ASSESSMENT OF EXISTING PUMPS FOR FADAMA IRRIGATION IN BIDA RICE PRODUCTING AREA.

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DEDICATION

This project is dedicated to the entire members of Samuel Maman Family and my beloved wife Mrs. Mercy I. Maman for making it possible for me on my write up.

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I wish to acknowledge the help I received from my lecturers and my colleagues at the Department of Agricultural Engineering. Federal University of Technology, Minna. Particular mention must be made to Dr. Adewumi of Department of Agricultural Engineering Minna (on sabaltical) who contributed much as my project supervisor through valuable advise and guidance that let to the success of this work.

It must be mentioned here that the Water user Association of three village in Bida Emirate Council namely Ndaloke, Majin Gari and Massage Village for their contribution in answering my questioners.

Finally, I wish to mention the Management of Niger State Agricultural Development Project, Minna for their financial support towards the success of the project.

ABSTRACT

It is very adequate for water supply for successful plant growth in an irrigated land. Generally in many areas of the world, the amount and timing of rainfall are not adequate to meet the moisture requirements of plant need. At certain place the undulating land topography leads a negative command that those pieces of land cannot be irrigated unless they are lowered down by leveling or simple method of selecting a water pump lifting machine which are use in lifting by pumping. This project was undertaken to devise a means to select, operate and maintain method for a suitable pump, that could be use in pumping water for an irrigation farms. Selection was made with three different type of pumps on use by our water user association within the eight Nupe speaking Local Government area. Operation of the pumps was carried out with the farmers association as group farmers and Maintenance of the pump were mostly carried out in our workshop made for general maintenance of motor vehicles and irrigation water pumps with different types of pumps on use for this study.

CHAPTER ONE

1.1 INTRODUCTION

Adequate water supply is a prerequisite for successful plant growth in irrigated land. In many areas of the world, the amount and timing of rainfall are not adequate to meet the moisture requirement of plants growth, which is necessary to meet the need for Food and Fiber. The increasing need for crop production for the growing human population is now causing the rapid expansion of irrigation farming throughout the World today.

General water supply is also very important in order to keep good health of rural communities. In rural areas of the developing countries need for drinking and other domestic water supply purposes is acute. The World health organization (WHO) estimated that about 57% of the Third World Population are without adequate sanitation and more than three quarters of these percentage live in the rural areas (Ahmed, 1983).

Irrigation is practiced in different spectrum, such as major schemes, medium schemes and minor schemes.

In Nigeria, the River Basin Development Authority, the State Agricultural Development Authority, Fadama Development sectors falls in the category of major and medium schemes. Besides, small-scale irrigation is also being practiced in Nigeria.

As in any country, individual farm and minor irrigation scheme constitute the first phase of development of irrigation Agriculture in Nigeria. Igbai (1975) categorized the minor irrigation schemes as that range from 2 ha to 1.2 ha. Igbal (1975) also reported that 8,780 ha of

land was under small-scale irrigation in Northern Nigeria. The figure of total hectare under minor irrigation cannot be considered as only this much, even though is quite considered.

Salazar and Moss (1980) considered the farm size from 0.5ha to 3ha as small – scale farming.

In Nigeria, the small-scale farming can be considered in the range of a few square meters to 3ha or so. The small-scale irrigation is practiced in the Fadamas to raise vegetable crops such as Tomato, Onions, Pepper, Cabbage, Potato, and Ameranthus a (leto). The small-scale farming is practiced for subsistence of family need for the vegetable crops as earlier mentioned.

Water for small-scale irrigation is lifted from streams, rivers, and shallow ground water tables. The pumping units installed for lifting of irrigation water in such cases are shaduf, bucked, transportation, hand pumps and in some cases by centrifugal pumps.

The manually operated system is strenuous when problem of water lifting is solved, water can be economically conveyed to the point of use by the conveyance method designed by Yadav (1983).

Agricultural Development Project (ADP) in various states throughout Nigeria have imported different brand of water pumping machines from different countries eg Bangladesh, England, France, India, Zimbabwe, and many other Countries and installed them at the focal points in their project areas. The Agricultural Development Project is putting emphasis on the use of these pumps for small-scale irrigation and for domestic water supplies in rural areas of Nigeria.

Tube wells, Wash-boring techniques have been demonstrated by (ADP) throughout Nigeria to bore hole water source in the areas with

1.2 JUSTIFICATION OF THE STUDY

There is greater need to select water lifting devices that can run without additional much cost to lift water to irrigate agricultural field.

1.3 OBJECTIVES OF THE PROJECT.

The main objectives of this projects are:-

i. To select a suitable pump that can lift water for small and large-scale irrigation farms.

ii. To select a suitable pump for ease of maintenance locally and with which the spare parts are readily available throughout Nigeria.

In order to reduce the drudgering in small-scale irrigations around Fadama area of Bida, Pumping water to the field replaces the shaduf' way of irrigation. Recently, the aim and aspiration of the Farmers in these areas has been dashed out due to constant break down of these pumps. In event, the total coverage by individual farmer daily during the irrigation season is small and consequently low production at the end of the season. It is therefore justifiable to address the perennial problems of constant break down of pumps.

This will be investigated in this study to meet the stated objectives in addition.

CHAPTER TWO

2..0 LITERATURE REVIEW

The axial-flow pump is the most wisely used small farm machine pump. It has been designed to suit local requirements of low lift and high capacity. The original design was not commercially available until 1957 when steel pipe and shaft materials were used and the impeller was modified. Since 1957, the pump has replaced the traditional wooden trough water-lift system they were using. Using the original basic concept that met the requirements of small-scale farmers, the private sectors provided most of the modifications and adoption to use the 2 wheel tractor as a power source over 600.00 units of the axial-flow pump has contributed a lot to a small farm machinery industry. The pump enables single cropping in some area, double cropping in others and continues cropping in the central plans.

ORIGIN OF THE AXIAL-FLOW DESIGN

The wooden tough water lift had been the primary water-lifting device in the world for years. The first axial-flow pump was designed in 1941 by the late M.R. Drebriddhi Tavakul, the founder of the Agricultural Engineering Division (5)

His objective was to design a single, low-cost, efficient low-lift pump that small manufactures and farmers could fabricate for themselves to use. For the initial design most components were of wood. The square pipe was made of 2.5 x 3.5cum and 2.5 x 3.1 cm lumber. The triangular wedges were place along the four inside corners of the pipes. The impellers, shat, and impellers, spaces

23cm apart were used for the 2.13m long pipes. The pump was first demonstrated in 1941.

