI Treadle Pump Technology Dissemination Programme in Nigeria'. Both organizations were encouraged to enter into working relation on the TPT because of the pump potentials in Nigeria and records of successes in similar developing countries like, Mali, Senegal, Sri-Lanka, Bangladesh and Burma.

EVIDENCE OF PROBABLE IMPACT

The initial design of the treadle pump was designed in the early '70's in Bangladesh and extended to India, Pakistan, Sri-Lanka and Myanmar (Burma). The positive impacts demonstrated by the technology in terms of net income, irrigated area

and labour time among small scale vegetable gardeners resulted in the purchase of the technology by more than 7,000.00 landless farmers in Bangladesh ‘and’ India since 1980.

A modified treadle pump adapted by ATI from the initial design was first introduced to some vegetable gardener within West African Sub-region eight years ago. This effort began with the private sector commercialization of the technology in Senegal and Mali and has expanded to Nigeria. The pump has also been introduced to Togo, Niger and Cameroon by other organizations. Positive impacts were again recorded via number of these countries. In Senegal for instance, where the pump was first introduced for a period of 3 years, a random sample survey indicated an average annual increase of 1,350 dollars in the net income of market gardeners using the pump. Irrigated surface are increased by 40 percent and yields – measured in term of the value of crop production per hectare, increased by 1,000 percent. On the basis of a sub-sample analysis labour time per farm year devoted to irrigation activities was reduced by 60 percent (with the excess labour re-allocated to other income generating gardening tasks). The participating local artisans on the other hand increased their cumulative net income by 49,800 towards the end of the third year. The project benefit/ratio was 3:95.

ACQUISITION OF THE TREADLE PUMP TECHNOLOGY

The Treadle Pump Technology was extended to Nigeria in 1991 and a pilot project was started in Sokoto State in 1992/93 dry seasons and in Katsina 1993/94 dry season.

Most successes were recorded in these states with favourable indications from the beneficiaries of the technology. A comprehensive dissemination and popularization project on the treadle pump where emphasis would be on the establishment of “priority intervention sites and beneficiaries” made great impact. A methodical and phased approach directed to specific beneficiaries (located in vibrant fadamas where the communities are participating in the National Fadama Development Project was adopted.

Field Evaluation of Treadle Pump

The NAERLS conducted series of evaluation exercise where the treadle pump was initially subjected to various tests with the aim of assessing its capacity, energy

requirements, maximum total head it can command, efficiency, operation and maintenance cost and maximum number of persons that can operate the pump. The satisfactory outcome of these exercises encouraged NAERLS to mount a dissemination programme in areas where the field situation favours the adoption of the technology. A comprehensive facility for testing the treadle pump was set up at the NAERLS Irrigation Field Laboratory at Shika near Zaria.

DEMONSTRATION OF TREADLE PUMP

Demonstration campaign was mounted across the country to create the awareness on the treadle pump. This was conducted for different group of people in different forums and location in the country. The initial targets were small-scale irrigation farmers, gardeners, and local artisans (welders, blacksmiths, etc). Locations where a vegetable gardener uses different water lifting method to irrigate their crops and where small land holdings dominate were given priority. Such locations are located close to settlements where readily available markets exist for the farmers' produce. Twelve States have participated in this field demonstration where over 100 locations/communities are covered. The target audience in each locations were mobilized by the state ADPs (see Table 1 for details on States).

Other avenues used for this exercise are Zonal or State Agricultural Shows, National and International Annual Trade Fairs organized in different parts of the country. The treadle pump has featured in more than 20 Agricultural Shows and over 100 Trade Fairs where it attracted not only farmers, artisans/industrialists but also political leaders at both state, national and international levels.

The field demonstrations were carried out with the following objectives:

- 1) To create interest on the treadle pump among vegetable gardeners, local artisans, industrialists, agric. Marketing, companies, etc.
- 2) To expose interested farmers, marketers, field staff on the use capabilities and limitations of the treadle pump.
- 3) To expose interested local artisans and other industrialists on the pump production and other requirements.