It had greater capacity than the wooden trough water lift, but no detail is made available on its performance. The successful pump was named Debriddhi pump by the Ministry of Agriculture and Co-operative, formerly the Department of Agricultural and Fisheries. However, the initial design was not commercial available.

In 1955, Tavakul modified the formal design. The main pipe and the discharge pipe were made of sheet steel. The discharge pipe was attached to the main pipe at right angles. The drive shaft was totally in the main pipe. The single impeller, similar to that of the deep well turbine pump, was attached to the suction end. A creener was attached to the inlet end. Small gasoline (3-5hp) powered 25 and 33cm pumps. The design became available to manufactures in 1957. The use of a small 4- wheel tractor as a power source was introduced.

For the 25cm pump, the capacity for 0.80m head with 30 degree inclinations was 2,346.7 liters / min at 1.400 rev / min impeller speed; for the 33cm pump. It was 5.677.5 liters / min at 850 rev / min, pumping in a Vertical position was possible using an electric motor. The capacity of the 33cm pump was much higher than that of the wooden trough water lift (1.700 liters / min) when operated at the same head.

After dissemination of the second prototype to manufacturers in 1957, 80,000 units of the axial-flow pump were fabricated by at least 6 manufacturers in the Bangkok area by in 1967. During this decade Tavakul was still modifying the adopting pump.

Impeller was provided with three blades. The discharged pipe was attached to the main at a 30 – degree angles.

The pump sizes for commercial use were reduced to 10, 13, 15, 18 and 20cm.

The pump was modified so it could propel a boast as well as pump water. Therefore, for this version, separate impellers for pumping and propelling were provided. To pump water while the pump was still on the boar, the discharge pipe was longer than for the standard version.

2.1 TYPES OF PUMP

There are five different types of pumps that are normally used in irrigation and water supply. These are listed below with their characteristic of operation, and their classification is based on the way the rotating elements (impeller or propeller) can imparts energy to the water, the breakdown is also shown as follows:

2.1.1 PROPELLER

Axial flow is type that water is been force vertically upwards and suitable on short line for large discharge and low head. The type of pump is normally not good for regulation.

2.1.2 CENTRIFUGAL PUMPS

Water is drawn into centrifugal pump axially and leaves readily. Horizontal- shaft centrifugal pump have the advantages of being efficient simply constructed, relatively free of trouble, low-cost, easy to install, and capable of high speeds, therefore, they usually connected directly to and electric motor. One of their principal disadvantages is their limited suction life and susceptibility to losing prime.

The practical suction lift will decrease with elevation, being not over 6 meters at sea level and generally less than 4.5 meters

at a 1500 meters elevation. If pumping seals are in excellent condition that lift can be maintained in very good condition. Because of the printing problem and limited lift, it is usually advantageous to set pumps as near the water surface as is convenient.

2.1.3 DEEP-WELL TURBINE PUMPS

When the impeller is suspended vertically on the drive shaft within a long discharged pipe, the pump is termed a deep-well turbine pump unit. The impeller may be a centrifugal unit, an axial-flow unit, or any design between their extremes, depending upon the desired head discharged relationship. The bowl of the pump houses the impeller and guide vanes when several bowls are connected in series to obtained the desired total head, the pump is referred to as a the multi-stage pump. There bowl assembles are nearly all located beneath the water surface.

Deep –well turbine pumps are used for irrigation when the water surface is below the practical life of centrifugal pumps successful installation have been made when water is as much as 300metre bellow the ground surface.

2.1.4 SUBMERSIBLE TURBINE PUMP

A deep-well turbine pump close coupled to a small diameter submersible electric motor is termed submersible pump. The characteristics of the pump unit are similar to the conventional deep-well submersible pump having the same flexibility and design possibility. Efficiency is increased by direct coupling and effective cooling resulting from complete immersion, which permits a

reduction in amount of iron and copper on the core. Submersible pumps are used wells over 4000 metres deep.

2.1.5 PROPELLER AND MIXED FLOW PUMPS

Propeller (axial-flow) and mixed-flow pumps are used for low-head high-discharge operation. By varying the vane pitch curvature of the impeller, a wide range of head-capacity requirements can be met without changing the impeller diameter. Multiple stags may be used to obtain a higher head.

The impeller of a pump should be have sufficient submergence to minimize cavitations. The impeller must be deep enough bellow the water surface to minimize the formation of vapour on the blades at the point maximum local velocity.

2.1.6 MIXED FLOW

Mixed flow system is when energy is been imparted to the water in both axial and radial directions simultaneously which is always suitable for medium discharge and head.

2.1.7 VERTICAL TURBINE

This is type that when the shape of the impeller is such that water is forced outward at right angle to the impeller axis. Always suitable for low heads of up to 9m.

2.1.8 VERTICAL CENTRIFUGAL

Vertical centrifugal with axial flow with diffuser casing, which is suitable for large quantities at moderate head, which can be used for regular flow.

2.1.9 HORIZONTAL CENTRIFUGAL

Is widely used for small-scale irrigation with radial flow with volute casing, which can be throttled to provide desired flow.

A great number of mobile, portable pumping plant in the market are of the horizontal centrifugal types powered by either petrol or diesel engine.

There are various manufacturers but perhaps one of the most popular is the YAHAMA, HONDA brand, which has four models in the market presently.

9YP10G, YP20GN, and YP12DJ.J) and HONDA (WB20T, WB30T, WB40T, and WB50T) for a wide variety of application.

The appropriate head range of a single stage for three different types of pumps, which were classified by impeller design, is given in table 2.1

TABLE 2.1 **HEAD RANGE METRES**

HEAD RANGE METERS	PUMP FLOW TYPE	CUSTOMARY
3.9M	Axial	There are referred to as propeller pumps from the impeller and the lifting action of the blades on the liquid.
9-19M	Mixed	Franci's pumps
18-300m	Radial	Since centrifugal forces define the principal action of these pumps, they often are referred to as centrifugal pumps.