- 4) To assess potential market outlets for the sale of the pump by potential manufacturers/suppliers.

SPECIAL TREADLE PUMP PRODUCTION TOOLING

The NAERLS in conjunction with Department of Mechanical Engineering, Ahmadu Bello University, Zaria have developed the capacity of producing these special tooling. The toolings are completely produced in ABU, Zaria. This capacity has been extended to private sector where John Holt Agricultural Engineers, Zaria Branch was also involved. It is gratifying to note that these tooling initially imported from USA are now produced locally in Nigeria.

The pump is fabricated using basic cutting, bending, drilling, filling, grinding and welding equipments. These equipments have been with the artisan metal working sector for quite a long time and are always available.

To ensure pump quality and inter-changeability of parts techniques on how to use the special tooling was developed. This is to enabled trained fabricators attain high precision in the production and to be able to produce a larger number in a relatively short period with less labour. These special tooling like drilling, bending and assembling jigs as well as boring fixtures are used to roll cylinders, produce valve boxes, valve – hinges, and pump frame. Some of the tooling is also used for assembling the completed pumps. Leather cups are molded using the wooden moulds and metal rings.

Training Conducted

Series of training were organized and held in various parts of Nigeria. The training were targeted to three groups:

1. Artisans
2. Field Extension Staff and
3. Farmers.

The ten artisans from Sokoto and Zamfara States were selected and trained in 1991. The Agricultural Development Projects, ADPs sponsored these people to the training and provided loan facility(in kind) which enabled the trained artisans to start

fabricating the pump. The ADP also created market outlets for the sale of the pumps through their commercial department.

By the end of 1992, five out of the ten trained artisans were successfully producing the pump and selling directly to interested farmers.

In 1993, a similar arrangement was made with Katsina State where another ten artisans also benefited with same package. In either case, NAERLS provided training facilities, material and instructors – who guided and taught the participants on different aspects of the fabrication procedure. NAERLS also carried out follow-up visits for technical monitoring and evaluation of the trained artisans performance. Refresher course was conducted for some of the trained artisans observed to have difficulties in acquiring the fabrication skill.

Other states that indicated their intention to join the first two states in training their artisans were Kano, Bauchi (Gombe and Bauchi), Jigawa, and Kaduna.

In 1996, Jigawa State succeeded in achieving this goal where she sponsored ten artisans selected across the state for similar training. This brings the total of 30 artisans trained on the fabrication of the treadle pump.

The other categories of people trained under this project are the Field Staff of the respective states that benefited from the training of artisan. Twenty-five people were selected from each state among field officers who are working with farmers in the Fadamas. Thus, to date a total of 75 extension field staff were trained on the operation and maintenance of the treadle pump from Sokoto, Zamfara, Katsina and Jigawa States.

The third form of training organized was the on-farm training of farmers on the operation and maintenance of the pump. Usually, pumps produced by artisans were used for this exercise. Artisans and ADPs, participate in mobilizing farmers in each community visited. The training session is devoted to teaching and discussing with farmers the correct ways to use and maintain the pump. Different water sources were used and a lot of discussions regarding the economy and availability of the pump were observed. Sometimes, a pump is left with the communities for use in the coming dry season which the ADO will retrieve thereafter. For this exercise, over ten states and 100 sites and or communities/locations in the country were covered.

OPERATION PROCEDURE AND ROUTINE MAINTENANCE

Treadle pump can be used by one or two adults or as many as four children. The total vertical distance that the pump can deliver water depends on the total weight of the operators. Two adults who together weigh 100kg can pump water up to 10 vertical metres. While one adult weighing about 50kg can lift water to only 5 vertical metres. If the pump is to lift water to less than four metres, one operator should be able to treadle comfortably on the suction side of the operators support handle. While for high lift of water (more than 4 metres) two operators should be able to treadle with each of them positioning him on either side of the operators support handle. Also, one operator can lift water to more than 4 metres high with his position on the delivery side of the operators support handle and the pump tilted at intake end to avoid tipping.