22 PUMP SPECIFIC SPEED.

The specific speed n_s of a pump is.

$$n_s = n\sqrt{\frac{q}{0.75H}}$$

n= Rotation Speed revolution / min

H= Best efficiency head developed m.

Q= Best discharge m^3 / second.

PUMP SPECIFIC SPEED: Is define as the rotation speed at which a given pump or geometrically or hydraulically similar pump discharges in m3/s of discharge under 1m of head while operating at the best (peak) efficiency point. The pump specific speed characterizes the type and shape of the impeller.

Pumps for irrigation purposes are of many different makes.

In general, they range from pumps with small discharge and with high head to large discharges with low head.

TABLE 2.2 **VARIATION IN PUMPS CHARACTERISTIC**

SPECIFIC SPEED	TYPE OF PUMP	HEAD DISCHARGE CHARACTERISTIC
ns=rpm $\frac{M3}{H3/4}$		
(a) 9.68	Centrifugal radial flow	High speed small discharge
(b) 19.36		
(c) 38.72	Franci's	Intermediate head and discharge
(d)58.0		
(e) 96.8	Mixed flow	
(f) 193.6	Propeller flow (axial flow)	Low head large discharge

To obtain an appropriate value ns in unit of r/min, m^3 / 5 and m multiply imperial customary ns (r/min, gal/min and ft) times 0.01936.

* High specific speed greater than 155 (8000 imperial units) indicate on axial-flow type impeller).
* Low specific speed of 87 (4500) or less indicate the radial the radial type impeller.
* Medium values of specific speeds generally indicate a mixed flow type impeller.

2.3 PUMP POWER REQUIREMENTS

Pump power requirements P in kilowatts is

Po= & PH

Where:

= The unit weight of the liquid.

= 9810 N/m^3 –9.81 KN/m^3.

= g) q=The discharge

H= The Total energy head

Or P= $\frac{9.8qH}{e}$

e=The efficiency

2.5 PUMP EFFICIENCY

Efficiency is output divided by input

E= $\frac{\text{output}}{\text{Input}} = \frac{\text{WHP}}{\text{BHP}} = \frac{Po}{Pw} = \frac{Po}{Pi}$

Hp= $\frac{QH}{273}$

Where Hp= horse power

Q= m3 / hr

H= Vertical lift

2.6 NET POSITIVE SUCTION HEAD

NPSH (net positive suction head) is define as the total suction head above vapour pressure at the highest point of the impeller inlet edge.

$NPSH = H_q\ H_s - H_v - H_i$

Where,

H_q= Atmospheric pressure head

H_s= Suction head

H_v= Water vapour pressure head

H_i= Suction side head losses

The available NPSH at the plant site must be equal to or greater than required NPSH.

CHAPTER THREE

3.0 METHODOLOGY

Proper operation of an equipment's like water pumps is crucial to its yields.

Some water pumps require steps that are totally unnecessary in others. To ensure proper operation, operation instruction should be easily available and training of the operator is absolutely essential.

Because of the wide dimensions in type, sizes, parts and design of irrigation pumps, manufacturers instruction manual should be carefully read and studied before attempting to start, operating or service any irrigation water pump plant. Detailed information on every aspect of the operation is normally given in such books including maintenance tasks that can be carried out by the operation and those that require the attentions of trained services personal.

Adherence to these guidelines will guarantees long and troubles free operations of the pump.

In some instance, manufacturers or dealers may supervise installation and conduct starting up test training under full operating condition before handing over to client.

3.1 PUMP ASSESSMENT

The methodology adopted on pump assessment for FADAMA irrigation in Bida Rice Production Area were based on questionnaire giving to water users association in eight (8)

local Government Areas of Nupe speaking areas, with three (3) association in each Local Government Areas to answer the questionnaire. They are associations with large irrigation sites with (3) three different types of water pumps located throughout the eight (8) Local government Areas of Niger State.

Three different types of pumps were chosen that are common in the project areas.

The pumps are as listed below:-

a) HONDA WB 20T

b) HONDA WB 30T

c) **DOZZEN DIESEL WATER PUMP 2 CYLINDER STROKE.**

The questionnaire for the survey work is found in appendix A. as stated earlier, the basic information one needs to know first is to facilitate pump selection so as to know different type of pump available and the type of work they performs. These are :-

- Discharge (flow rate)
- Head or lift (vertical distance between source and delivery point)
- Operating know how.
- Availability of Spares.
- Ease of Maintenance.

The discharge and the suction head are actual data that depend on the size and topography of the land being irrigated and type of crop.

3.2 PRIMING OF PUMP

Before A Horizontal Shaft Centrifugal Pump can be started, it is necessary to fill the suction pipes and pump case with water. This operation of filling the pipe and pump case is designated "priming the pump" priming is essential on the horizontal shaft centrifugal pump; because of the no- positive action of the impeller. These pumps must be primed before they are able to lift from the source of supply.

3.3 POWER REQUIREMENT AND EFFICIENCY

Power requirement and efficiency of water pumps tells us the engine capacity that must go along with the type of job to be carried e.g.

If the source of water is from shallows or deep well power required and efficiency must be put into consideration in order to avoid too much load on the engine. Distance in water transportation is also to be considered.

We should make sure that the suction diaphram are properly tightened and the suction hoses are not cracked, consider the depth and distance of water transportation before determining the engine load / and capacity.

3.4 PUMP SETTING

This is the setting of the required quantity (pressurise) of water that must come in and out from inlet and outlet hoses.

3.5 STARTING AND OFF STATING

Starting the engine means to make the engine work.

The steps taking are as follows;-

a. The first thing to do is to turn fuel valve to the on position.

b. Turn the engine switch to the "ON' position.

c. Raise the throttle level up slightly

d. Turn the choke level to the close position

e. Pull the starter grip lightly until resistance is felt, then pull briskly.

f. Turn the choke lever to the open position.

g. Turn the throttle lever to the desired position.

h. Pull the choke rod (for cold starting only).

3.6 STOPPING THE ENGINE AFTER WORK

a. Move the throttle level down fully.

b. Turn the fuel valve to the "OOF" position

c. Turn the engine switch to "OFF" position

3.7 PUMP MAINTENANCE AND EVALUATION OF PUMP PERFORMANCES

Equipment's that are generally associated with the operation of irrigation development consist of electrical, mechanical in the form of preventive (stopping problems from occurring) and corrective repairs after breakdown, maintains must be carried out on this unit, for small – scale irrigation pumps, the preventive maintenance involve daily routine inspection of the pump before starting the engine. The engine checklist may include the following.

3.8 DAILY CHECKLIST ROUTINE PREVENTIVE MAINTENANCE.

Note oil levels and conditions if it is clear cloudy e.t.c also check lubricants.

Check packing gland.

Note sound of pump and engine (motor) in operation.

Check for over heating, check for excessive vibration.

Check oil as at when due.

Check change plug as at when due.

3.9 CORRECTIVE MAINTENANCE

Some of the tasks under preventive maintenance can usually be carried out by the operator either by experience of by training of both. However, when problems arise and the equipment will not work and all the trouble-shooting guides have been exhausted, it is absolutely essential that the services of qualified personal be sought to effect the repairs.

3.10 TROUBLE CHECK LIST

When a centrifugal pump is faulty to operate or the discharge pressure drops, the fault can likely be traced to the suction line, its joints elbows, foot valve and other accessories.

i. If the pump fails to prime, the failure is most occurred by an air leak in the suction line or the pump prime section.

ii. The most common sources of air leak are in the threaded connection in suction live. Coat connection with pipe cement or white lead and then draw them tight. All connection should parodied with gaskets and draw then tight.

iii. The check valve in the discharge side of the pump may have debris clogged between the rubber and the value sit this prevent the valve from sealing and forming an air tight joint.

iv. Priming hen bender the pump and the prime most be airtight or the pump.

i When pump fails to develop sufficiently the pump will vary clerically with speed and pressure will vary with the design. On internal engineer check the Governor and adjust if necessary.

ii **Check suction lines** especially the foot valve strainer, they may be clogged with debris. The food valve may be too small or not immersed deep enough too prevent air and water been drawn in.

iii **Check for air leak**:- Pumps or suction line a small air leak which is not great enough to prevent the pumps from priming may reduce both capacity and pressure.

iv. **Check suction lift**:- If suction lift is too high reduction in capacity will occur. The close the pump can be located to the source of supply the better will be the, resect obtained.

v. **Check the impeller for clogging**:- If the impeller is clogged with foreign materials the reduction in both capacity and pressrun will occur.

vi. **Check for worn out parts**:- Such as impeller bearing e.t.c. will reduce both capacity and presume.

TABLE 3.2 Shows the detailed particular of each pump that will be use on the field . Each of this pump differ in their operating head, revolution per minute (rpm) and discharges. The table also contains information as to what to check on the field for maintenance and operation purposes.

The information requirement in the table will be followed strictly in executing this project.

Here attach on fig 3.2 a mechanical workshop with the mechanic working on daily maintenance of irrigation water pumps supply to the association by Niger State Agric Development Project Minna.

TABLE 3.2:-

PUMPS CHARACTERISTICS AND PARTICULARS

ITEM MODEL	WB 20T	WB 30T	DOZZEN2STOKE WATER PUMP.
Pump	WB2OT	WB 30T	
discharge port dia (in)	2	3	1
Total head (m)	23	26	40
Max suction head (m)	7	7	30
Max capacity l/ min	560	900	15
Engine			
Type	4 stoke	4-stroke	25 stroke
Displacement (cm2)	147	201	4.3/500
Max output (ps/rpm)	3.6/3800	5.2/.4000	4.3/3.500
Rate output (ps/rpm)	2.6/3.500	3.8/3.600	3.0/3,800
Fuel	Gasoline	Gasoline	Pre mixed gasoline
Fuel capacity (p)	3.0	4.1	3.25
Lubrication system	Force speech	Force sprash	
Lubricating oil capacity (cm3)	550	600	