ROUTINE MAINTENANCE

The parts of the treadle pump that require most maintenance are those that are easily consumed or damaged. These include:

- a) The pulley, which should be kept in good shape and its shaft lubricated with oil (e.g. grease) every day before pump is used.
- b) The leather cups of the pistons should be lubricated with oil (beef tallow or engine oil) before use. Where there is tear then the cups should be changed with a new one. But if stiffness occurs, the cups should be soaked in water before use. If problem of cups changing shapes occurs resulting in cups not fitting into the cylinders after each pump usage.
- c) The valves should always be checked before use. If valve tear occurs, it should be replaced with a new one. And if bolts and nuts loosen, they should be tightened up.
- d) The treadle pumps should be handled with care since rough handling during treading can cause breakage. Also the rope should be changed when they cut or show signs of weakening.
- e) If gravel or sand entered the pump, it can usually be removed by taking off the inlet and outlet hoses and pouring water into the cylinder with the pistons

removed, and opening the valves with fingers. If the procedure fails, then remove the base-board and wash the valve chamber.

DEVELOPMENT OF DISSEMINATION PACKAGE

Since the beginning of this project, a number of activities were carried out in the aspect of media, publications, or audio-visual materials that helps in the promotion of Treadle Pump Technology to the target audience. To date, a total of three extension bulletins, one extension guide, two campaign posters, a leaflet and a slide and transparency packages were produced by NAERLS. Some of these materials are widely circulated among ADPs, Ministry of Agriculture and Natural Resources, at Agricultural Shows/International Trade Fairs, etc. While others are used exclusively for training purposes.

Also media packages like Radio, TV Programmes, video Documentary on various aspects of the treadle pump were produced by NAERLS and aired/broadcasted over Radio and Television Stations across the country. Many technical papers were presented on different aspects of treadle pump at different for a both in and outside Nigeria.

MONITORING AND EVALUATION

The programme has an in-built mechanism for monitoring an evaluating the activities carried out. These are at the level of the artisans, extension staff and farmers. The performance of the trained artisans was quantified and refresher course organized where necessary. The quality of advisory services rendered by extension staff on the operation and maintenance of the treadle pump to the farmers was also assessed and appropriate interventions were designed to address any shortcoming observed.

The monitoring and evaluation of the treadle pump adoption by farmers were, however, initiated by NAERLS after five years of introducing the technology. This exercise is being carried out in the Pioneer States (Sokoto and Katsina) where it is believed that appreciable period has lapsed to allow a successful conduct of this study. The study pinpoint at the characteristics of both the farmers, the Extension Staff and the Local Artisan. Farm characteristics were also quantified especially in the fadama areas, while the relative advantage, complexity, etc. of the treadle pump was established. It is

hope that all these would make it easy for the change agents to determine in good time, problem areas with the Treadle Pump Technology and after practical solutions where possible.

LIMITATIONS/CONSTRAINTS

The laudable achievements recorded by the Treadle Pump Dissemination Programme in Nigeria conducted over a period of seven years, would have been much more if the following limitations/constraints were address:

- Upgrading of willing local artisans' workshop to a level suitable for the fabrication of the treadle pump.
- Provision of loan facility to allow trained artisans participate in the ADP initiated marketing of the pump was a hill-task.
- Protection of the technology from dubbers who lack the right skill for the pump fabrication and are not willing to come forth for training was quite a difficult assignment.
- Training of every farmer who purchase the pump to acquire the correct operation and maintenance skill is another big problem to both the extension staff and NAERLS.

FUTURE PLANS

The NAERLS intends to encourage and is willing to enter into working agreement with any interesting organization/body government or non-governmental in Nigeria or elsewhere to among others:-

- Demonstrate this Treadle Pump Technology to any target audience.
- Train artisans, extension staff and irrigation farmers on different aspects of the Treadle Pump Technology.
- Develop dissemination package for the promotion and mass adoption of the pump through.
- Extension publications, radio and television programmes, campaign posters, slides and transparency packages, flip charts, etc.

- Mounting an adoption study to monitor and evaluate the impacts; of the programme on the beneficiaries.