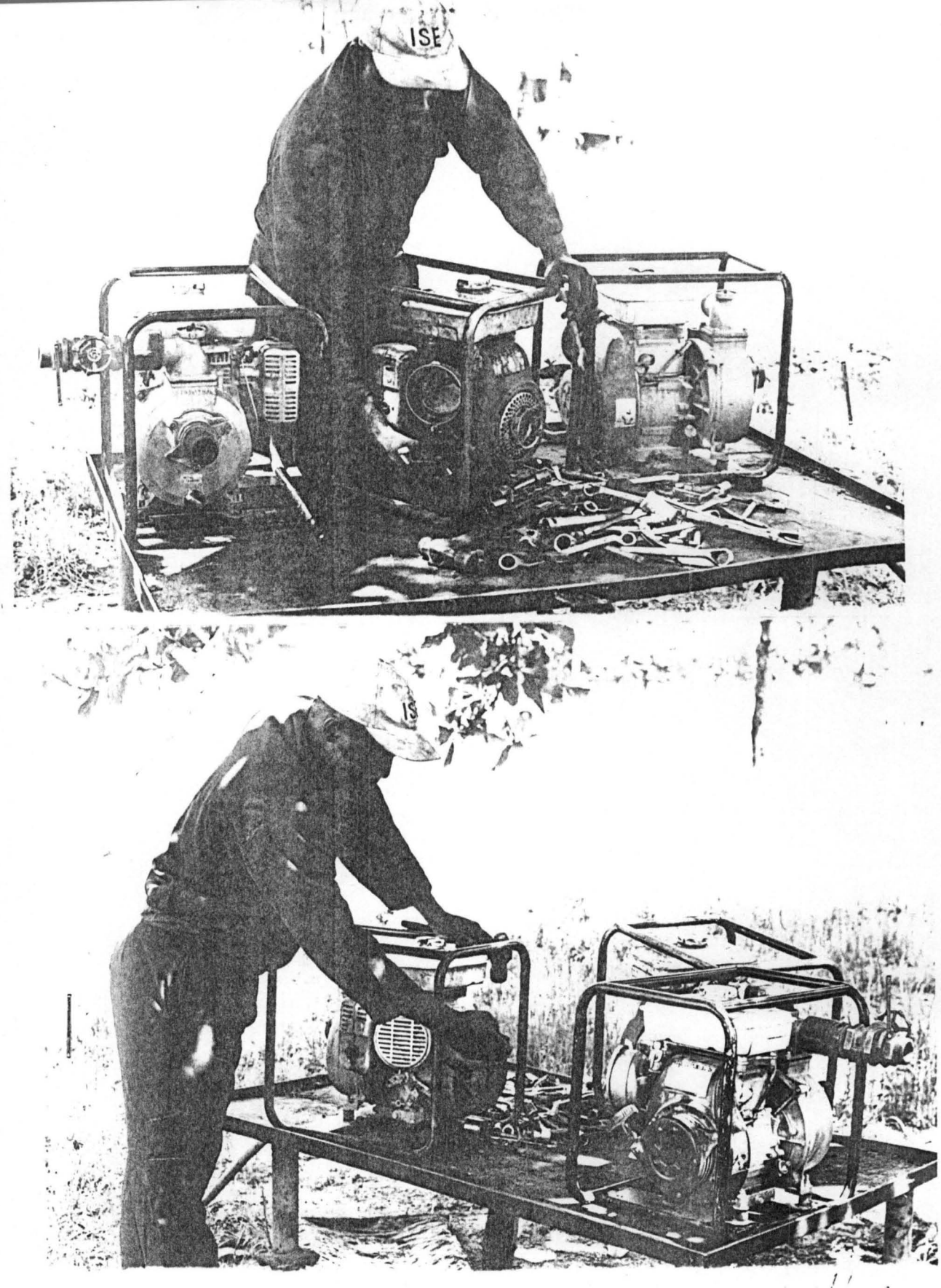

FIG 3.2 PUMP MAINTENANCE WORKSHOP WITH THE PUMP Mechanic

ASSESSMENT OF EXISTING PUMPS FOR FADAMA IRRIGATION IN BIDA RICE PRODUCTING AREA.

GENERAL QUESTIONNAIRE TO WATER USERS ASSOCIATIONS USER OF DIFFERENT METHOD OF IRRIGATION WATER PUMPS.

The questionnaire serves as the methodology to be employed on the mode of selection operation and maintenance of a pump.

(1) The farm location and area----------

(2) Area to be covered on operation ----------

(3) What type of pump specification:----------

(a) Capacity of pump ----------

(b) Make of the pump----------

(c) Model of the pump----------

(4) Hours of operation per day/week on a month.----------

(5) Days on operation before servicing the engine----------

(6) What are mostly trouble shooting you have come across on the model-------

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---

(7) How often are the problems----------

---

(8) How common are part available locally----------

---

(9) How and where do you likely solve the problems----------

---

(10) What parts are commonly given trust----------

---

(11) What is the reference plane:-

(a) Horizontal shift----------

(b) Vertical----------

(c) Impeller----------

(12) What is static suction and delivery head----------

---

(13) What is actual head or Total static head of the pump----------

---

---

(14) What is recommended angle of installation----------

---

(15) Maximum recommended suction head----------

---

(16) Result of performance test table.----------

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

Eight Nupe speaking Local Government area as indicated in table 4.1 was taking as the basis for the study. Each local Government area has three (3) water user associ

ation, which are registered with Niger. ADP. Each water users association within the Local Government that were registered with the state Agricultural Development Project Fadama Department were given either a bore-hole or a Tube well and a water pump Machine which were put together as a package to each association registered with Fadama section for irrigation Farming activities.

Attached is table 4.1 which shows Names, No of associations under each Local Government area together with No of Farmers in each association per Local Government area and Detail Land in (hectage) per Local Government with Detail distribution of various types of pumps for each Local Government area of Niger State under the study.

4.1 INTRODUCTION

Three forms for each pump as indicated earlier with questionnaire were supply to the water users Association in (8) Local Government area of Niger State. The response to the questionnaire is attached in appendix.

Each pump were tested by me to evaluate the general performance on operation, which are equally shown in table 4.1

The common water pump that were been supplied by the ADPs to the groups in loam were only the three (3) types been considered in this study Namely

a. HONDA WB 20T 1 cylinder pump
b. HOND WB 30T 1 cylinder pump

Table 4.1

DETAIL LAND (HECTAGE) AND DISTRIBUTION OF VARIOUS TYPES OF PUMPS USE TO EACH LOCAL GOVERNMENT AREA.

NO OF PUMP SELECTED	NAME OF THE L.G.A AREA AND NO. OF ASSOCIATION IN EACH		NO. OF FARMES IN EACH L.G.A			FADAMA AREA UNDER EACH ASSOCIATION HA.			TYPES AND MODEL OF PUMPS.		
3	MOKWA	3	30	28	25	15	30	15	HONDA WB 20T	HOND WB 30T	DOZZEN DIESEL
3	EDATI	3	28	25	20	15	20	15	"	"	"
3	LAVUN	3	18	35	30	25	28	25	"	"	"
3	GBAKO	3	25	30	26	18	18	18	"	"	"
3	BIDA	3	15	25	35	20	15	32	"	"	"
3	KACHA	3	30	28	32	32	23	18	"	"	"
3	AGEIE	3	40	28	32	22	20	25	"	"	"
3	LAPAI	3	30	38	35	15	25	25	"	"	"

4.2 TESTING OF DIFFERENT TYPES OF PUMPS

4.2.1 HONDA WB 20T WATER PUMP.

HONDA WB 20T was tested by me on 27/7/2001 at river Mussa in Majin Gari Fedama area. And the following results were gotten after pump testing. Pump stroke per minute of the pump was found to 560, static suction head from the water to where the pump was sited was 7m, static delivery head of the pump in ps/rem) was found to be 23,m while this discharge ratio in diameter of the pipe was 2" and fuel capacity in litres was 3.0 litres for working condition of about 3 hours.

Attach in fig 4.2.1 HONDA WB 20T on operation during test pumping at the rice farm.

4.2.2 HONDA WB 30T WATER PUMP

HONDA WB 30T was test by me on 27/7/2001 at river Mussa in Majin Gari Fedama area. And the following results were gotten after pump testing. Pump stroke per minute of the pump was found to 900, static suction head from the water to the position of the pump was found to be 7m, static delivery head was 5.2 / 4000, with Total static head (m) to be 26m while the discharge rate in diameter of the pipe to 3" and fuel consumptive capacity in litres to be 4.1litre for working time of about 3 hours. Attach in fig 4.2.2 HONDA WB 30T on operation during test pumping at the rice farm.

4.2.3 DOZZEN LISTER PETER DIESEL ENGINE

Dozzen lister peter Diesel engine was tested at the same fedama on the 27 / 7/ 2001. the engine is permanently sited at N.R.I Baddegi. It was equally tested and the following results were gotten. Pump stroke per minute was found to be 1400 e/min, static suction head from the water to the pump House was 30m, static delivery head was found to be 4.3 / 5000, Total static Head in (m) was 40m, while the discharge

FIG 4.2.1 HONDA WB 20T ON OPERATION DURING TEST PUMPING at the rice farm

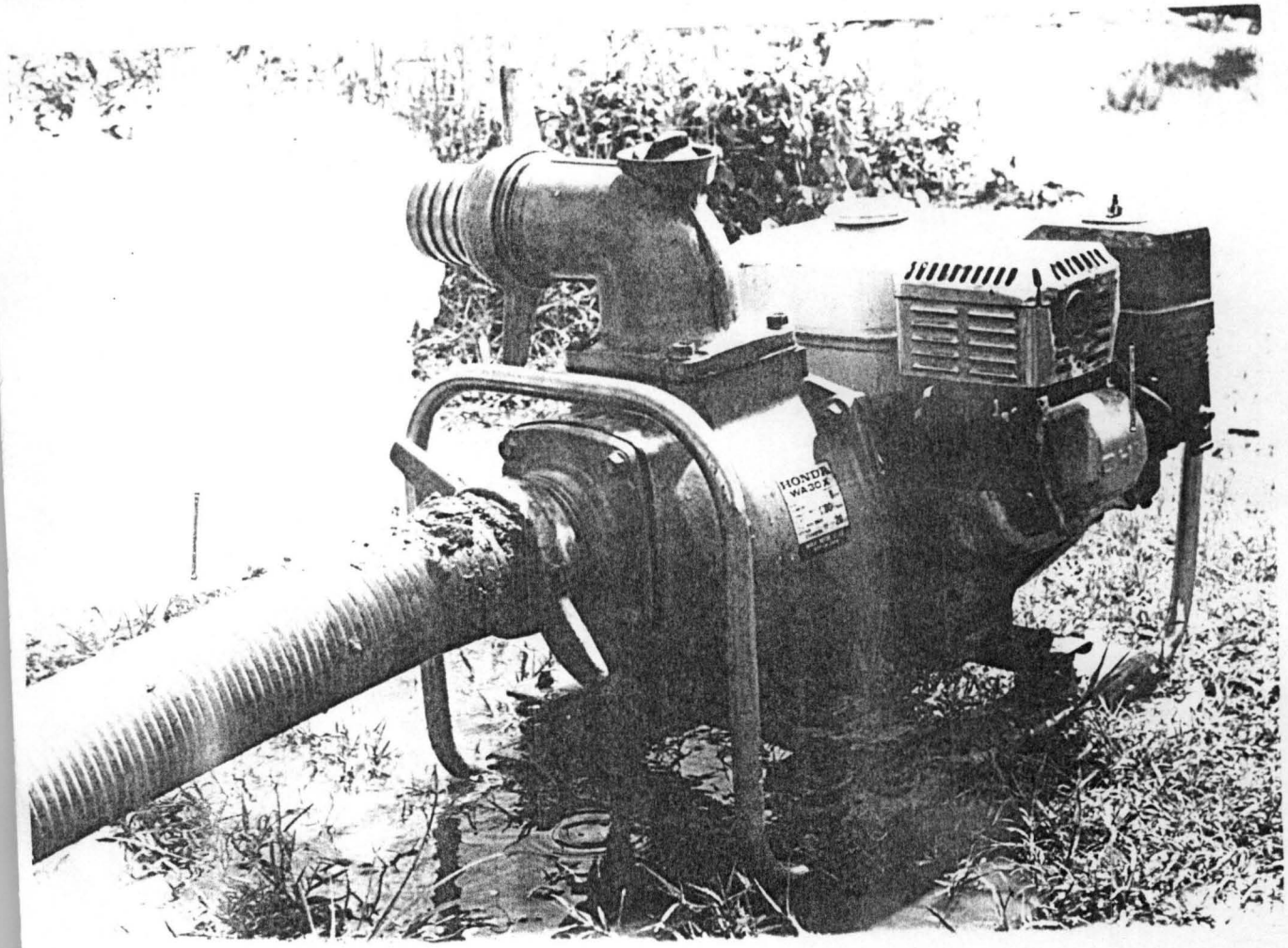

FIG 4.2.2 HONDA WB30T ON OPERATION DURING THE TEST PUMPING AT THE RICE FARM.

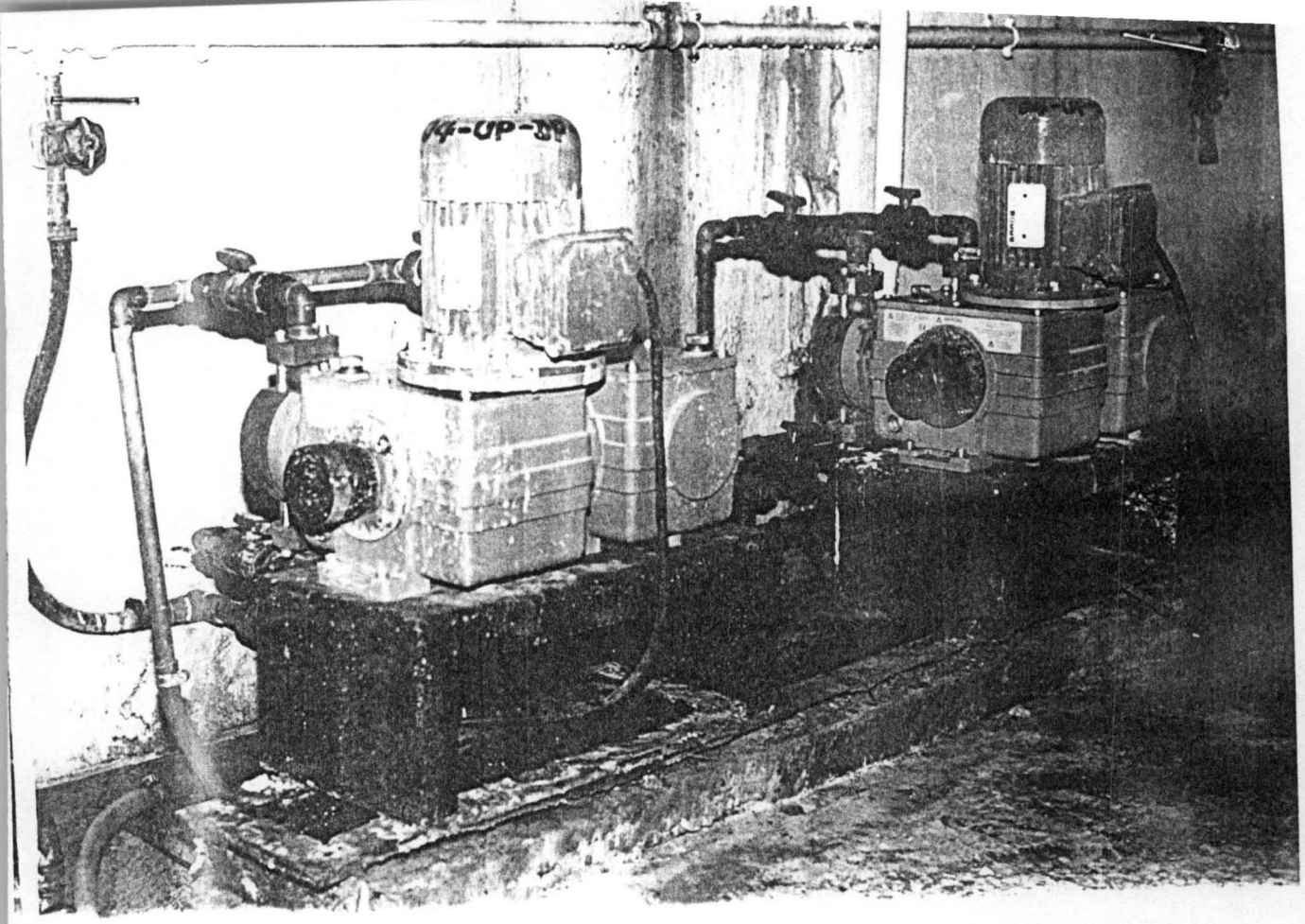

Fig 4.2.3 Jaojen Listen peter Diesel water pump on operation during the test pumping at rice farm

rate in diameter was 4" and fuel capacity was 5.2 litres for working time of 3 hours. Attach in fig 4.2.3 Dozzen lister peter Diesel engine during tests pumping at a rice farm.

4.3. PUMP SELECTION

The distribution to each of the eight Local Government areas is been shown in Table 4.1

Questionnaire (sample Found in Appendix 2) was given to each of the groups to supply information concerning the water pump and practical study was conducted by me concerning pump test operation in order to finding out the general peculiar problems.

Table 4.2 shown the detail investigation conducted on the operation of each pump in use.

General test was performed on the three different model of pumps under study at Maim Gari on River Mussa on the 27th of July 2001 using information in Table 4.2. are available and even the spare paint are equally available for replacement on HONDA WB 20T than the other two water pumps.

Attached in Appendix III is the Mechanical workshop with the Mechanics who takes care on repairs immediately on HONDA WB 20T.

Appendix II shows the cost analysis of the three types of pump on the study HONDA WB 20T has less cost per unit, less cost on the spare parts and even less cost on servicing and workmanship.

4.4 DISCUSSION

From Table 4.2 it was discovered that Honda WB 20T (petrolengine) Performed better than Honda WB 30T (petrol engine) and Dozzen lister peter (diesel engine) because of less fuel consumption and durability on working condition and total availability of spare parts.

Even though the static suction head in (m) shown on Table 4.2 proves that is less than that of lister peters diesel engine, most Local Farmers operate within 7 meter as indicated in table 4.2.

It was also discovered that static delivery head (ps/rpm) 3.6/3800 is very small compare with the other two with higher ps/rpm. Which always cost much money due to the diameter of the pipes.

The discharge rate of Honda WB 20T is equal in the study because it serves the farmers better in the normal control of the channels on use. It was also discovered that each of the pumps will go 3 hours of working with the fuel capacity indicated on table 4.2 . this also showns that Honda WB 20T engine is very economical to the Farmers. Cost per unit of water pumps carried out from the market is been attached in appendix II, which showns that Honda WB 20T has less cost per unit compare to the other two pumps. On the spare parts that mostly gives trouble. Honda WB 20T has less cost to the spare parts are ready available to our local markets throughout the state.

Maintenance can be done in our workshops where mechanics are available and even the spare part are equally available for replacement on Honda WB 20T than the other two water pumps.

Attached in appendix III is the mechanical workshop with the mechanics that takes care on repair immediately on Honda WB 20T.

Appendix II shows the cost analysis of the three types of pump on the study.

Honda WB 20T has the spare part and even less cost on servicing and workmanship.

It was also discovered that each of the pumps will go for 3 hours of working with the fuel capacity indicated on table 4.2. this also shown that Honda WB 20T engine is very economical to the local Farmers. Cost per unit of water pumps carried out from the Market is been attached in Appendix II, which shown that Honda WB 20T has less cost per unit compare to the other two pumps. On the spare parts that

mostly gives trouble. HON 2A WB 20T has less cost to the spare parts that mostly gives trouble. And this spare parts are really available to our local Markets throughout the State. Maintenance can be done in our workshops, where mechanics in each association per local government area and Detail Land in (hectages) per local government with detail distribution of various types of pumps to each local government area of Niger static under the study.

TABLE 4.1 DETAIL LAND (HECTAGE) AND DISTRIBUTION OF VARIOUS TYPES OF PUMPS USE TO EACH LOCAL GOVERNMENT AREA.

NO.OFPUMP SELECTED	NAME OF THE LG.A AREA AND NO. OF ASSOCIATIO-N IN EACH		NO. OF FARMES IN EACH L.G.A .			FADAMA AREA UNDER EACH ASSOCIATION HA.			TYPES AND MODEL OF PUMPS.		
3	MOKWA	3	30	28	25	15	30	15	HONDA WB 20T	HONDA WB 30T	DOZZEN DIESEL
3	EDATI	3	28	25	20	15	20	15	"	"	"
3	LAVUN	3	18	35	30	25	28	25	"	"	"
3	GBAKO	3	25	30	26	18	18	18	"	"	"
3	BIDA	3	15	25	35	20	15	32	"	"	"
3	KACHA	3	30	28	32	32	23	18	"	"	"
3	AGEIE	3	40	28	32	22	20	25	"	"	"
3	LAPAI	3	30	38	35	15	25	25	"	"	"

TABLE:-4.2: PERFORMANCE EVALUATIONS OF EACH PUMP

PUMP TYPE	**B**	**B**	**DOZZEN**
TEST NUMBER	**W20T**	**30T**	**LITER PETER**
Date	27/7/2001	27/7/2001	27/7/2001
Location	Majin Gari	Majin Gari	Majin Gari
Sources of water	R.Mussa	R.Mussa	R. Mussa
Pump stroke per minute	560	900	1400 e/min
Static Suction Head (m)	7	7	30
Static Delivery Head (ps/rpm)	3.6/3800	5.2/4000	4.3/5000
Total Static Heaf (m)	23	26	40
Discharge Rate (dia0 in	2	3	0.78 or 1
Fuel	Petrol	Petrol	Dieel.
Fuel capacity in (1)	3.0	4.1	5.2
Lubricating system	Force sprash	Force sprash	
Lubricating oil capacity (cm^3)	550	600	

APPENDIX 1 : RESPONSE FROM EACH FARMER IN EACH L.G.A WHERE THE STUDY WAS CONDUCTED.

HONDA 20T

LOCATION OFTHEFARM.	AREA COVERED	MODEL OFPUMP	METHOD OFOPERATION	HOURS OF OPERATION	TROUBLE SHOOT	SOLUTION	COMMON PARTS ONTROUBLE.
1. Massaga	30	Honda wb 20t	Lifting	4h for 3 timeper week.	Water ceil replacement	Servicing 2timesper month.	Piston, ring water ceils.
2. Duma	28	"	"				
3. Batako 1	18	"	"				
4. Bakeko	25	"	"				
5. Gbajigi	15	"	"				
6. To ro	30	"	"				
7. Enagi	40	"	"				
8. Jagi	30	"	"				

HONDA WB 30T

LOCATION OFTHEFARM.	AREA COVERED	HONDA WB 30T	METHOD OFOPERATION	4 HOURS 3 TIME PER WEEK	PISTON&RINGS WATER CEIL REPLACEMENT	SERVING 2 TIME PER MONTH.	PISTON RING WATER CEIL.
1. GBADAFU	28	Honda wb 30t	Lifting	4h for 3 time per week.	Water ceil replacement	Servicing 2timesper month.	Piston, ring water ceils.
2.GULU	25	"	"				
3. Batako ii	35	"	"				
4. YINTI	30	"	"				
5.MASSAGA FU	25	"	"				
6. BATATI	28	"	"				
7. GUZZAN	28	"	"				
8. KUDU	28	"	"				

DOZZEN DIESEL PUMP.

ɔCATION FTHEFARM.	AREA COVERED	MODEL OFPUMP	METHOD OFOPERATION	HOURS OF OPERATION	TROUBLE SHOOT	SOLUTION	COMMON PARTS ONTROUBLE.
Edozhigi	25	Dozzen diesel engine	Lifting	4hours3 time per week.	Nodles blown	One time in a months.	Diesel very costly
Lapai gbako	20	"	"				
Boro kassana	30	"	"				
Baddegi	26	"	"				
Nassarafu	35	"	"				
Doko	32	"	"				
Fazhni	32	"	"				
Dutsu	35	"	"				

APPENDIX II

COST ANALYSIS ON WATER PUMPS

PUMP TYPE	COST PER UNIT OF WATER PUMP	COST PER UNIT OF SPARE PARTS	MAINTENANCE COST AT THE WORKSHOP
HONDA WB 20T	N25,000.00	Piston & rings = 3500 Water cell =650 Connecting rod = 1500 Block engine = 3000	General Servicing = 1500 Workmanship = 500
HONDA WB 30T	N38,000.00	Piston & rings =4300 Water cell =850 Connecting rod =2500 Block engine =4500	General Servicing = 2000 Workmanship = 500
DOZZEN LISTER PETERS DIESEL ENGINE	N58,000.00	Piston & rings =6000 Water cell =1500 Connecting rod =3000 Block engine =6000	General Servicing = 3000 Workmanship = 1000

CHAPTER FIVE

5.0 RECOMMENDATION.

In light of tests and results obtained from three different types of irrigation water users association in Niger State ADP, Result shown on Table 4.2 on performance aveluation of each pump under study, and again with General questionnaire given to each water user association area, showns in APPENDIX 1 and response from each farmer in Local Government area where the study was conducted and also showns in table 4.1 Detail Land (Hectage) and Distribution of various types of pumps use. To each Local Government area with cost analysis on the three water pumps shown in APPENDIX 11 proves that Honda WB 20T is vary durable in general field performances with suction head within 7m and delivery head of about 3.6 / 3800 ps/ rpm/ with discharge rate of 2", fuel consumption very little.

General Cost analysis proves that Honda WB 20T is cheaper in Market cost than the remaining two, with cheaper spare parts and always available at the Local Market within the state. It is always very simple to convey to the site of work by either motor bicycle and even with bicycle.

Therefore Honda WB 20T water pump under this study showed a promising result.

5.1 CONCLUSION

The performance of Honda WB 20T water pump to our water users association within Niger state Agric Development Project under this study showed a very good promising results.

- It is a durable water pump
- Easy to mainten
- Simple to convey to the site of work
- Spare parts available every place within the state.

So therefore concluded that it should be encourage to our farmers for use in irrigation activities for food production in the country Nigerian selection were made with three different type of pumps on use by our water user association within the eight Nupe speaking Local Government area.

Operation of the pumps was carried out with the farmers association as group farmers and Maintenance of the pumps were mostly carried out in our workshop made for general maintenance of motor vehicles and irrigation water pumps with different types of pumps on use for this study.

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